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AI Watch
European Landscape on the Use of Artificial Intelligence by the Public Sector

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Foreword

This report is published in the context of AI Watch, the European Commission knowledge service to monitor the development, uptake and impact of Artificial Intelligence (AI) for Europe, launched in December 2018.

AI has become an area of strategic importance with potential to be a key driver of economic development. AI also has a wide range of potential social implications. As part of its Digital Single Market Strategy, the European Commission put forward in April 2018 a European strategy on AI in its Communication "Artificial Intelligence for Europe". The aims of the European AI strategy announced in the communication are:

- to boost the European Union's technological and industrial capacity and AI uptake across the economy, both by the private and public sectors;
- to prepare for socio-economic changes brought about by AI; and
- to ensure an appropriate ethical and legal framework.

In December 2018, the European Commission (EC) and the Member States published a "Coordinated Plan on Artificial Intelligence", on the development of AI in the EU. The Coordinated Plan already mentioned the role of AI Watch to monitor its implementation.

Subsequently, in February 2020, the Commission unveiled its vision for a digital transformation that works for everyone. The Commission presented a White Paper proposing a framework for trustworthy AI based on excellence and trust.

Furthermore, in April 2021 the EC proposed a set of actions to boost excellence in AI, and rules to ensure that the technology is trustworthy. The proposed Regulation on a European Approach for Artificial Intelligence and the update of the Coordinated Plan on AI aim to guarantee the safety and fundamental rights of people and businesses, while strengthening investment and innovation across EU countries. The 2021 review of the Coordinated Plan on AI refers to AI Watch reports AND confirms the role of AI Watch to support implementation and monitoring of the Coordinated Plan.

AI Watch monitors the European Union's industrial, technological and research capacity in AI; AI-related policy initiatives in the Member States; uptake and technical developments of AI; and AI impact. AI Watch has a European focus within the global landscape. In the context of AI Watch, the Commission works in coordination with Member States. AI Watch results and analyses are published on the AI Watch Portal.

From AI Watch's in-depth analyses, we will be able to better understand the European Union's areas of strength and the areas where investment is needed. AI Watch will provide an independent assessment of the impacts and benefits of AI on growth, jobs, education, and society.

AI Watch is developed by the Joint Research Centre (JRC) of the European Commission in collaboration with the Directorate-General for Communications Networks, Content and Technology (DG CNECT).

This report addresses the following objective of AI Watch:

- to offer an overview of the situation in Europe concerning AI adoption in the public sector;
- to identify which are the challenges, barriers and risks of the use of AI in the public sector and how to address those; and
- to provide policy recommendations to policymakers dealing with AI adoption and implementation.

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Abstract

This report provides the result of the second landscaping study conducted in the context of AI Watch, the European Commission knowledge service monitoring the development, uptake and impact of Artificial Intelligence in Europe. The report presents the results of the mapping of the use of AI in public services. The findings are based on three pillars: (i) an analysis of national strategies by European Member States on AI that focuses on how these strategies describe policy actions to address AI development in the public sector; (ii) an inventory of AI use cases in the public sector to provide an overview of the status of AI implementation in Europe; and (iii) in-depth case studies which describe in detail the factors crucial for the responsible development and adoption of AI and their consequences. The findings highlight that the use of AI by public administrations is growing and that AI technologies could significantly improve the effectiveness and efficiency of public administrations. However, the diffusion of AI remains unequal, and the breaking down of barriers to AI adoption requires significant consideration by policymakers. Progress in this area will depend on ensuring the right balance between public and private sector expertise and capacity, strong collaboration, enhanced data governance and risk mitigation. These results contribute to the existing body of knowledge on the topic by moving from a more theoretical and anecdotal view to a more systematic analysis that is based on a large number of concrete examples.

Executive summary

Objectives

The main goal of the report is to offer an overview of the situation in Europe regarding AI adoption in the public sector and, by drawing on the collected data, look at the associated challenges, barriers and risks and how to address them. Moreover, it aims to offer policymakers a series of recommendations for dealing with AI implementation. The analysis is based on original evidence and insights on three main topics: (i) the National Strategies published by Member States on AI, with a specific focus on how those strategies address public sector related challenges to AI development and use; (ii) an inventory of AI use cases in the public sector; and (iii) an in-depth view of 8 cases of AI use in the public sector, where a variety of "on-field" information has been collected through case study research.

Research and policy context

The body of knowledge has recently started expanding, as has the academic sector's research interest in the use of AI in government. In fact, policymakers recognise that the integration of AI in the public services is in some cases already providing large benefits and public value to citizens through improved efficiency, the reduction of administrative burdens, or by making public services more proactive and personalised. At the same time, the use of AI in government faces several specific factors which makes it distinct from the use of AI in the private sector. In fact, the potential benefits of AI technologies for the public sector are massive, but they are accompanied by some serious risks which must be avoided. The use of AI within government comes with additional ethical considerations due to its unique role, legal status and expectations compared with the private sector, and thus greater care and consideration should be given to mitigating ethical concerns.

The policy context is also rapidly evolving. The first important step was taken in 2018 with the Coordinated Plan on the Development and Use of Artificial Intelligence COM (2018). Since then, several policy documents have been published. The main recent legislative step on AI happened in April 2021, when the European Commission released the proposal for a regulation of the European Parliament and of the Council laying down harmonised rules on AI (Artificial Intelligence Act), the first legal framework to regulate AI. The new AI Proposal for a Regulation laying down harmonised rules on Artificial Intelligence aims to promote transparency and compliance to ethical requirements for systems that interact with humans by following a risk-based approach.

Results. The national strategy analysis

As the first step of the analysis, the research team reviewed published national AI strategies to specifically address initiatives stimulating the uptake of AI within the public sector as mentioned in those documents. The main highlights from this analysis are:

- The strategies recognise that AI expertise and competence within public administration is low and needs to increase to make the most of the possibilities of AI. As such, strategies often mention that some form of training will be made available for the public sector to train public servants in working with AI.
- Despite the need for proper funding for AI-enabled innovation in the government, funding amounts as described in strategies vary or are not explicitly mentioned. Rather, stimulating the AI start-up ecosystem is often seen as a priority in many strategies. Utilising and reforming public procurement to acquire innovative AI in government is frequently mentioned.
- Some strategies seem to focus more on public-private cooperation on the development and adoption of AI in government, while others are more oriented towards tackling data-related barriers. Other strategies included the improvement of internal capacity as another important instrument that, in connection with the ones previously mentioned, will stimulate the uptake of AI in government.

Results. Inventory of use cases

The study includes an overview of 686 use cases of AI in the public sector in use across all 27 EU Member States plus some other Countries in Europe, characterised by different features and qualities. The high number

of cases collected is an initial sign that AI is now more widespread in the public sector in all European countries. The main results from this analysis are:

- A third of the cases were found to be implemented and used in daily operations, but many are still in the pilot or development phase.
- The analysis suggests AI development is driven by national governments because they have the human and financial capacity to sustain development.
- At the same time a considerable number of AI initiatives are developed by regional and local administrations, demonstrating that regions, cities and municipalities – even small ones – can play a key role in pushing the development and usage of AI.
- Most AI deployed in the public sector supports public services engagement, followed by analysis, monitoring and regulatory research purposes and internal management goals. Only a handful of cases relate to adjudication tasks, indicating that AI solutions are rarely solely used for the automation or assignment of social benefits.
- The largest category of **AI cases is based on Machine Learning (ML) techniques** in several different ways. However, several other techniques are also used in the public sector, for example **Natural Language Processing (NLP) technologies**.
- Most AI use in the public sector aims to improve the quality of public services or to improve administrative efficiency. A few AI use cases aim to improve the capacities of governments to become more open by increasing transparency, participation or public control.

Results. In-depth case studies

In addition to the general overview of use cases, the report includes an analysis of 8 in-depth case studies. The analysis has been conducted with a review of all the information available online and at least one interview with someone involved in the implementation of the AI solution. The main take-aways from this analysis are:

- The identified success factors for AI implementation go beyond the requirement of "developing the AI" and consist of many social, organisational, cultural, and even economic factors, like new organisational structures or a different approach toward the role of the technology.
- The public sector is bound by specific development and design factors that are unique to the public sector and has to consider different values and approaches, such as increased need for transparency and how AI systems can be explained to citizens.
- To develop and work with AI, there is a need to gain AI-related expertise, either by organising training, attracting data scientists, or using external expertise. However, none of the cases rely solely on external expertise, as the absence of internal expertise might lead to challenges in setting up the projects, managing the AI development, and maintaining and evaluating the AI systems when they are in use.
- The riskier and more impactful the AI system is, the more risk mitigation measures are conducted. Furthermore, the implementation of AI brings additional security and legal constraints to the organisation which have to be taken into consideration.
- A successful development or procurement of AI solutions does not immediately mean that the AI system is successfully implemented – following a piloting phase, additional considerations must be taken into account, and there has to be a stronger focus on value for the organisation and balance with existing organisational interests.
- In particular, the general acceptance of the AI system by the civil servants who end up having to use it remains crucial, and it can take time and additional effort to secure this support.

Policy recommendations

Thanks to the evidence collected it was possible to formulate some recommendations for the policymakers and public managers dealing with AI implementation. The recommendations are mainly focused on the organisational level, highlighting what should be done to prepare for the introduction of AI solutions. For a more

in-depth overview of high-level recommendations a dedicated report has been published (Manzoni et al., 2022). The recommendations are:

- Public organisations should start considering AI not only as a research and innovation area but also as a set of solid and available technologies for improving the administrative machine. Moreover, they should start preparing themselves for diffuse and widespread use of AI in all public sector areas.
- Public administrations should consider in-house knowledge on AI for the – partial or complete – internal development of AI, for the direction and adjustment of the system developed by external suppliers, and/or for ensuring proper management of procurement activities.
- Public administrations should start considering AI as a technology that will affect the daily routines of most employees, start thinking about the wide diffusion of basic knowledge on how the algorithm works, and how to deal with systems that use AI techniques.
- Given that a public organisation is likely to need support for developing an AI system, they should carefully select the proper partner(s) and/or suppliers and balance internal and external development.
- Risks should be systematically assessed with a structured and well-defined procedure, avoiding any form of discriminatory and unfair use of the AI system. Proper mitigation measures should be identified for ensuring a human-centric use of AI. This needs to become routine for public organisations.
- Public administrations should be aware that the technical effort for coding an AI system is only a small portion of the effort needed for its implementation. Introducing an AI solution requires a general awareness of AI but also new task allocation and, new roles and positions within the organisation as required.

1. Introduction

1.1. Objective and structure of the report

Artificial Intelligence (AI) has become an area of strategic importance with the potential to be a key driver of economic development and with a wide range of potential social implications. The European Commission recognises the central role of AI for the future of our society and aims at creating EU global leadership in trustworthy AI. The public sector is one area in which AI is already playing a key and pivotal role, and this is likely to increase further in the future. Existing policy documents demonstrate the EU's commitment to harnessing this change for the public sector. The 2021 review of the Coordinated Plan on the Development and Use of Artificial Intelligence COM (2018) declares that one of the main goals for the future is making the public sector a "trailblazer for using AI". Moreover, Member States often highlight public sector related initiatives in their national strategies (Misuraca & van Noordt, 2020; Van Roy et al., 2021).

The trend towards the use of AI by the public sector is not only reflected in policy documents but also in concreate solutions, and several studies in fact highlight how public administrations already started adopting AI (Ahn & Chen, 2020; Misuraca & van Noordt, 2020; Wirtz et al., 2019). While the academic field was still lacking in publications on AI in the public sector up until a few years ago (Sousa et al., 2019), the body of knowledge, as well as research interest, has recently started expanding. This can be seen in an increasing number of publications of academic articles and literature reviews (Medaglia et al., 2021; Wirtz et al., 2021; Zuiderwijk et al., 2021), special issues in academic journals and conferences including special elements on AI in government. Yet, while research in this field is increasing, several unresolved or only partially resolved questions remain, and these will require further research efforts.

AI can – and probably will – have a significant impact on the public sector (Sun & Medaglia, 2019), bringing significant benefits to citizens. At the same time AI is also posing a range of important challenges – technological ethical and societal (Wirtz et al., 2019) – which limit both its current and future development and its integration with public administrations. More research on these main drivers, barriers, impacts, and unforeseen consequences is required, as is a better understanding of which AI system is being used for which purpose. Further research is also needed to explore and understand the dynamics underlying AI implementation in the public sector and to give evidence-based recommendations to public administrations from the national to local level in both governing with and of AI.

This report contributes to the increasing body of knowledge on AI in the public sector. It is based on analysing original evidence about how AI is being used in the public sector and how it is affecting it. The report presents the state of the play of AI in the public sector in Europe, and identifies the challenges, barriers and risks of AI in the public sector and how to address them.

The report is built on three main pillars of research activities:

- an analysis of the National Strategies published by Member States (plus Norway) on AI, with a specific focus on how those strategies address public sector related challenges of AI development and use
- an inventory of AI use cases in the public sector, offering a general overview of the status of AI implementation in Europe
- an in-depth view of 8 use cases of AI in the public sector, where various "on-field" information was collected through case study research

The three pillars are reflected in the structure of this report. Chapter 2 provides an overview of the state of play in research and policies to provide both the background and context guiding the research conducted in the report. After this overview, the analysis continues along the three pillars. Chapter 3 presents the analysis of the national strategies, highlighting how Member States (and Norway) aim to stimulate the use of AI within their own public sector. Chapter 4 then reports the results of the mapping exercise, in which 686 cases of AI use in the public sector were categorised and described. To provide a more detailed view of some of the ways AI is being developed and used in the public sector, Chapter 5 includes a comparative-analysis of 8 in-depth case studies describing how governments developed and integrated AI in their operations. Chapter 6 proposes some policy recommendations derived from the analysis with a focus on the organisational level. The report concludes in Chapter 7 with the main findings, as well as recommendations for future research activities.

Additional Annexes are included that give more details on various aspects not included in the main text of the report. **Annex I** presents the country factsheets prepared for the analysis of each national strategy as part of

the overview available in Chapter 2. In addition, **Annex II** gives a more detailed description of each of the 8 cases analysed as part of the in-depth case studies done in Chapter 5[1].

Finally, the entire database with 686 cases of AI in the public sector has been published as open data in the JRC data portal,[2] to give policymakers and the research community access to the raw data in the hope of fostering further research based on the information collected by the AI watch team over the years.

1.2. Related publications of the AI Watch

The current report is part of broader activity for the AI Watch research on the exploration of AI in the public sector that started in December 2018 and resulted in several interconnected reports on the subject. The information and data reported here are the result of a long research journey that started in December 2018, and the findings describe its accumulation of knowledge.

Use cases of AI in the public sector. In 2020 the AI Watch published the first report on AI in the public sector titled "AI Watch – Artificial Intelligence in public services" (Misuraca & van Noordt, 2020). The report contains the first exploratory mapping of the use of AI in public services in the EU. Overall, 230 cases of AI in the public sector were collected and analysed. One of the main takeaways from this first research was that there is a large variety of ways of implementing AI solutions in the public sector. Many projects analysed were just in the pilot or testing phase, even though in 2019 and 2020 there was already a sizeable portion of cases effectively implemented and used in daily public services operations. Some of the collected cases were also published in open data in the JRC data catalogue. This collection of cases represents the basis for the current inventory, which will be presented in Chapter 4 and is published in open data in the JRC data catalogue, updating the previous version.

National Strategies. The first country in the European Union that published a national strategy on AI was Finland in October 2017. Since then, 24 countries have published their strategies. The AI Watch has monitored and analysed those strategies and a specific report was published analysing and comparing them overall (Van Roy et al., 2021). A web page for each country's strategy is available on the AI Watch website,[3] and an updated version of the report is underway. Moreover, since 2019 AI Watch has focused specifically on how the strategies are dealing with AI uptake in the public sector. A first analysis was published in 2020 (Misuraca & van Noordt, 2020). An updated analysis is included in Chapter 3.

Theoretical reflections. The evidence collected through the case studies led the research team to focus on the implementation phase more than on the adoption phase. AI is becoming a more mature technology and public administrations are reflecting on how to move beyond pilots and adopt AI solutions in their daily activities. In 2021 AI Watch published a second technical report "AI Watch. Beyond pilots: sustainable implementation of AI in public services" (Molinari et al., 2021). The report points out some critical challenges to the AI implementation phase in the EU public sector, including: (i) the generation of a critical mass of public investments; (ii) the availability of widely shared and suitable datasets; (iii) the improvement of AI literacy and skills in the involved staff; and (iv) the threats associated with the legitimacy of decisions taken by AI algorithms alone.

Peer-learning workshops. AI Watch organised a series of peer-learning workshops in 2020 and 2021 to engage with EU Member States and relevant stakeholders. The workshops were an opportunity to co-create, share, and discuss the ongoing research and to report experiences of public administrations that are dealing with AI implementation. The proceedings of the workshops were each published in a dedicated report. The first workshop (van Noordt et al., 2020) discussed how the current state of AI in the public sector shows AI is widely experimented with across European countries. The second one (van Noordt & Pignatelli, 2020) focused on the impacts of the COVID-19 crisis on the development and uptake of AI in public services. In the third one (van Noordt et al., 2021) the AI Watch and some Member States (MSs) presented initiatives and analyses on the uptake of AI. Finally, in the fourth one (Manzoni et al., 2021) an interactive event took place for discussing and validating the policy recommendations described below.

Recommendations. One of the main goals of the whole AI Watch initiative is to provide Member States with recommendations to support them in the implementation of AI. This exercise started with the report published in 2021 (Molinari et al., 2021). It draws a preliminary set of recommendations for EU decision-makers willing to undertake the systemic approach to AI governance. This set of recommendations was the starting point for

1 Annex I and Annex II are published as separate documents

2 https://data.jrc.ec.europa.eu/dataset/7342ea15-fd4f-4184-9603-98bd87d8239a

3 https://knowledge4policy.ec.europa.eu/ai-watch/national-strategies-artificial-intelligence_en

an upcoming Science for Policy report in 2022, titled "AI Watch. Road to the adoption of Artificial Intelligence by the public sector" (Manzoni et al., 2022). The whole report is dedicated to presenting recommendations on the uptake of AI in the public sector. It lists and explains 16 policy recommendations clustered in four areas of intervention, accompanied by several actions, at different operational levels. Recommendations and actions presented are intended to support forward-looking managers, practitioners, and innovators throughout the public sector at the European, national, and local levels. It is the first endeavour at the European level to outline avenues to promote AI in support of public services.

2. Scientific and policy background

2.1. AI in the public sector: what we know from the existing literature

Before getting into the details of the background on AI in government it is important to briefly introduce the discussion around the definition of AI. There is a large debate on how to define AI that risks AI becoming a mere buzzword used without clarity. Moreover, as further detailed below, the need for a clear definition is becoming compelling, as the European Commission is proposing a new regulation on AI, the Artificial Intelligence ACT, for regulating the development of Artificial Intelligence in Europe. The discussion on the definition of AI is still ongoing, and, as explained below in the methodological section, the current report won't enter this debate. However, as a guiding definition, the most solid one can be considered the one proposed by the High-level expert group on AI appointed by the European Commission, here reported for the sake completeness and clarity:

"Artificial intelligence (AI) refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals. AI-based systems can be purely software-based, acting in the virtual world (e.g. voice assistants, image analysis software, search engines, speech and face recognition systems) or AI can be embedded in hardware devices (e.g. advanced robots, autonomous cars, drones or Internet of Things applications)."

Recent advances in computational power, the exponential increase in data, and new algorithmic techniques are now advancing the widespread use of AI technology. There seems to be a general awareness that AI has the potential to disrupt almost all industries (Raisch & Krakowski, 2021). The public sector is not excluded from this disruptive change, indeed it has been recognised as one of the sectors where AI can have a larger impact (Sun & Medaglia, 2019), by improving internal operations, decision-making, public services and trust in government, amongst other things.

Government is involved with two different lines of actions because of its characteristics, and its role in society. On the one hand, it focuses on legislation advancement for ensuring ethical and human-centric use of this technology to reduce risks and to prevent societal harm from that use. On the other hand, it reflects on how to use AI for fulfilling its own duties more efficiently and effectively. The report focuses on the second line of actions, looking **at how, where, why and for whom AI is adopted in public settings**. In this, legislating and applying legislation on the risk of AI are crucial, but are not the only considerations to be borne in mind when considering the effective use of this technology. As such, we briefly discuss AI legislation to provide context, as – obviously – the public sector itself must also adhere to legislative obligations and directives when developing and using AI. Nevertheless, the main focus of the report is on all drivers and barriers to AI use.

Several other AI Watch studies demonstrate how public administrations have already started adopting AI (Ahn & Chen, 2020; Misuraca & van Noordt, 2020; Wirtz et al., 2019) in several disparate areas such as surveillance, law enforcement and service delivery (Zuiderwijk et al., 2021). Moreover, nowadays public administrations are not simply exploring the potentialities with piloting solutions or testing environments, but **several AI solutions are already deployed and in use in daily operations** (Misuraca & van Noordt, 2020; Molinari et al., 2021). This evidence testifies to its large potential in public settings.

The integration of AI in the way public services are managed and delivered has the potential to provide, and in some cases is already providing, large benefits and public value to citizens. For example scholars have highlighted the potential value of AI in enabling faster and more accurate detection of social issues, in making better predictions of the effect of potential policy solutions and faster and more accurate feedback loops after the deployment of new policies (Höchtl et al., 2016). Other scholars instead stress efficiency benefits, since processes could be automated and staff supported and empowered through the recommendations of AI systems (Mehr, 2017). Benefits can also be detected in public service delivery in various ways, from personalised services to chatbots, but also proactive services diminishing the administrative burden for citizens and firms (Androutsopoulou et al., 2019; Kuziemski & Misuraca, 2020).

Surprisingly, the expansion in the usage of AI by public administrations is growing, out-running the attention of the scientific community (Kankanhalli et al., 2019), although, as mentioned earlier, the body of knowledge is growing as well. This creates an – almost paradoxical – situation where administrations are using AI with scarce support and evidence from researchers. In fact, the research on AI is mainly theoretical, debating the principles, potential challenges and risks while leaving a gap of solid, empirical evidence and exchange of practices (Sun & Medaglia, 2019), Finally, observing that AI, whilst challenging, is now being implemented and used in public administrations, as stated by the previous report of the AI Watch (Molinari et al., 2021), **there is also a need to make a step forward in research going beyond the study of pilots and moving towards insights**

that can support public administrations in the implementation phase. The latter has been identified as one of the critical steps that prevent AI use from being as widespread as it potentially could be is in public sector settings (Venkatesh, 2022).

The study on the implementation of digital technologies in public administrations is not new. For many decades there has been great interest in utilising technologies to improve the functioning of governmental organisations as part of the e-government research field. Research has already pointed out the difficulties of integrating digital technologies in government as well as providing some recommendations to overcome them (see for example Omar et al., 2020; Tangi et al., 2021; Weerakkody et al., 2011). The use of AI in government falls under this body of existing knowledge and insights gained from looking at the past challenges of integrating technology in government are still relevant for the use of AI today (van Noordt & Misuraca, 2020).

However, several peculiarities mean previous literature on public sector innovation and ICT implementation is not fully applicable to the use of AI in government. First, the technology is different and has peculiar features – in a nutshell AI is different from standard digital technologies as it does not follow simple *if-then* logic, meaning schemes are no longer simple artefacts but actually a new class of organisational agents (Desouza et al., 2020; Maragno et al., 2022; Raisch & Krakowski, 2021). Second, the adoption of AI is different in the public and private sectors as the first poses unique challenges. Wirtz et al., (2019) identify four main classes of challenges related to AI in the public sector: (i) **societal**, including the issues related to social acceptance of AI, like citizens' trust or fear of workforce substitution; (ii) **ethical**, embedding all the challenges related to machine ethics, like discrimination or machine value judgements; (iii) **regulatory**, focusing on the legal issues like privacy or accountability; and (iv) **technological**, comprising the issues related to the implementation of AI in the specific context of a public organisation like data integration or employees specialisation.

These challenges have been complemented and refined over the years, such as for example in Mikalef et al., (2021) who highlight the importance of funding and incentives, organisational innovativeness and pressure from the government, and Ahn and Chen (2021) who highlight the importance of training and education on AI. In addition, de Bruijn, Warnier, & Janssen, (2021) recently listed a series of challenges for making AI more explainable since any AI-based solution will be more acceptable if it can be explained to both civil servants and the public. Moreover, Maragno et al., (2022) highlight the organisational challenge of designing a new team for dealing with AI training. These challenges go beyond merely technical explanations of how the AI system work to include the management of the dynamic environment in which these AI systems will operate as well as the lack of expertise and the acceptance and management of machine biases, depending on to whom the information is to be provided. As such, AI used in the government has to be more transparent and explainable than similar applications used in a private sector context.

2.2. Towards human-centric AI in European public sector

The potential benefits of AI technologies for the public sector look impressive but are accompanied by some serious risks. Obviously, these risks must also be governed while respecting democratic values and human rights, to ensure that AI is used for societal good and not for malicious purposes. Similarly, any potential unintended negative consequences following the deployment of these technologies should be prevented. Much work has already been done to highlight ethical concerns and dilemmas, and the potential impacts of AI on human rights. There are open issues to clarify how the rising use of AI may impact society, like creating large scale job losses, increasing or perpetuating existing biases in society, concentrating power and wealth and thus further amplifying inequality and damaging democratic processes. In addition, ethical concerns are coming from increased human-AI interactions, such as deception or manipulation through AI systems. It is also possible that the more AI gets deployed in our society, the more it may increase dependency on AI and consequently change relationships between humans as well.

A study for the European Parliament[4] has pointed out how AI can raise questions concerning liability and accountability. As complex AI systems become black boxes, it is increasingly challenging to understand how AI systems reach their decisions. Next to societal concerns, the computation involved with the design and development of AI systems comes with an increasing environmental impact that cannot be overlooked. While AI could be used to assist in the green transition and protect the environment, the development of AI itself brings an environmental impact and may also be used for non-green goals which would contribute to climate change and environmental degradation. This element has not been considered in the current study, however, the research group started and is fostering the discussion in this direction and explicitly mentions the

[4] Artificial intelligence: From ethics to policy https://www.europarl.europa.eu/thinktank/en/document/EPRS_STU(2020)641507.

sustainability aspect as one of the recommendations toward the adoption of AI in the Public Sector (Manzoni et al., 2022).

When these concerns relate to the government, they raise even more attention because ethical requirements like equity and transparency are at the core of public affairs. **The use of AI within government requires careful ethical considerations due to its unique role, legal status and expectations when compared with the private sector, and thus greater care and consideration should be given to upholding ethical concerns**. Governments are under additional legal constraints, often deal with vulnerable citizens, or and have the duty to assist all citizens independently from their status. In addition, citizens may have higher expectations regarding the quality and transparency and explainability of AI systems used by their government organisations rather than private sector organisations.

Previous publications of the AI Watch (Molinari et al., 2021) have already identified specific ethical risks which, unless successfully prevented, harm the input, throughput and output legitimacy of government organisations. **Incorrect use of AI may lead to unfair outcomes by amplifying discriminatory biases**. Furthermore, decisions taken with or by AI systems may become more opaque, and so harder to justify. Severe data collection practices combined with new knowledge from data analysis could further threaten the privacy of citizens or make surveillance of citizens by governments more commonplace, threatening civil liberties. To lower this risk, some algorithm registries are being developed for increasing transparency towards citizens. Examples of this include Amsterdam[5] and Helsinki.[6]

These (perceived) ethical concerns make administrations less likely to initiate AI-related projects or, following a successful pilot, unresolved ethical questions halt the implementation. As such, ensuring that ethical dilemmas and concerns regarding AI technology are resolved would make the sustainable use of these technologies more likely in government. Naturally, ethical AI is also a requirement not only needed to facilitate adoption – but also to make sure that the **effects of the use of AI in government yield socially desirable results**.

Governments thus ought to be aware of these different impacts AI may have on society and **take appropriate actions to prevent them, mitigating risks**. Such "governance of AI" is well underway, with ethical guidelines, regulations and declarations on AI being introduced and signed by the EU Member States in the last years (see Chapter 2.3 below for more details). The EU in particular aims to develop "trusted AI" based on truly European ethical and societal values borrowed from the European Charter of Fundamental Rights and has been putting forward various policy initiatives to achieve this.

2.3. Regulatory and policy context in the EU

The first policy building block on the European Level is the **Declaration of Cooperation on AI**[7] adopted by all EU Member States, Norway, Switzerland and the United Kingdom on 10 April 2018, which aims to boost Europe's technology and industrial capacity in AI and its uptake.

Shortly after, the **Communication "Artificial Intelligence for Europe"** of 25 April 2018 (COM/2018/237)[8] endorsed by the European Council in June 2018, proposed an overall strategy on AI for Europe. This Communication set out the European vision and laid the policy foundations in this domain to create the ideal conditions for the development and implementation of AI in Europe and to allow civil society and the private sector to benefit from the opportunities it could offer.

The strategy was followed by the Communication on a **Coordinated Plan on the Development and Use of Artificial Intelligence** (COM (2018) 795 final),[9] which provided a shared policy collaboration framework and encouraged all Member States to develop their national AI strategies. The coordinated plan was updated in 2021, with a new document ("Coordinated Plan on Artificial Intelligence 2021 Review")[10] putting forward a concrete set of joint actions on how to create EU global leadership on trustworthy AI. Among those actions, one – action 14 – aims at making the public sector a "trailblazer for using AI".

5 https://algoritmeregister.amsterdam.nl/en/ai-register/
6 https://ai.hel.fi/en/ai-register/
7 https://ec.europa.eu/jrc/communities/en/node/1286/document/eu-declaration-cooperation-artificial-intelligence
8 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2018%3A237%3AFIN
9 https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52018DC0795&from=EN
10 https://digital-strategy.ec.europa.eu/en/library/coordinated-plan-artificial-intelligence-2021-review

The **High-Level Expert Group (HLEG) on AI** put forward several recommendations[11] to develop, use and scale trustworthy AI, leading to AI-based public services that are human-centric and safeguard the fundamental rights of the beneficiaries of the new AI-based public services.

The recent Member States' **Berlin Declaration** on Digital Society and Value-based Digital Government[12] also acknowledges the importance of creating value-oriented, human-centric AI systems for use by the public sector. The declaration stresses the importance of ensuring the responsible, accountable, transparent, and explainable use of AI and that unlawful discrimination by AI used in the public sector should be minimised. Generally, the public sector is seen as a catalyst for sustainable growth and innovation, and the strategic use of public procurement to fund innovation is part of this view.

The subsequent **Lisbon Declaration on Digital Democracy with a Purpose**[13] further upheld human rights, ethical values and democratic participation in the digital era and recognised the importance of green and digital technologies, including AI, as a key element of economic growth by balancing innovation and competitiveness with social and environmental development.

The **Digital Europe**[14] and the **EU Recovery and Resilience Facility (RRF)**[15] programmes include funding opportunities for AI in the public sector through the European Digital Innovation Hubs, Testing and Experimentation facilities, AI skills and awareness raising and AI procurement.

The **Digital Europe Programme**[16] includes support for the experimentation of AI within cities, such as the Large-Scale Pilots initiative. This should help validate the Data Place for smart communities by enabling the experimentation of portable, AI-enabled, cross-sectoral, cross-city urban data services. In addition, the setup of AI-powered Local Digital Twins within European cities will be stimulated by the creation of an EU Local Digital Twin Toolbox that cities could use in a modular fashion to build their own twins.

The **White Paper on Artificial Intelligence** – A European approach to excellence and trust (COM/2020/65)[17] presents policy options to ensure that the development of AI is trustworthy, secure, and in line with the values and rights of EU citizens. In doing so, it introduces the concepts of "ecosystem of excellence" along the entire value chain of AI adoption, and "ecosystem of trust" to give citizens, businesses, and public organisations the highest possible confidence in using AI. The white paper includes a specific section dedicated to the adoption of AI by the public sector. From the public consultation on the white paper, respondents highlighted the importance of promoting the adoption of AI by the public sector by ensuring trustworthy AI in Europe.[18]

With regards specifically to the public sector, the **Communication on a European Strategy for Data** (COM/2020/66)[19] emphasises the need to grasp the benefits brought by data for improving decision-making and public services by updating regulation, and the importance of embracing cloud technologies to deploy AI.

To stimulate the deployment of AI in public administration and to implement some of its acts, the European Commission launched various activities. The **AI Watch initiative**[20] was established in 2018 as a common knowledge service to monitor the development, uptake, and impact of AI in the EU. It was jointly implemented by the Directorate General Communications Networks, Content and Technology (DG CONNECT) and the Joint Research Centre (JRC). Building on the White Paper exhortation to undertake policy dialogues with public sector organisations to facilitate the development, experimentation, and adoption of AI technologies.

Following on from this, the **Adopt AI programme,** mentioned in the Coordinate Plan, will aim to support the public procurement of AI, and the change of public procurement processes by assisting Member States in overcoming common challenges in the public procurement of AI systems.

The **European Digital Innovation Hubs** (EDIHs)[21] are also expected to play a crucial role in supporting public administration in moving forward with the use of AI by assisting in the experimentation with and deployment of the Common Services promoted within the European Digital Government Eco-System. It will also help cities

11 https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=60343
12 https://www.bmi.bund.de/SharedDocs/downloads/EN/eu-presidency/berlin-declaration-digital-society
13 https://www.lisbondeclaration.eu/
14 https://eur-lex.europa.eu/eli/reg/2021/694/oj
15 https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility_en
16 https://digital-strategy.ec.europa.eu/en/activities/digital-programme
17 https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020_en.pdf
18 https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=68462
19 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0066
20 https://ai-watch.ec.europa.eu/index_en.
21 https://digital-strategy.ec.europa.eu/en/activities/edihs

and communities implement AI-enabled urban digital services and urban digital twins, on top of interoperable urban digital platforms. The Big Data Test Infrastructure (BDTI)[22] will further help public administrations to be more efficient through the use of big data.

A further move in that direction is the **DIGITAL GovTech Incubator cooperation framework call**[23] which was published in February 2022. It is aimed at supporting the discovery of new interoperable solutions, and so also AI, that can be adopted by EU countries and that can become part of the offer on the Common Services Platforms. At the same time this instrument will support the sharing of best practices, for example in the procurement of innovation. In addition, it will give GovTech start-ups and SMEs the opportunity to widen their market and their opportunities to grow, as well to get inspiration from Europe's diversity in digital public administration and to benefit from simplified schemas of procurement of innovation or simplified sub-granting mechanisms allowed by the programme.

On a related note, **the DT4Regions project**,[24] promoted and funded by the European Commission, is working on creating a European Platform for Regions to enable AI and Big Data solutions for regional and local public administrations. This is a pan-European platform to facilitate the uptake and use of AI and Big Data to enhance public administration efficiency and effectiveness in providing user-centric services.

What can be considered the main legislative step on AI happened in April 2021, when the European Commission released the proposal for a regulation of the European Parliament and of the Council laying down harmonised rules on AI (**Artificial Intelligence Act**),[25] the first legal framework to regulate AI. The new AI Proposal for a Regulation laying down harmonised rules on Artificial Intelligence aims to promote transparency and compliance to ethical requirements for AI systems by following a risk-based approach. The following paragraph (2.4) is dedicated to this act and its consequences for the public sector.

In December 2021 the Commission has adopted **new rules on Open-Source Software**[26] that will enable its software solutions to be publicly accessible whenever there are potential benefits for citizens, companies or other public services. The decision follows the Commission's Open-Source Software Strategy 2020-2023. It is driven by DG Informatics (DG-DIGIT) under the theme "Think Open" and sets out a vision for encouraging and leveraging the transformative, innovative, and collaborative power of the open-source, its principles and development practices. The Strategy contributes to the goals of the overarching Digital Strategy of the Commission and the Digital Europe Programme. Similar policies have already been adopted in several Member States. This reflects the strong impact of open-source software (and hardware) on technological independence, competitiveness and innovation in the EU economy. This is demonstrated by the fact investment in open source leads to returns that are on average four times higher.[27.] The possibility of relying on open-source solutions must be considered also by every AI solution implemented in the public sector.

In February 2022, the European Commission also released the **new Data Act**,[28] published as a proposal first announced in November 2020, which will ensure fairness in the digital environment, stimulate a competitive data market, open opportunities for data-driven innovation and make data more accessible for all. Data are fundamental resources for AI development and implementation, and the Act will lead to new, innovative services and more competitive prices for getting market, aftermarket related and from connected objects data. This last horizontal building block of the Commission's data strategy. This means **public sector bodies can access and use data held by the private sector** only in exceptional circumstances, for example during public emergencies such as floods and wildfires, or to implement a legal mandate if data are not otherwise available. Data insights are needed to allow a quick and secure response, while minimising the burden on businesses.

2.4. The Artificial Intelligence Act and its consequences for the public sector

As part of its digital agenda and introduced in the previous section, the European Commission has proposed harmonised rules regarding AI solutions and published a proposal for regulation for the development and adoption of AI in the EU, the Artificial Intelligence Act (AI Act), in April 2021. In the following section, a brief introduction to this legislative proposal will be described as well as its potential application in the public sector. This report does not aim to enter the debate that is now revolving around the AI Act and its consultations.

22 https://digital-strategy.ec.europa.eu/en/policies/bdti
23 https://joinup.ec.europa.eu/collection/interoperable-europe/news/call-digital-govtech-incubator-open
24 https://dt4regions.eu/
25 https://digital-strategy.ec.europa.eu/en/library/proposal-regulation-european-approach-artificial-intelligence
26 https://ec.europa.eu/commission/presscorner/detail/en/ip_21_6649
27 https://digital-strategy.ec.europa.eu/en/library/study-about-impact-open-source-software-and-hardware-technological-independence-competitiveness-and
28 https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1113

However, given the importance of the **AI Act and its possible high impact on society**, the authors believe that the publication of a whole report with a collection of cases on AI cannot completely ignore the current effort toward new legislation.

The AI Act's impact will be widely felt across the economy with obligations for AI solutions/tools used in all fields, such as financial services, education, employment and human resources, law enforcement, industrial AI, medical devices, the car industry, machinery, toys and many more. This new regulation emphasises an approach that is risk-based and shaped by EU values, ensuring both safety and fundamental rights protection.

The AI Act in the current version first defines AI as software that uses one or several of the techniques identified in its Annex I. These include various machine learning approaches, logic- and knowledge-based approaches as well as statistical approaches. Moreover, it defines AI as a software that "can, for a given set of human-defined objectives, generate outputs such as content, predictions, recommendations, or decisions influencing the environments they interact with".

Second, the AI Act introduces a practical "product safety regime" modelled around four risk categories and imposes a drafted set of requirements for market entrance and certification for High-Risk AI Systems through a mandatory CE-marking procedure that is under definition and that will also include verifications on machine learning training, testing, and validation datasets. Consequently, any organisation with EU market exposure that develops or wants to adopt AI will be affected by the AI Act.

The AI Act proposes to prohibit AI systems which pose **unacceptable risks**, i.e. systems that:

- manipulate persons through subliminal techniques or exploit the fragility of vulnerable individuals, and could potentially harm the manipulated individual or third person;
- AI-based social scoring for general purposes carried out by public authorities; or
- real-time remote biometric identification systems in publicly accessible spaces for law enforcement purposes.[29]

Therefore, public authorities ought to be aware that using AI systems that are capable of social scoring are prohibited.

High-risk AI applications pursuant to Article 6(2) are certain AI applications belonging to the following areas:

- Biometric identification and categorisation of natural persons
- Management and operation of critical infrastructure
- Education and vocational training
- Employment, workers management and access to self-employment
- Access to and enjoyment of essential private services and public services and benefits
- Law enforcement
- Migration, asylum, and border control management
- Administration of justice and democratic processes

The AI Act highlights that access to essential public services is necessary to participate in society and to improve standards of living. Often, those applying for public assistance are in a vulnerable position in relation to the public authority. As such, AI systems that are used for determining whether benefits and services should be denied, reduced, revoked, reclaimed by authorities and AI systems used in dispatching emergency response services may be classified as high-risk.

Similarly, the AI Act describes several AI systems intended to be used in law enforcement which could introduce negative impacts and thus are seen as a high-risk solution. These include AI systems that make individual risks assessments for offending, reoffending, or becoming victims of a criminal offence; AI systems that are intended to be used as polygraphs or to detect the emotional state of people; AI systems used to detect deep fakes by **law enforcement** authorities and AI systems intended for the evaluation of the reliability of evidence; and others, such as AI used in crime analytics.

[29] Exceptions to this exist which are enumerated in AI Act Article 5(d)(i), (ii) and (iii).

In the area of **migration, asylum and border control management**, the AI Act mentions these AI systems affect people in particularly vulnerable positions and are dependent on the actions of authorities. As such, AI systems intended to be used with tasks in migration, asylum, and border control management – such as, for instance, AI used as polygraphs, assessing risks by people entering a Member State's territory, verifying the authenticity of relevant documents or AI systems assisting in the examination of solutions – are classified as high-risk systems.

For AI systems intended for the administration of justice and democratic processes, the AI Act states that they should be classified as high-risk as well due to their significant impact on democracy, the rule of law and citizens' rights. Systems that are intended to assist the judiciary in researching or interpreting facts and the law could have potential biases, errors, and be opaque – and are thus considered high-risk.

As it is likely that public administrations operate in some of these areas, it is crucial for them to be aware when their current or planned use of AI falls under any of these high-risk categories. If any public administration is planning to use an AI system that falls under any of these high-risk areas, the systems will be subject to strict obligations before they can be of use.

Providers and public sector decision-makers adopting high-risk AI systems must ensure that these AI systems follow adequate risk assessments and mitigation systems and are fed with high-quality datasets. They must also ensure that results are logged and traceable, provide detailed documentation on the system to authorities, provide clear and adequate information to users, ensure human oversight measures, and ensure an elevated level of robustness, security, and accuracy.

AI systems that interact with humans, recognition systems, biometric categorisation systems or AI systems capable of creating or manipulating digital content would also be **subject to transparency obligations** to make people aware that they are interacting with an AI system or that the content has been generated through automated means. Remaining AI systems are considered of minimal risk and do not have to conform to any additional requirements or obligations to be put in the EU market, although the AI ACT recommends that minimal risk AI systems follow voluntarily the requirements as defined by the AI Act.

In addition, the AI Act considers an AI system high-risk if it is used as a safety component of a product, or if it is covered by one of **19 specified pieces of EU single market harmonisation legislation** (e.g. aviation, cars, and medical devices). If the AI system is a component of a product covered by existing single market harmonisation legislation, the product is already required to undergo a third-party conformity assessment. These mandatory third-party conformity checks will incorporate the AI Act's requirements after the legislation is passed

The last element to summarise here on the AI Act is that it would further **discourage Member States from regulating AI technology at the national level** leaving only limited scope for regulatory intervention. For example, the AI Act does not cover AI solutions for military use and the proposed regulation leaves the tuning of the AI regime to the specific national contexts to national discretion. The penalties management is left to the Member States, and it is subject to compliance with the Regulation and to provide a set of sanctions that are effective, proportionate, and dissuasive. Specifically, Member States can decide not to subject public authorities and bodies to administrative fines. The regulation proposal provides public authorities with powers, such as accessing the "source code" of the AI systems, and expressly requires that those be made available to national authorities.

As the regulation is still in draft, however, it should be kept in mind that the categories, definitions as well as requirements of high to low-risk AI systems and other elements of the legislation are subject to change as the proposal undergoes (possible) amendments by the Council of the European Union and the European Parliament during the ordinary legislative procedure.[30]

[30] The status on the AI Act can be tracked here https://eur-lex.europa.eu/legal-content/EN/HIS/?uri=CELEX:52021PC0206

3. National strategies on Artificial Intelligence

3.1. Introduction and methodology

This chapter reports an analysis of the National Strategies on Artificial Intelligence of the European Member States with a specific focus on the public sector. This research is an update of the previous analysis on National AI strategies performed and published in 2020 (Misuraca & van Noordt, 2020). The update consists of the analysis of additional national strategies that have been published by the Member States since the publication of the previous report. Moreover, some adjustments have been done to the categorisation of the policy initiatives and the wording of the categories.

The aim of the strategy analysis is to **deep dive into each strategy and then compare the different policy initiatives** planned in the different national AI strategies to stimulate the development and the adoption of AI in the public sector.

For the analysis, all 27 EU Member States plus Norway have been taken into account. Switzerland did not release any national strategy. At the date of the strategy analysis, (January 2022) 24 national strategies had been published and analysed (the list is reported in **Figure 1**). Only the official strategies have been considered. Specific AI-related actions for the public sector published in different strategic documents (for example digital government strategies) have not been considered.

Since some of the strategies were published in languages other than English, machine translations were used to analyse the text through automatic translation tools.

As mentioned, the analysis has been conducted with a specific focus on the public sector: the research team did not include all the other policy initiatives that are not directly and explicitly relevant for and impacting the public sector. This might be seen as a limitation of the study as there might be initiatives targeting the private sector or society as a whole, where public administrations may be also affected. As such, the analysis is based on sections in the strategy documents explicitly referring to either the public sector, public administration, state administration, public services, or government. Some of the strategies also include agriculture and/or health care in their description of the public sector. However, this chapter focuses primarily on only policy actions that refer to the state administrations.

This chapter aims at being a first illustration of the different intentions of governments to boost AI use within their own administrations and to act as a peer-learning instrument to learn from specific examples. Similarly, this analysis does not provide nor aim to benchmark, rating or represent any other form of Member States assessment neither the quality of the national strategy document nor the consequent observed effects related to the fulfilment of the identified strategy actions.

The remaining sections of the chapter present the comparative analysis of the strategies, whereas **Annex I** presents one country-factsheet per country with a synthesis of the main elements that characterise the strategy with respect to the public sector. The links to the national AI strategy documents are reported in the references. The list also includes AI-related action plans, roadmaps or vision documents that have not been analysed but are useful complementary sources of information for further research.

The AI Watch is also analysing the national strategies with a broader and horizontal view that embraces all sectors, dedicated country strategy reports have been published in the AI Watch website[31] and a comparative analysis have been published in a different report (Jorge Ricart et al., 2022)

[31] https://ai-watch.ec.europa.eu/index_en

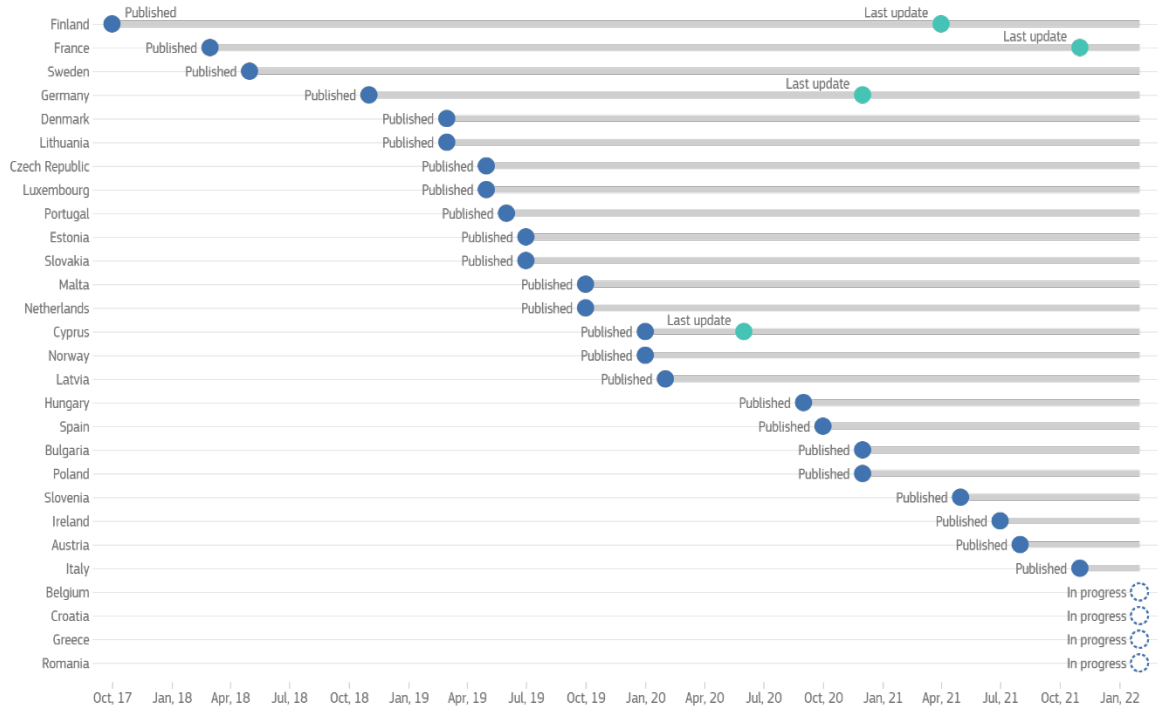


Figure 1. Overview of published AI national strategies from the EU27+NO. Last update 01/02/2022

Source: Jorge Ricart et al., 2022

3.2. Identified areas for the analysis

The areas reported in Table 1 group the initiatives described in the National Strategies mentioned for introducing AI in government services. Those areas have been identified through an iterative coding procedure: the documents have been analysed through an analytic process of examining data paragraph by paragraph searching for significant concepts. Those concepts then have been labelled and then aggregated in 6 thematic areas, slightly adjusted from the analysis done in the first iteration in the previous landscaping report (Misuraca & van Noordt, 2020).

Table 1. List of areas for grouping policy initiatives.

#	Name	Description	Main policies initiatives
1	Stimulating awareness	Initiatives that focus on stimulating awareness among civil servants on AI and on fostering mutual-learning initiatives for facilitating knowledge and experience transfer among public servants.	— Awareness campaigns — Building an international community
2	Improving data access and quality	Initiatives that aim at improving the data quality, availability and accessibility of the public sector to develop and implement AI.	— Improving data quality — Improving data access — Enhancing access to private sector data
3	Improving internal capacity	Initiatives related to the improvement of the qualified internal capacity in public administrations. This implies also the design of initiatives for increasing public servants' AI-related skills.	— Training on AI — New public bodies

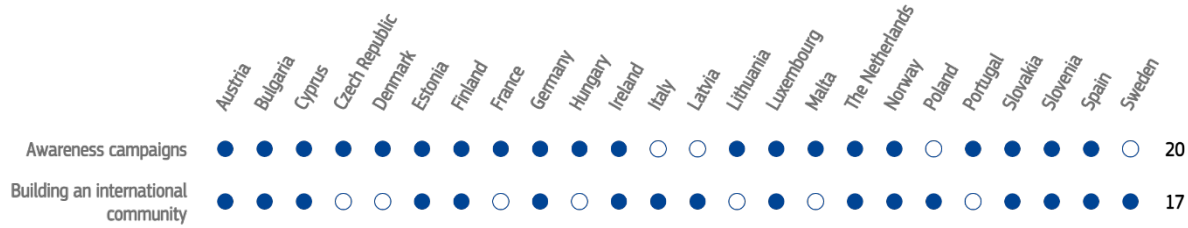
#	Name	Description	Main policies initiatives
4	Learning by doing: pilots and experiments	Initiatives related to the promotion and development of AI flagship projects used to learn from AI implementations and their effects.	— Regulatory sandboxes — Pilot projects
5	Ethical and legal AI guidelines	Initiative related to the development of normative frameworks, to act as a guide for public sector AI usages, intended to reflect ethical considerations of using AI.	— Development of ethical frameworks — Reform on data sharing laws
6	Funding and procurement	Initiatives intended to stimulate the development and uptake of AI by providing adequate funding, for example through special funding programmes to provide financial resources for AI experiments and projects.	— Funding for AI projects — Stimulation of GovTech startups — Revision of procurement processes

3.3. Comparative findings

In the following sections, the strategies have been analysed according to the six areas described above. This shows the policy actions which are mentioned more frequently, but also on original and peculiar policy actions mentioned by a handful of countries. The narrative of the sections follows in numerical order the areas reported in Table 2.

3.3.1. Area 1. Stimulating awareness and knowledge sharing

Table 2. Area 1 – Mapping of the coverage of the main policies initiatives



The first area of policy initiatives is related to improving the awareness of civil servants on what AI is, the kinds of opportunities it can provide, and how to learn from different practices. In this analysis (Table 2), a comparison is made on two main policy initiatives: (i) the hosting of awareness campaigns, and (ii) the participation in international events to improve networking opportunities.

Several strategies highlight the need to **improve the awareness of AI among public sector staff**, as understanding the potential of these technologies in daily activities is very important. In fact, several strategies highlight the need of increasing the knowledge of public servants on what is AI and how it can be adopted. Only through initiatives like this can opportunities be detected and acted upon – often as the first step in deploying AI in their services. For instance, the Austrian strategy includes awareness activities specifically dedicated to the "demystification" of AI amongst public officials as well as to create a realistic view of its risks and benefits.

Another illustrative example is from the Maltese government that promoted a communication campaign towards public servants for spreading the new AI strategy and a series of awareness events between 2020 and 2021 to:

"Equip public officials with foundational AI knowledge and insights into projects being undertaken by the Maltese Government"

Overall, out of the 24 strategies reviewed, 20 (83%) mention that the government is planning to **improve understanding of AI through awareness campaigns** in one form or another. It is to be noted that many other strategies also aim to improve the awareness of AI among civil servants, but do not do so through

awareness campaigns but rather through more dedicated training programmes, which will be discussed in the relevant section.

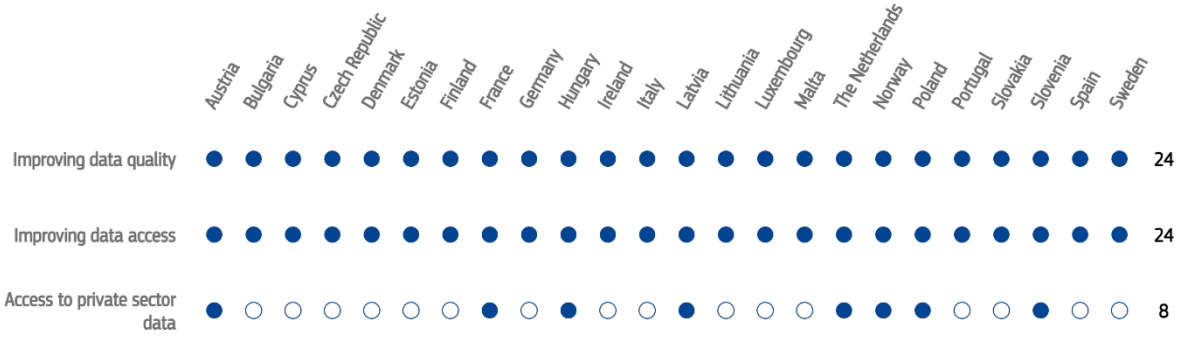
Lastly, 17 out of the 24 countries (71%) highlight the need to have public servants being part of and contributing to international communities to learn from the surrounding environment.

Cyprus for example highlighted the need for participating in the international research network to provide access to top international know-how and facilitate the sharing of knowledge with high-level researchers. Moreover, different countries identified our AI Watch initiative as a possible way to achieve this goal. Spain explicitly refers to the publications of the AI Watch initiative, while Austria highlights the need to establish monitoring units that should work in close collaboration with the AI Watch.

In conclusion, all the analysed strategies introduced initiatives in this area in one form or another. This highlights a **strong perceived need for community building in Europe**, both among public administrations and between public administration and external stakeholders. Governments assume that they can gain a lot by establishing formal and informal communication channels, working groups or communities that facilitate the sharing of information and experiences. In fact, the novelty and the complexity of AI, the need for a cultural shift, as well as the fearfulness and idealisation that still revolve around AI, require governments to join efforts and share practices toward a realistic and objective vision of what AI is, how it can support the public sector, and its limits with regard to preserving and respecting European public values.

3.3.2. Area 2. Improving data access and quality

Table 3. Area 2 – Mapping of the coverage of the main policies initiatives



Artificial Intelligence requires large volumes of data available for analysis to allow the system to create relations between data and formulate predictions that are as accurate as possible. Hence, improving data accessibility and quality is crucial for the development of AI. National strategies mirror this need with a strong focus on data, and a long list of associated initiatives.

Improving the data quality and the data access to stimulate public sector usage and development of AI is always mentioned. On this, Austria will develop department-specific data strategies for clear and unified indications that specify the conditions that need to be verified for making data available. The Lithuanian strategy, furthermore, lays great emphasis on improving data quality. The aim is to foster a unified approach to data management, favourable for the use of AI. For doing this the strategy proposes:

> *"Data scientists and experts need to work together with Lithuania's current data team in order to create a model for data management. The model will serve as a basis for revisions to current data infrastructure and future"*

Another important element described in the strategies is to increase the **availability and accessibility of public data**. All the 24 analysed strategies have some initiatives related to data openness. The availability of data is one of the main preconditions for developing AI systems, hence initiatives in this direction are included in the AI strategies. Data availability is mainly related to two different aspects: (i) making the data available in open data, and (ii) facilitating the accessibility of data by other public organisations. The narrative in the strategies on improving access to public datasets is often focused on the first aspect to support private companies in developing AI with these datasets, but this may naturally assist in the development of AI by public administrations themselves too. For example, Germany claims that:

"Data is to become 'open by default', so that making data publicly available will become the new normal for public authorities."

However, activities aimed at improving data access do not necessarily relate to only opening public datasets, but this also includes initiatives on improving inter-organisational data sharing among public administrations. This is concretely reflected in increasing the use of APIs and/or moving towards the creation of a centralised repository for administrative data. Examples seen in strategies include the proposed API Platform which is to be developed in Slovakia. The platform aims to facilitate the sharing of data for use in new AI solutions by both the market and governmental organisations. The European Commission aims to further advance in this direction through the Open Data Directive, the High Value Datasets Implementing Act as well as the European Data Spaces.

It is interesting to also note some traces of an opposite direction that is probably newer in the public debate: the assurance of access to private sector data by public administrations. Private organisations often have valuable datasets that could be used for the development of AI in the public sector. Some strategies highlight the need for more collaboration across sectors, but only a handful of strategies (8, 33%) describe **actions to facilitate access to private sector data**.

As an example, Hungary aims to create a Data Market platform to allow private sector data to be shared with other stakeholders. The Polish strategy for example highlights the need for "powering data warehouses with data from public institutions and enterprises". For supporting this the strategy highlight that:

"The provision of digital data generated by the company should be included in the mechanism for financing implementations of AI solutions as a precondition for participation in the project [i.e. projects commissioned by state entities]."

However, taking action to increase the sharing of private sector data with governments might prove to be a challenge (Micheli, 2022).[32] In that respect, the Norwegian strategy highlights that while sharing private sector data could be highly valuable, there is hesitation to oblige companies to share their data. Similarly, achieving the voluntary sharing of private data could also be challenging, which is why the Norwegian government will explore what can be done to make more datasets from the private sector available.

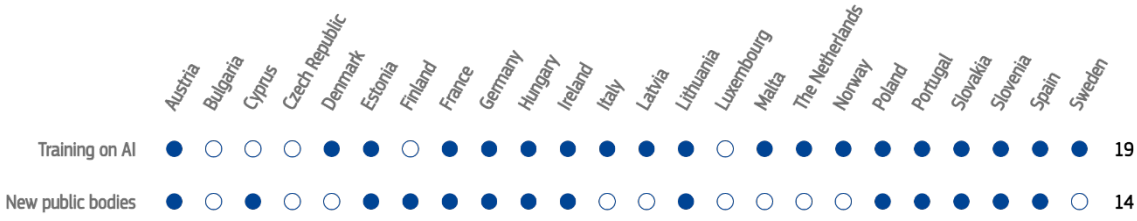
To conclude, data are at the core of AI development, and this is widely recognised in all AI strategies. Looking at the strategies it appears clear that the public sector has high barriers and high responsibilities with regard to providing this data for AI. Fragmentation of governments and policies and reluctance on the part of some public administrations makes the availability of a large amount of interoperable high-quality data difficult (van Loenen et al., 2021), but it remains an indispensable step for adopting AI. Naturally, this will be part of the ongoing process in making public administrations more data-conscious and data-driven, which will probably take time to be established at all layers of public administrations in all Member States. Here the positive element is that all strategies recognise the issue and work for improving on this aspect as part of their commitments to improve AI uptake. In that respect, the possibilities provided by AI could stimulate administrations to take more actions to prepare this baseline of data for future use of AI.

Moreover, the public sector has the duty, and obligation through the High Value Dataset Implementing Act, of publishing its data both for transparency reasons and for supporting the growth of the private sector. All governments are moving in this direction too. Finally, integration of private and public data seems a promising path for the future of the use of AI in the public sector, and some governments have highlighted this in their national strategies. Those initiatives should be properly monitored for sharing best practices all around Europe.

[32] The B2G Data Sharing Expert Group has also put forward recommendations on this https://digital-strategy.ec.europa.eu/en/news/experts-say-privately-held-data-available-european-union-should-be-used-better-and-more

3.3.3. Area 3. Improving internal capacity

Table 4. Area 3 – Mapping of the coverage of the main policies initiatives



The reviewed strategies often highlight the challenge that expertise and competences in AI within the public administration is currently (extremely) low and needs to increase to make the most of the possibilities of AI. This element is embedded in a broader issue related to a lack of digital skills in the public sector, as also highlighted in some of the strategies.

In this respect, there are 19 (79%) strategies that highlight **some form of training will be made available for the public sector to train public servants in working with AI**. Increasing digital competences within the public sector workforce are often mentioned as a key factor needed to successfully work or develop AI. The French strategy, for example, mentions that civil servants should be trained in working together with automated decision-making technologies to prevent any biases which may occur. A second example is Denmark, where an "internal academy for central government" will be established with the specific aim of providing generalist training courses. The Maltese strategy also highlights that their public service training courses will be updated to include AI-related courses.

Together with general training for most public servants, national strategies often highlight the need for more specialised training, which aim to give civil servants the required skills to develop AI, i.e. more advanced training tailored for technical personnel. In Denmark, the universities will work together with government organisations to develop IT specialist courses for civil servants. This type of more advanced, technical or specialist training is less often mentioned in strategies compared with more "general" AI or digital competences programmes. An interesting example of a specialised training course is included in the Spanish strategy that contains an initiative aiming to create a new master's degree for civil servants specifically targeting AI within the public sector. Malta, furthermore, will stimulate and fund civil servants to pursue certified AI training courses to increase the amount of AI expertise within government organisations.

Even though it is not directly related to the public sector capacity, it is worth mentioning that AI strategies have a strong focus on educational programmes for master students and in general young people. This does not directly affect the public sector in the short or medium term, but it is an extremely promising aspect for the long term, where – if these initiatives will become concrete programmes – we may observe a new generation of public servants with the proper skills for dealing with new, emerging technologies. To this extent, the European Commission is further promoting training on AI through the DT4Regions project, the PoliVisu H2020 project's MOOCs[33] and by making the Elements of AI[34] course more widely available.

Another leverage for **improving the internal capacity is to change the structure of government organisations**, with 14 strategies mentioning it (58%). This can be broken down in a change of roles and positions or macro structural change, as the creation of new departments or institutions. These changes in the strategies are often linked with the stated need for new ways for sharing knowledge (see area 1 above), acting as a governmental centre of expertise or stimulating the uptake of AI. In the Slovakian strategy, for example, there is the intent to create Digital Innovations Laboratories, which act as hubs achieving "substantial changes" in the public sector.

The Estonian strategy states that – at least at the level of ministries or areas of government – a Chief Data Officer is needed to assist with data governance, AI projects and more. In Ireland, the government proposes the creation of a GovTech Delivery Board that:

> *"Will lead the digital transformation of the public service. The GovTech Delivery Board will consider AI adoption in the public service as part of its work, providing strategic leadership and ensuring a coherent and*

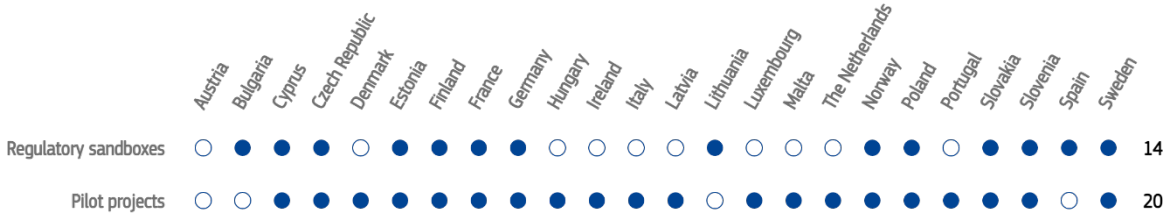
[33] https://www.open.edu/openlearncreate/course/view.php?id=4619
[34] https://www.elementsofai.com/

cohesive approach by the public service in adopting AI as part of its toolkit for addressing societal issues."

Finally, an open question on the involvement of the private sector for filling the competence gap that exists in public administrations is mentioned in the documents. Some strategies say that the public organisations should work more together with private organisations (where the missing skillsets are present), either through partnerships or by procurement. On the one hand, this is an extremely important and promising shift in the public sector that more and more must move towards a networking perspective. In fact, the complexity and variety of skills required by AI cannot be always completely internalised. On the other hand, such partnerships and procurement still require a baseline in expertise in AI within the public sector staff to avoid common mistakes or dependency on external parties.

3.3.4. Area 4. Learning by doing: pilots and experiments

Table 5. Area 4 – Mapping of the coverage of the main policies initiatives



The use of Artificial Intelligence within organisations is experimental in all layers of society. There are still many unanswered questions regarding the possibilities, effects, and consequences of the use of this technology. There is consequently a great interest to learn about AI and what it could mean for the public sector through starting pilot projects and running tests in a safe environment.

However, the testing of AI technologies in the public sector has another layer of complexity related to the fulfilment of legal compliance. For this purpose, several AI strategies (14, 58%) **list the need to introduce regulatory sandboxes for AI for public administrations**. This sandboxing is valid both for the Public and Private Sectors and it is interesting to see how the different strategies tackle the role of the public sector in these initiatives. In some strategies, for example, the government is only tasked with creating these testing areas or supervising them – it is often unclear if these sandboxes are thus also available for the public sector as a "user" of this protected environment for testing some AI solution. In the opposite direction, in the Estonian strategy a technological sandbox will be introduced to allow the testing and the development of AI solutions specific for the public sector. Along the same lines, Lithuania is proposing to:

"Create a regulatory sandbox that will allow the use and testing of AI systems in the public sector for a limited time frame. This will allow the developers to test out their product in a live environment and allow the public sector to determine what solutions can be integrated."

The Norwegian strategy adds more details, listing the main areas of application for regulatory sandboxing, (even though leaving a door open for other, unidentified areas): autonomous transports, and data protection.

Naturally, the testing of AI solutions within the government comes with the **introduction of pilot projects**.[35] Many strategies (20, 83%) touch upon this topic, albeit with different degrees of concreteness. Some strategies share concrete existing pilots, others describe pilot projects which are to be implemented in the coming year. Finally, some strategies describe the need to implement pilot projects to learn from its effects and share the results. The common ground of all the strategies is that conducting pilots is seen as crucial as it reduces the risk of long and expensive AI projects which may lead to few results without early testing.

In the Slovakian strategy it is clearly stated that "testing pilot solutions will become a common practice in the public administration". Norway also has pilot schemes for supporting specific initiatives:

"Where pilot projects depart from applicable laws and regulations, they can be conducted with statutory authority in special laws, as in the

[35] The European Commission also promotes the testing of AI pilots through, for instance, the CommuniCity project

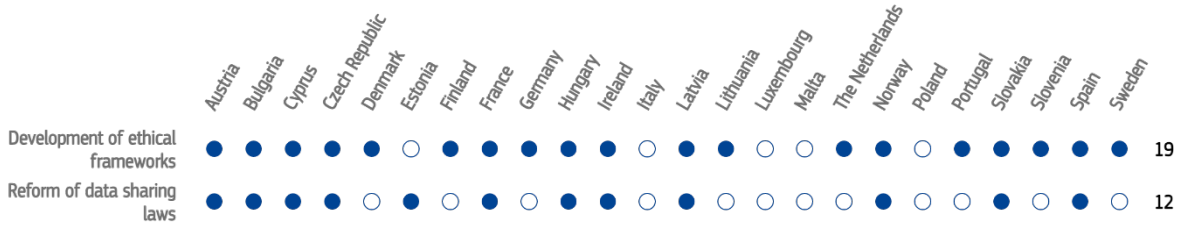
examples mentioned, or in the Pilot Schemes in Public Administration Act. Under the Pilot Schemes, public administration can apply to the Ministry of Local Government and Modernisation to depart from laws and regulations in order to test new ways of organising their activities or performing their tasks for a period of up to four years."

Some of the concrete projects mentioned in the strategies are:

- Malta: a pilot on the central government information platform to create and test an AI-driven email assistant for civil servants
- Denmark: a pilot to create and test AI aiming to shorten unemployment periods by making it easier for case officers to personalise unemployment services to citizens
- Hungary: a project to have predictive maintenance of public property with AI technologies
- Finland: various AI projects to be piloted under the AuroraAI programme to make public services more personalised

3.3.5. Area 5: Ethical and legal framework

Table 6. Area 5 – Mapping of the coverage of the main policies initiatives



The public sector plays two important roles in AI development. If, on the one hand, it is one of the main sectors where AI can transform and improve processes and services, on the other it also has the duty to question the existing regulatory framework and identify the adjustment needed to guarantee the fairness of AI development in all industries. In this respect, the strategies often highlight the need to introduce new legislation or ethical frameworks to facilitate or regulate the use of AI within their own administrations.

The ethical aspect related to AI introduction is one of the main concerns of Member States. Many strategies describe the various ethical concerns which accompany the ongoing technological developments of AI. Hence, the introduction of an ethical framework for the public sector to guide the development of AI to serve societal needs is seen as an important initiative to develop. Some countries describe that they will introduce their own ethical guidelines, while others refer to existing guidelines made available by the High-Level Expert Group on Artificial Intelligence (HLEG-AI). It is interesting to note that 19 strategies (79%) refer **to the introduction of ethical/legal guidelines specific to or tailored for the public sector, recognising that the public sector deserves specific attention**. One example of this is in the Spanish strategy, which outlines that a guide will be introduced for the government to assist with the introduction of AI and to adhere to ethical principles and existing regulations. Another example is the Dutch strategy, which describes a roadmap with assistance to legal and ethical challenges for stakeholders in healthcare. The Austrian government will create guidelines to assist the use of AI following fundamental rights.

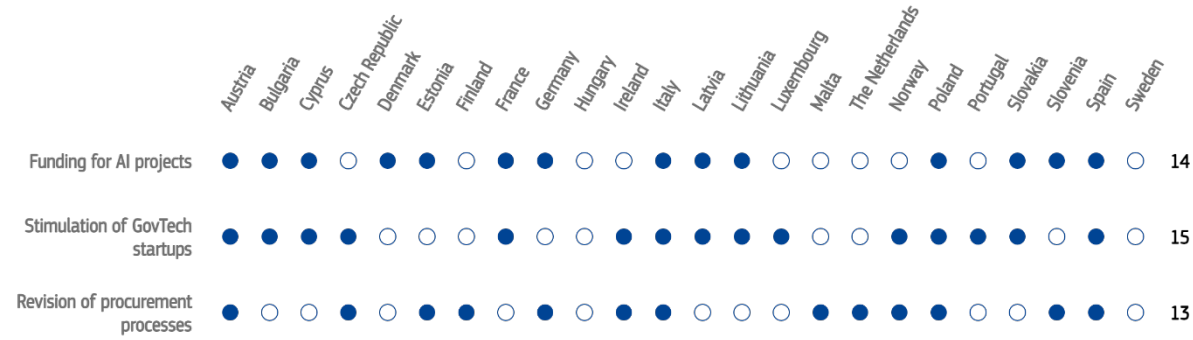
While the introduction of these ethical frameworks is often mentioned, it is not always made clear or explicit for whom they should be applicable or whether they should be followed by public administrations if they are developing or using AI. Similarly, not many strategies make clear whether the public sector should also adhere to the ethical guidelines published by the HLEG-AI, or if only private developers should do so. Similarly, it is often not made explicit whether public sector AI should adhere to higher standards than the private. Some documents do suggest that there are specific ethical considerations for the public sector, which is why the Portuguese strategy lists that a research project on the ethical considerations on AI in government will be conducted. Similarly, the use of AI in the Irish government must always follow ethical and human rights assessments.

In this respect, and consistent with the strong focus on data reported in area 2, 12 strategies (50%) highlight the **need to reform data sharing laws or directories**. As an example, the Norwegian strategy mentions a

National Data Directory to "provide an overview of the types of data held by various public agencies, how they are related, and what they mean". Within the regulatory reforms on data sharing, however, there is a tension between making it easier to share data and introducing more ways to enhance privacy by restricting (uncontrolled) sharing of data. These two elements, in our view, can be seen as two sides of the same coin: data must be shared but in an ethical way that guarantees the proper level of data protection. Most of the strategies mention these two desires, even though it is often not clear how to align these two sides into an overall, unique data framework. To this end the European Commission is promoting the use of European data spaces to allow a secure environment where data can be shared under specific conditions.[36]

3.3.6. Area 6: Funding and procurement

Table 7. Area 6 – Mapping of the coverage of the main policies initiatives



One of the most common barriers highlighted in research on innovation in the public sector is the lack of funding. Hence, for any ambition for AI to materialise within the public sector, **the availability of proper funding is necessary, especially in the current experimental phase**. 14 strategies (58%) mention that funding for AI projects in the public sector will be (or should be) made available. The funding amounts vary or are not explicitly mentioned. Beyond the funding directly addressing the public sector, strategies mention additional funding for research on AI technologies or for the private sector for supporting public administrations, such as improving the local start-up ecosystem. The Polish strategy mentions that each public finance unit, including local governments, should allocate at least 10% of its public procurement budget for the development of AI.

In this respect, the stimulation of the national **AI start-up ecosystem is often seen as a priority in many strategies. Funding or other types of support mechanisms** towards start-ups working with the public sector is mentioned in 15 strategies (63%). This often falls under the term GovTech. In fact, stimulating the GovTech ecosystems is seen as a highly important instrument to introduce AI in the public sector. The Czech government will establish a start-up support programme focusing on AI in the public sector and the Polish strategy, for example, introduces a whole GovTech programme:

> *"Based on the best international experience, GovTech Polska has been created, which […] creates optimal conditions for the implementation of digitisation in public administration. The aim of the programme is to improve the dialogue between public administrations and innovators: SME entrepreneurs, start-ups, and the scientific community."*

The need to work together with the private sector in this area is repeatedly stressed. However, strategies mention that historically it has been difficult for innovative companies to work together with government authorities due to cumbersome procurement regulations. In this area, several strategies (12, 50%) come up with **new policy initiatives to improve the procurement processes**. The Spanish strategy, for example, mentions that new innovative public procurement mechanisms will be introduced to help the procurement of new solutions from the market, while the Maltese government describes how existing public procurement processes will be changed to facilitate the procurement of emerging technologies such as AI. The Dutch and Czech strategies mention that hackathons for public sector AI will be introduced to assist in the procurement of

[36] See on this for instance also the SITRA data sharing rule book: https://www.sitra.fi/en/publications/rulebook-for-a-fair-data-economy/#download-the-rulebook,Open DEI design principles for data sharing: https://h2020-demeter.eu/wp-content/uploads/2021/05/Position-paper-design-principles-for-data-spaces.pdf and the Ecosystems Transaction Management MIM: https://mims.oascities.org/mims/oasc-mim-3-contracts

AI. Civil servants will be given training and awareness in procurement to assist them in this process, something that is highlighted in the Estonian strategy. The French strategy stresses that current procurement regulation already provides a lot of freedom for innovative procurement but that because of risk aversion present within public administrations all possibilities are not taken into consideration.

In conclusion, the procurement of AI technologies or the increased collaboration with innovative private partners is seen as an important way to facilitate the introduction of AI within the public sector. Guidance on how to stimulate and organise AI procurement by civil servants should potentially be strengthened and shared among Member States. The European Commission is also currently working on this, for instance through the promotion of best practices such as the procurement guidelines designed by the city of Amsterdam.[37]

3.3.7. Other insightful policy initiatives

In analysing the strategies, a clear cut on common topics was done, hence several insightful initiatives would not fit in the identified categories but are still worthwhile to highlight and share.

Reusable AI. Several countries discuss the introduction of reusable AI solutions or platforms, such as the AI on Demand Platform, which can be used across the public sector. For instance, the French strategy mentions that a government-wide AI platform will be introduced to manage and perform administrative procedures which are simple and recur across different public administrations. The Slovenian strategy mentions that ongoing AI projects will serve as building blocks for reusable AI solutions in other state administrations. To stimulate the use of chatbots within the Latvian administration, the government will work on the creation of a government-wide platform on which chatbots can be based to create a shared knowledge base. Other policy documents report the starting of a central platform for language translation. In particular the strategies of countries with less widely spoken languages, such as Slovakia, Hungary, and Norway, state that they will work on a language corpus to assist in the development of AI solutions in the public based on Natural Language Processing.

AI infrastructure. Strategies highlight some infrastructural actions which will be undertaken to boost the uptake of AI technologies. For instance, Estonia aims to improve the underlying IT infrastructure of all public organisations for making it more convenient to process large volumes of data across the existing data exchange portal. The Maltese government will review the technical architecture of AI solutions that are to be implemented within the government to ensure that they fit the existing ICT infrastructure. Others, such as the Czech strategy, promote the use of high-performance computing centres to develop new AI solutions for their public sectors.

Academia. Partnerships with the academic sector may also be a fruitful endeavour to attract AI experts to work in and with the public sector, and to develop innovative AI solutions. To this end, the Irish strategy includes the public sector Fellowship programme, which enables academics to work on AI-related projects in the public sector, seconded to various governmental departments. The Italian strategy describes that new PhD Programmes will be developed which are specifically targeted at improving AI-related competencies in a government context.

Innovation process. Lastly, some strategies mention activities aimed at the ways public administration organise the innovation process. The Cyprus strategy mentions that public sector projects should start working with agile methodologies as they make AI projects more likely to succeed. Similarly, the Estonian government is planning to change the evaluation criteria of IT and AI projects to plan them as ongoing developments rather than a one-time project.

3.4. A view on the pervasiveness of the public sector angle

The analysis reported above looks at the presence or absence of a certain category of policy initiatives in the strategies. This type of analysis is missing a qualitative overview of how much the public sphere pervades the strategies. Figure 2 aims at looking at this aspect, clustering the strategies for their main focus or focuses concerning three elements, namely data, internal capacity, and the external network. The cluster has been assigned through a look at how much the strategy insists on a specific topic. It differs from the previous one that was looking at the coverage of a specific topic. From the result of this analysis, we can draw the conclusions reported below. These approaches should be seen as indicative, and not conclusive of the general approach these countries take on the use of AI in their government. Rather, it shows that these strategies tend to lean or mention more strongly these approaches. As such, they represent broad generalisations to group highly diverse AI strategies.

[37] https://www.amsterdam.nl/innovatie/digitalisering-technologie/algoritmen-ai/contractual-terms-for algorithms/

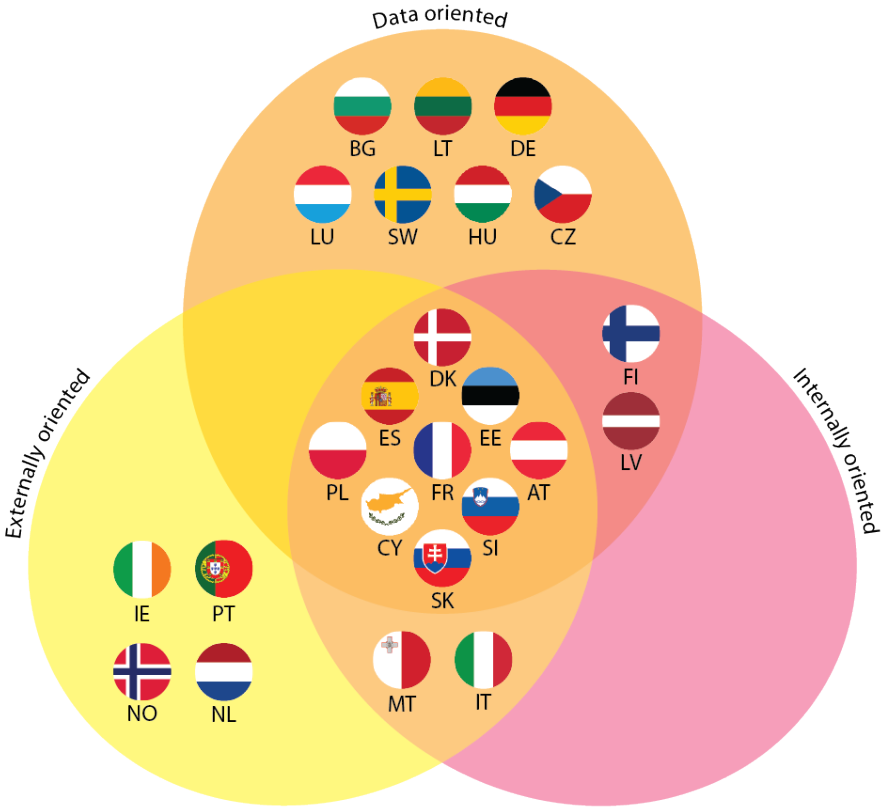


Figure 2. Clustering exercise on the national strategies

3.4.1. Externally oriented

One main approach to stimulate the adoption of AI within the government is externally oriented. Countries that lean towards this approach could be regarded as countries that focus more **on public-private cooperation for AI development in the public sector**. Those countries recognised that public administrations do not **have enough capacity and competences, and the systems are too complex for dealing with AI autonomously**. For those reasons, they focus the public sector sphere of the strategy in fostering the relationship with the private sector creating a cooperative environment for the uptake of AI. Coherently those countries emphasise how to enhance the procurement process. In particular, those countries:

- Place strong emphasis on stimulating the local GovTech ecosystem, thus assisting start-ups and other companies to emerge and to develop AI for usage in the government sector.
- Acknowledge that existing procurement processes limit the procurement of innovative technologies within the public sector and thus take actions to improve collaboration between the public and private sectors.
- Focus on Digital Innovation Hubs as catalysts for sharing expertise from the private sector for usage in the public sector and act as a hub to start projects, networking activities and testing areas for AI.

It is extremely interesting to monitor the uptake of AI in those countries. On the one hand, they can offer important best practices on **how to regulate the relation between the private and the public sector to have fruitful cooperation and avoid negative effects like vendor lock-in**. On the other hand, this choice opens questions that need to be addressed. As reported also in the case studies in Chapter 5, there are different ways of governing AI uptake, from organisations developing it exclusively with internal capacity, to others completely externalising the development. Between these two extremities there are different hybrid options. This is one of the upcoming challenges in the public sector. Public organisations should be able to identify the

most adequate external capacity available, avoiding strong dependencies and lock-in from external service providers.

3.4.2. Data-oriented

The second approach which could be identified in the strategies is more data oriented. The group of countries leaning towards this approach aim to mostly facilitate the availability and quality of data to stimulate AI. These strategies mostly describe initiatives to tackle the various **data-related barriers that hinder the development and uptake of AI in the public sector**. A strong focus is placed on improving both the data and the technical infrastructure to improve the general ecosystem of the country to develop AI – either by the private sector or by the public sector themselves.

In essence, these include:

- Making more public data sets available for the development of AI and facilitating data sharing among public institutions
- Improving data governance, data standards and data collection practices to have more data available
- Ensuring that overall connectivity and high-performance computing power is made available to develop AI solutions

Overcoming data-related barriers is fundamental for moving ahead with AI in government. As with the other cluster the example of these countries is to be monitored to identify best practices and lessons learned. However these countries should look at the diverse initiatives proposed by the others to learn about complementary activities being undertaken on other aspects of AI development.

3.4.3. Internally oriented

The third approach mainly focus on improving internal capacity as a key instrument to stimulate the uptake of AI in their governments. Strategies from the countries which lean towards this approach often describe various activities such as:

- Creation of new public bodies or units/departments for dealing with AI
- Training and awareness events for increasing the knowledge on AI
- Acquisition of more technical knowledge, through hiring programmes or specialised training

It is interesting to note that none of the countries falls exclusively under this category, as no strategy had a strong focus on exclusively improving the internal capacity of public administrations as the best approach to facilitate the uptake of AI. This means that this element **was never identified as the sole solution for increasing the usage of AI in government**. For example, some governments see this as an extremely relevant area that needs to be developed together with infrastructural conditions (like data availability) and support from a network of actors. Italy and Malta combine this type of initiative with plans to support the development of a network of actors revolving around government, while Finland and Latvia mix these initiatives with others related to data availability and usage.

4. Inventory of cases on AI adoption in the PS in the EU

The chapter describes the results of an inventory of use cases of AI across the European Union. This overview and analysis is the expansion and update of the earlier research published in 2020 (Misuraca & van Noordt, 2020). All those cases are examples of the adoption of Artificial Intelligence in the public sector in Europe and have been used for providing a general overview of the state of the art in Europe.

Compared with the previous report of the AI Watch (Misuraca & van Noordt, 2020), the new collection has a larger database of cases and a refined list of features for characterising each case. The new analysis profiles **686** cases heterogeneously implemented in all 27 EU Member States plus some other Countries in Europe and characterises them with different features and qualities.

This inventory, to our knowledge, is the first attempt to create a repository of AI cases at the European level. The objectives are multiple. First, it aims at answering the basic questions: how, when, where why and for whom AI is adopted in the public sector. Second, it investigates the risks involved, borrowing from the upcoming legislation on AI. Last – but not least – the AI Watch inventory hopes to offer policymakers and researchers a large database of cases for fostering research, the exchange of practices and supporting policymakers with concrete examples. To this end, the database is also published in open data in the JRC open data catalogue.

Our ambition is to provide a brick to build a new step in the existing knowledge on AI in government, moving from more theoretical and anecdotal information to concrete and practical cases. This shift, in our view, is more appropriate for the situation in Europe, **where AI now has moved beyond rare experiments and pilots to a rich set of concrete applications and solutions applied daily to increase government efficiency and effectiveness**.

This chapter will first provide details about the methodology for collecting the 686 different AI use cases. The updated AI taxonomy used to classify the AI use cases is then introduced. Next, a description as well as an analysis over these AI cases are reported, starting from the general overview, and going on to drill down on the relationship between technology, functions of the government and governmental tasks. Compared with the previous landscaping report, there are several additional categories included which enrich the analysis, such as the inclusion of the recipients of the AI systems and an estimation of the data input used to enable the development of the AI system. Finally, the chapter provides some conclusive considerations over the outcomes to provide some useful guidance for decision-makers within the public sector.

4.1. Data collection

The case collection started at the very beginning of the AI Watch, in December 2019. The first set of cases was published in 2020 with 230 cases (Misuraca & van Noordt, 2020). Many of those cases have been published also in open data and made available to the community[38]. After publication, the case collection continued until December 2021. Overall 686 cases have been collected and are analysed here.

Cases were collected combining different sources of information:

- **News articles** collected through an internet search. We scanned the web as much as possible in search of AI cases in the public sector. This was the main source of information for our database.
- **Scientific and grey literature**. We reported all the cases we detected from scientific publications or grey literature.
- **International and local initiatives or direct contacts** with Member States or other institutions. We included as much information as possible directly from Member States. For example, we included several cases collected by the NL AI Coalition.[39]
- **A survey** ran for collecting information on barriers and challenges for AI adoption that was also giving basic information on the use cases. Information on the survey is reported in the science for policy report "AI Watch. Road to the adoption of Artificial Intelligence by the public sector" (Manzoni et al., 2022).

[38] https://data.jrc.ec.europa.eu/dataset/7342ea15-fd4f-4184-9603-98bd87d8239a
[39] https://nlaic.com/en/

- A collaboration with the Digital Agenda Observatory of the Politecnico di Milano[40] that made a case collection worldwide published also in a scientific publication (Maragno et al., 2021).

After the collection of the information, each case went through a precise and structured procedure before its inclusion in the database. First, it passed a validation process that consisted of the involvement of at least a second researcher that double-checked the information and the categorisation. The whole team was involved in taking decisions about critical cases. Second, for the cases collected at the beginning of this activity, a "maintenance" activity was done, double-checking the information after several months to explore any modification.

4.2. The applied taxonomy

To categorise and analyse the collected AI cases, a broad taxonomy, composed of various elements, was designed to describe features of the AI systems used in the administrations. The taxonomy provides insight on both the technological dimensions of AI (such as the data used), the AI technique and to which AI domain the AI system belongs, as well as the broader administrative context in which the system is being deployed, which policy sector and which level of government the system is being used for (to understand what kind of value the system aims to create). In doing so, the AI taxonomy also relates strongly to the OECD's Framework for Classifying AI Systems released in February 2022,[41] which recommends that AI systems should be described by the data and other input; the AI model used; the tasks and output of the AI system; the economic context; and contextual factors related to people and planet. Whilst the dimensions of the AI Watch taxonomy and the OECD's Framework relate to each other, there are differences in the scope as well as the depth for the dimensions and criteria used to describe the specific elements under these categories.[42]

Furthermore, in addition to providing a categorisation and overview of the AI use cases presented, the taxonomy also serves to provide a structured approach for categorising AI cases that can be easily reused elsewhere by the research community.

The AI Watch Taxonomy for case categorisation combines general concepts that can describe any digitalisation initiative in the public sector with other concepts that are specific to the AI technology domain (Figure 3). The taxonomy adopted is evolving, and is trying to conceptually stay aligned with the bigger classification effort done by OECD.AI. The general concept includes:

- Organisation information that is leading the AI case implementation. Part of the organisation information is the contextual public sector related information; in particular, the level of government which uses the system, the policy domain in which the system is being used (following the COFOG[43] classification), and the main purpose of the AI system.
- Service information of the AI use case – the name of the system, a description of it and the start and end year, and the process type and the application type targeted by the AI case (if any).
- Data used by the AI case and the nature of the data, as part of the service information.
- Service public value and potential impact for the public sector derived from the use of the AI system described by the case.
- AI system details, starting from the status of known use of the AI system, either planned, in development, implemented or not used anymore (in case of dismissed AI solutions), and its other characteristics, including who the recipient or final user of the AI is. The features strictly related to the AI system in use include the AI technique, AI domain/subdomain of the case.

40 https://www.osservatori.net/en/research/active-observatories/agenda-digitale

41 OECD Framework for the Classification of AI Systems: a tool for effective AI policies https://oecd.ai/en/classification

42 Clearly, there is room to align the approaches, although the limitations of the data collection processes of landscaping may hinder obtaining all the required information to merge approaches.

43 https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:COFOG

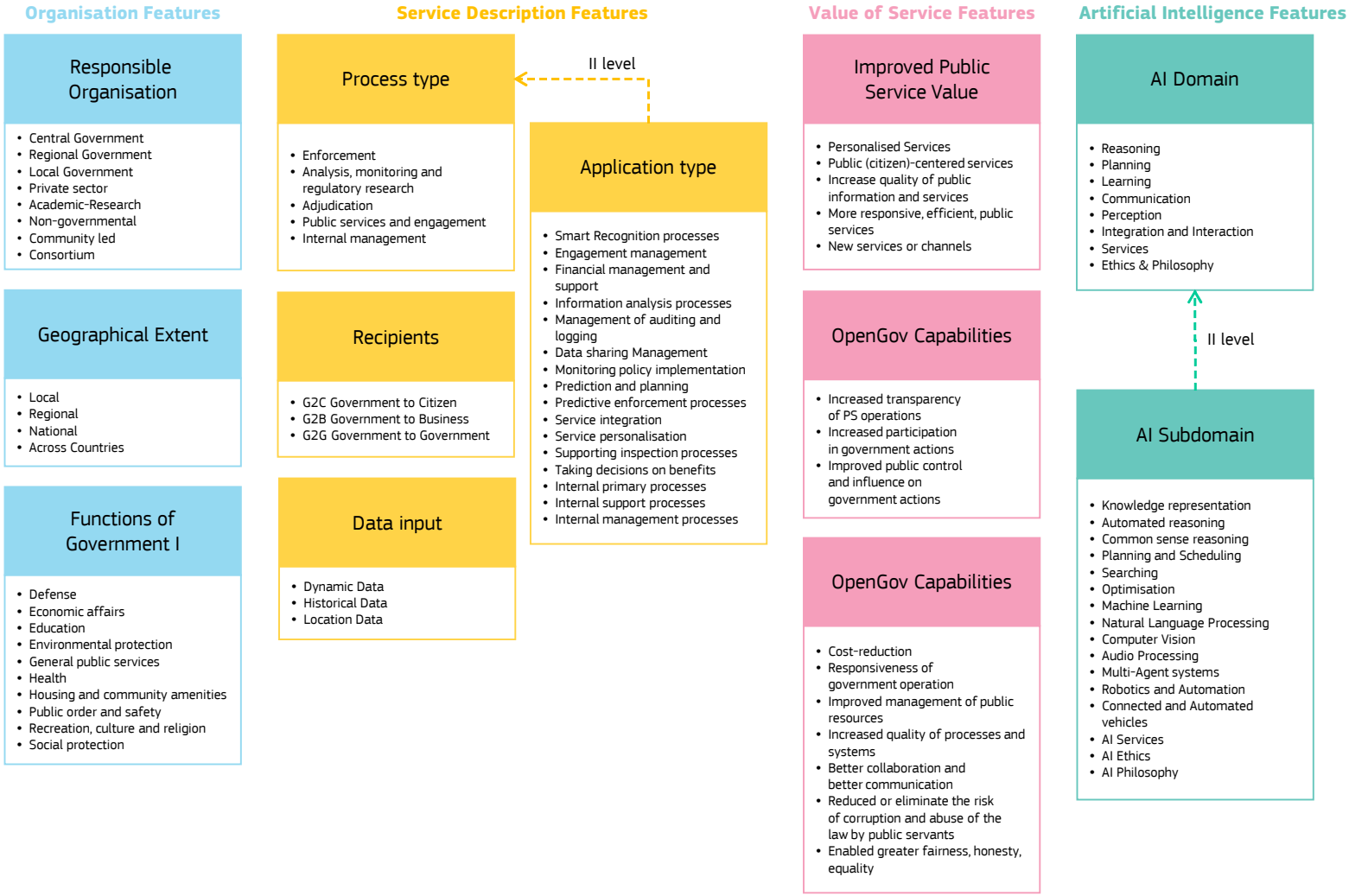


Figure 3. Taxonomy for AI case categorisation

Source: JRC own elaboration

Table 8. Main classification reference sources

Feature	Description	Source
Functions of Government I	The Classification of the functions of government, abbreviated as COFOG, was developed in its current version in 1999 by the Organisation for Economic Co-operation and Development and published by the United Nations Statistical Division as a standard classifying the purposes of government activities.	OECD
Process Type	Classification of 5 high-level types of government decision-making task commonly implemented with basic processes/tools and potentially governed with AI.	Engstrom, Ho, Sharkey, & Cuéllar, 2020
Application Type	Process subdomain to detail more specific tasks for which the AI case was developed. It is a mean between different case collection sources (not standardised).	JRC own elaboration
AI Domain AI Subdomain	List of representative core and transversal AI domains and subdomains will assist us to classify R&D and industrial agents and their activities. Therefore, it encompasses the main theoretical AI scientific areas, and AI-related non-technological issues from industrial and R&D AI Activities, as well as ethical and philosophical issues.	Samoili et al., 2021
AI Technique	Techniques and approaches listed in AI Act Annex I that can, for a given set of human-defined objectives, generate outputs such as content, predictions, recommendations, or decisions influencing the environments they interact with (Machine Learning, Reasoning, or Statistical).	AI Act Article 3, pt 1, Annex I
Responsible Organisation	Organisations are organised over 7 categories: Central-Government, Local Government, Non-governmental, Academic-Research, Private sector, Community led or a Consortium.	JRC own elaboration
Level of Government	Defines the administrative level where the case is being deployed and is composed of 4 levels: Local, Regional, National, and Across Countries.	JRC own elaboration
Value for Public Service	Dimensions of value: possible values to describe the e-government value of the AI cases, which could be generalised into three overarching and also overlapping public value dimensions of Improved Public Services, Improved Administration, and Improved Social Value.	Twizeyimana & Andersson, 2019 Maragno et al., 2021

Source: JRC own elaboration

A more in-depth explanation is needed on the features **"process type" and "application type"**. The overall idea behind this classification is to understand the governmental purposes and activities in which AI is implemented. This has been reflected in the establishment of a governmental functional-related classification based on 5 different governmental process types, with several underlying application types each. For that reason the classification is split into two different levels, namely level 1, the "process type" and level 2, the "application type".

Process type is described in Table 9 and it includes the main governance process type in which public sector organisations are and could potentially apply AI. The classification relies on the one proposed by (Engstrom et al., (2020).

Table 9. Governance Process Types descriptions

Purpose of AI use in government	Description
Enforcement	Tasks that identify or prioritise targets of agency enforcement action
Analysis, monitoring, and regulatory research	Tasks that collect or analyse information that shapes agency policymaking
Adjudication	Tasks that support formal or informal agency adjudication of benefits or rights
Public services and engagement	Tasks that support the direct provision of services to the public or facilitate communication with the public for regulatory or other purposes
Internal management	Tasks that support agency management of resources, including employee management, procurement, and maintenance of technology systems

Source: Engstrom, Ho, Sharkey, & Cuéllar, (2020)

The collected cases have also been classified with an additional subdomain that seeks to detail more the activity for which the solution was developed (Table 10). This classification has been designed by the AI Watch team to answer the question "What activity does the AI technology support?" It should be considered an experimental proposal that was done following a pragmatic trial and error process.

Table 10. Application Types descriptions

Process Type	Application Type	Description
Adjudication	Taking decisions on benefits	Processes used for making decisions regarding approval, validation or revocation benefits (e.g. social).
Analysis, monitoring and regulatory research	Information analysis processes	Information and data analysis is the process of inspecting, transforming, and modelling information. It is made by converting information into actionable knowledge (e.g. dashboard to support decision-making).
	Monitoring policy implementation	Processes that follow and assess policies implementation to ensure they are developed, endorsed, and implemented.
	Prediction and planning	Processes for management of resources based on prediction models, to support planning.
Enforcement	Smart recognition processes	Processes that can identify objects, people, places, texts, situations and actions in images, video, audio, or other detectable physical phenomena.
	Management of auditing and logging	Collection of records, and/or destination and source of records that provide documentary evidence of the sequence of activities that have affected at any time a specific operation, procedure, event, or device.
	Predictive enforcement processes	Processes that analyse amounts of information available to predict and help prevent potential future crimes/mistakes/misunderstandings.

Process Type	Application Type	Description
	Supporting inspection processes	Supporting processes used to identify wrongdoing or mistakes before an intervention by the responsible authorities (e.g. tax positions to be checked, businesses registered with anomalies).
Internal management	Internal primary processes	Process that directly create value for the external customer and the impact of their performance on the level of customer (citizens, firms) satisfaction.
	Internal support processes	Processes that produce services and information for the functioning of the organisation. They have only internal customers.
	Internal management processes	Processes that provide management, control and decision support tools necessary to achieve the organisation's objectives and which have stakeholders and managers as clients.
Public services and engagement	Engagement management	Establish and enhance connections with citizens and businesses to build trust at every point in their PS journey throughout the user relationship established.
	Data Sharing Management	Data sharing processes are supporting accesses to PS data, considering interoperability and data licensing (e.g. open data).
	Service integration	Service Integration is the management of the integration of multiple service suppliers and information sources to provide a tailored new specific service to citizens or other organisations or even for internal purposes.
	Service personalisation	Delivering customised services considering the needs of the customer (citizen/businesses/civil servant). Recommendation systems are here included.

Source: JRC own elaboration

The current taxonomy is a refinement and an extension of the previous one used in 2020 for categorising the previous inventory of 230 use cases (Misuraca & van Noordt, 2020). In particular:

- The addition of the following categories: responsible organisation, data input nature, recipients, AI risk category and the AI risk level.
- An application of the AI domain and AI subdomain as defined by the AI Watch (Samoili et al., 2021) instead of the previous one which used an AI typology consisting of 10 broad categories of AI.
- Expansion of the public value driver to highlight more specifically the type of public value the AI aims to achieve.
- A refinement of the category AI process type, now linked with a more general category (the application type).

4.2.1. Limitations of the approach

Before going through the result of this analysis, it is important to state the limitations of the study to the reader in understanding what can and what cannot be explained by the analysis. The current inventory is **by no means a complete overview of the use of AI in government**. In other words, the data are not and do not aim to be representative of the situation in Europe. For example**, no comparison can be made among Member**

States on their maturity in the adoption of AI, as it is likely that some countries are underreported in the collection of the cases.

First, as explained, the process of data collection was based on the information available online or collected by the AI Watch. However, despite the width and depth of this exercise, it is **not an exhaustive overview** and **the information gathered from public data was clearly limited by the research team's searching capacity**.

Second, the collection of the AI use cases strongly depends on the **availability and intelligibility of the information**. The information available on specific AI use cases found online was often limited and, in some cases, rather vague. In addition, not all the information was easily accessible in English, creating translation issues. Hence the interpretation of the cases, the description, assessment, and subsequent categorisation is done under the discretion and expertise of the authors. Furthermore, a significant part of the collection depends on the availability of information provided by the Member States. Some Member States have, for instance, a national repository with a subset of AI systems used in their administrations, conducted landscaping studies, or found other ways (e.g. sectorial workshops) to gather an overview of which AI they are using which has been shared with the AI Watch team or was identified through public sources. For other Member States no such collection was available.

Third, the cases are reported often in a **snapshot taken in a specific moment** (for example the date of a news article). This means that for several cases we don't have information on the evolution of the project over time. For example, a case collected in 2019 might be in a different status now, and this information was simply not publicly available. This is especially relevant since some of these initiatives were not already adopted but had only been announced. It might be that some cases were discontinued after the announcement of the piloting phase, and this was not made publicly available.

Fourth, building on top of these limitations, **definitional issues surrounding AI** remain despite the progress in providing a definition of AI.[44] As a result, there can be misunderstandings of different interpretations across countries, administrations and individuals on when a technology can be considered AI or not. Some do not use the term AI but similar ones, such as algorithms or data science. In addition, as AI is used as an umbrella term and in some cases as a keyword – and often a buzzword – for journalistic or marketing purposes, it was not always easy to discern whether a certain case is using AI or not.

Another **definitional issue surrounds the concept of the public sector**. This is relevant for domains like health, economic affairs (energy, transport, agriculture, etc.), environmental protection, education, and public safety as well as others since they are often included in the discourse on the public sector. However, depending on the countries and other factors (for example the concept of public sector of the person writing the news article), it is not always clear if an organisation is a public or a private one. Moreover, there is always a grey area or mix of private-public organisations, like private organisations partially or totally owned by the government. This might create wrong categorisations or a wrong decision regarding the inclusion or exclusion of a certain case.

This means that, despite the best attempts of the AI Watch team, looking at the single case, there can easily be mistakes or wrong categorisations. However, given the large number of cases collected, it is assumed that no systematic error is introduced. Some important considerations can therefore be drawn from the case collection that represents the unique attempt at the European level of offering an overview of the current situation with respect to AI development and use in public services in included countries.

4.3. Overview of the inventory of cases

4.3.1. General overview

Overall, 686 use cases of AI in the public sector have been collected and analysed. The cases were collected from 30 different European Countries, as reported in **Figure 4**. The high number of cases collected is a first sign of how widespread AI now is in the public sector in all European countries. The cases are more than three times the number collected in 2020 (Misuraca & van Noordt, 2020) testifying not only a **higher usage by the public sector but also higher attention on the topic by all the relevant stakeholders** (public administrations, journalists, policymakers, etc.).

[44] See for example the work done by the High Level Expert Group: https://ec.europa.eu/futurium/en/system/files/ged/ai_hleg_definition_of_ai_18_december_1.pdf

The information on the distribution among Countries simply describes the sample and it is not relevant for drawing any conclusion or fostering any reflection. In fact, the distribution is rather unbalanced and, as mentioned above, does not try to compare the maturity level of European Countries. The highest number of cases detected is from the Netherlands, due mainly to the existence of a country repository of cases, followed by Italy and Portugal.

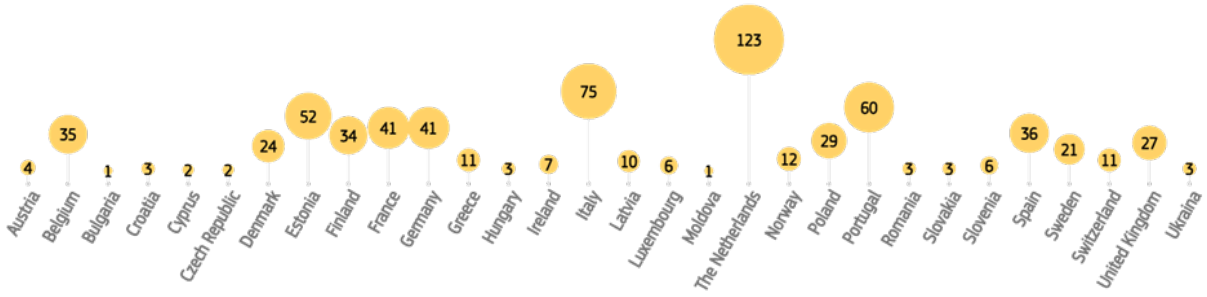


Figure 4. Mapping the use of AI in the public sector in Europe

Source: JRC own elaboration

4.3.2. Chronological distribution of cases

The initiation of the AI use cases have been assessed by the team which shows that there has been a constant progression of cases initiated over the year with a peak of 167 cases in 2021 (**Figure 5**). The decreasing of the slope might be simply related to how the data have been collected, there are more possibilities to have information on projects that started earlier as we mainly based our collection of data on news articles.

Despite this, the number is increasing every year, testifying to the positive trend. Compared with 10 years ago, when only few AI cases where initiated, the trend is showing that **the number of cases is growing significantly and it is likely that in the future** more and more AI will be used in public administration.

In reading this data it is important to consider that the starting date is simply the earliest date available in the information at our disposal. This can be the effective starting date if declared or an approximation, like the date of publication of the news article, or a hypothesis that relies on the interpretation of the information available.

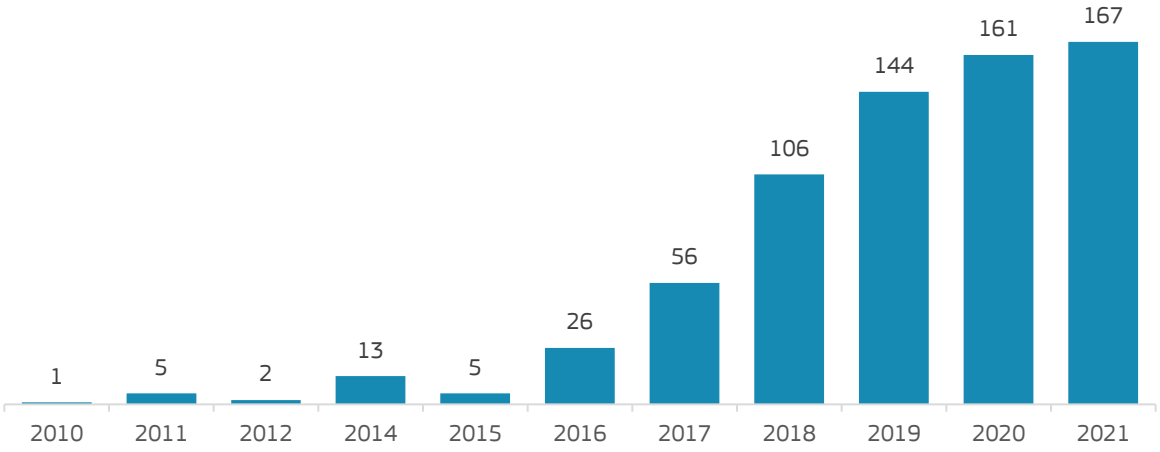


Figure 5. Historical progression of AI cases

Source: JRC own elaboration

4.3.3. Level of Government

More than half of the cases (**54%**) are initiatives launched at the **national level** (**Figure 6**), followed by **local** (**27%**) and **regional** ones (**10%**). Finally, cases classified as Across Countries (9%) are initiatives involving multiple nations that aim to drive experimentation and the adoption of AI-based solutions with piloting or with a cross-cutting effort over a specific use case or a specific AI technology. The 9% of Across Country cases also highlight the role of the European Commission in promoting AI, as they mainly are H2020, or other types of European projects or international consortia supported by the European commission.

The results show how AI development seems driven by national governments, which might have the human and financial capacity to sustain the development. However, a considerable number of initiatives are developed by regional and local administrations, demonstrating that regions, cities, and municipalities (even small ones) can play a key role in pushing the development and usage of AI solutions.

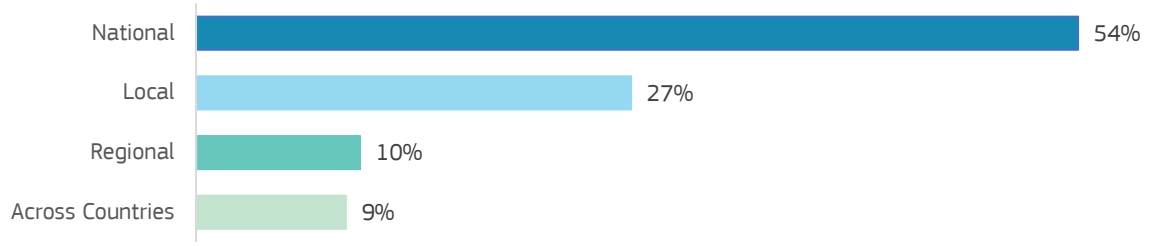


Figure 6. Level of Government involved

Source: JRC own elaboration

4.3.4. AI technology

The classification AI domain and subdomain of all collected cases also sought to characterise functional and technological aspects in several ways based on the AI classification used in the previous landscaping report, AI Act and those documented by AI Watch and used for the purpose described in Paragraph 4.2.1.

This classification is not mutually exclusive, i.e. multiple associations are allowed for a single case. The cases classification has been made using the AI Watch taxonomy that is composed of two levels, the second of which is detailed and focused on the technology itself. We have only considered this second level. We are aware that this classification is limited, in that it does not clearly consider the whole spectrum of AI technology available on the market and listed differently in existing literature. However we consider this to be a fair balance between having a detailed classification and a manageable number of items.

Mostly, cases have been categorised with multiple values (Figure 7).

58% of the cases are categorised as **Machine Learning**. ML is a quite wide type of AI solution required to provide systems with the ability to automatically learn, decide, predict, adapt, and react to changes, improving from experience without explicitly programming. ML represents the basic algorithmic approach in AI systems, and this is the reason behind the high percentage of cases using this type of technology. Several other different types of learning (for example reinforcement, supervised, semi-supervised, unsupervised, even some NLP systems) also use the ML technique (Samoili et al., 2021). In the public sector ML is adopted in a wide variety of applications, for example, fraud detection, quality improvement of documents, predictions based on available data, automation of repetitive tasks with adaptation capability.

The second category, with **30% of usage, is Automated Reasoning techniques** (logic/knowledge-based approaches, inference and deductive engines, symbolic reasoning, and expert system, etc.). It tackles the task of inferring facts from knowledge represented in several forms of information and data. This kind of AI system, which addresses knowledge representation and automated reasoning, is used for describing the process of reasoning over the available data and information, and to provide solutions based on a set of symbolic rules. Application examples collected for this domain are many decision-making support systems like the CityFlows project where AI is used for automating the flows analysis of crowds in large public spaces in cities like Amsterdam, Milano and Barcelona.

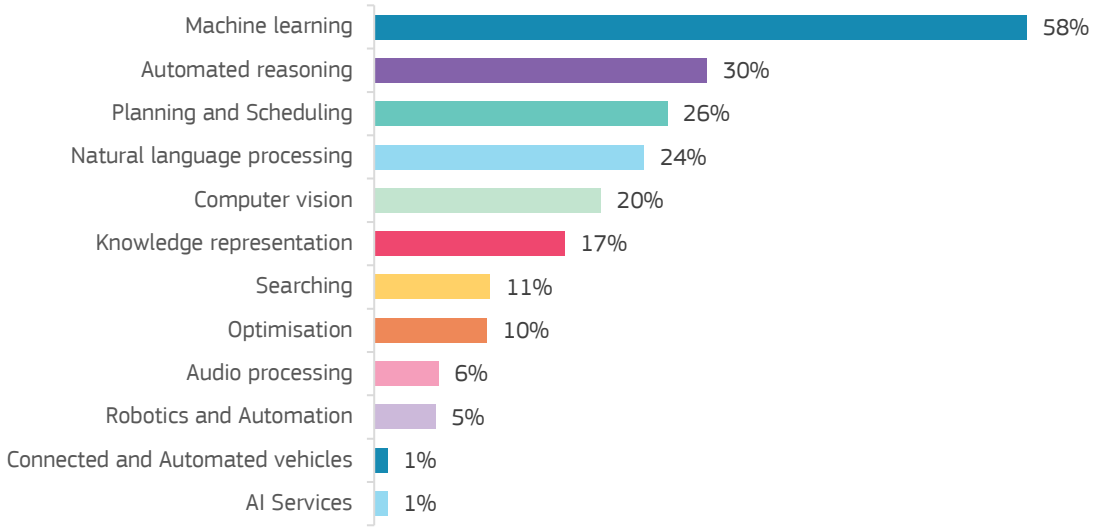


Figure 7. AI cases by AI technology

Source: JRC own elaboration

The high percentage in Machine Learning and Automated reasoning derives by the fact that these two technologies are used also in combination with and in support of more specific AI technologies, like for example Natural Language Processing or Computer Vision. Those technologies, for example often rely on Machine Learning of some kind.

The third major subdomain is **Planning and Scheduling (PS), 26%**. It includes cases involving different smart processing automation, sometimes involving robotics. In fact, this category is about the design and execution of a set of actions to carry out some activity, performed by intelligent agents, autonomous robots, and unmanned vehicles. Unlike classical control and classification problems, the solutions in this subdomain are more complex and in most cases they need optimisation in a multidimensional space. Application examples collected for this domain are planning and management tools used in the public sector for taxes, resources, employment, healthcare, energy, materials, and many more.

It is notable that the **24%** of the cases involve the use of **Natural Language Processing (NLP)** techniques. NLP is a more focused category of AI solutions. In fact, NLP is a kind of AI that gives systems the ability to identify, process, understand and/or generate information in written and spoken human communications. It encompasses applications such as text generation, text mining, classification, and machine translation. Some examples in cases collected are automatic document processing (applied differently to procurement or legislative or administrative documents), or services such as chatbots and virtual assistants.

Slightly lower in quantity, is **Computer Vision (CV), 20%**. This category refers to AI solutions targeted to identify objects in digital images, as part of object-class detection (also called machine perception). In some cases, it refers to image pattern recognition for specific tasks, or as in a broader sense, as machine vision, with applications on face and body recognition, video content recognition, 3D reconstruction, public safety and security, health, and others. Application examples are visual controlling systems (cars, bikes, persons, plates, land areas, etc.) based on locally installed video cameras or even satellite images.

Still quite relevant is Knowledge representation, with a bold 17%. This type of technologies is used in conjunction with other technologies (e.g. Machine Learning and Automated Reasoning) focusing the building of an adequate machine-readable information repository required to run the selected algorithm. All the remaining AI subdomains are present in percentages of a lower order of magnitude and although they are very promising application domains, they should be considered very peculiar compared to those listed above.

The explanation is that both are transversal technologies that often support the implementation of the cases or are also “used” by other more specific AI technologies like, for example, Natural Language Processing or Computer Vision that are often rely on some kind of Machine Learning.

4.3.5. Functions of Government (COFOG)

This property shows the primary policy sectors in which the AI initiative is taking place, following the COFOG criteria. The classification has three levels of detail: divisions; groups; classes. The research considered the first main level.

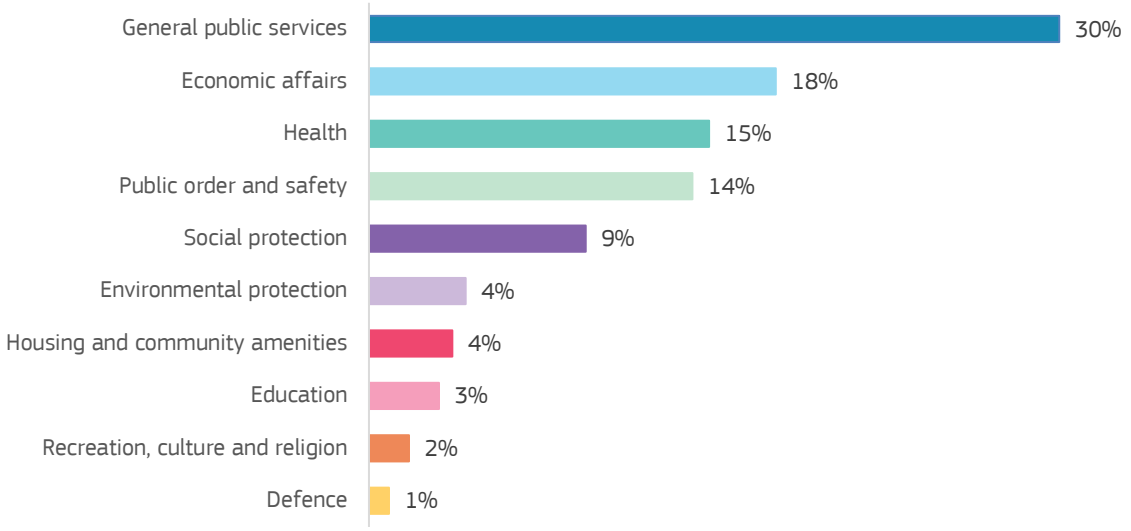


Figure 8. Governmental functions (COFOG Level I)

Source: JRC own elaboration

The main governmental function emerging is the **General Public Services (30%**), followed by **Economic Affairs (18%) and Health (15%) and Public Order and Safety (14%).** This is not unusual and is similar to the previous findings of the AI Watch research, as the General Public Services are an area where public administrations typically play an active role.

Fewer cases focus on **Social Protection (9%) and Environmental protection (4%)**. There are few AI cases in Defence and Recreation, Culture and Religion. This may either be because public administrations themselves are not the leading implementing organisations in these policy areas (due to historical outsourcing and/or increased involvement of private sector organisations) or, in the case of Defence, there is a lack of transparency surrounding the use of these technologies due to safety/security concerns.

A more in-depth view on the General Public Service is helpful to understand examples within this large and comprehensive category. The category includes:

- Chatbots and virtual assistants used not only to interact externally with citizens and businesses but also to speed up internal processes
- Notifications, monitoring, recognition of several type of public space by cameras, microphones or other sensors
- Comparison, detection and misinformation handling management
- Classification, storage, and search of documents (even hand written), videos and/or recorded speeches with metadata and information automatic extraction
- Several kinds of data anomalies detection, or potential frauds

4.3.6. Development and implementation of AI solutions

The research has categorized the implementation status of the cases. In must be remarked that in some cases, is very difficult to know the actual status of the project with the public information available.

The level of development (**Figure 9**) of the cases collected is heterogeneous. **38% of cases are implemented so the AI solution is fully developed** and used in daily operations within the public administration. **25% is in development**, meaning that the AI solution collected is under development but not yet implemented. It must be noted that a considerable percentage of **30% of cases are pilots, proof of concepts or experimentations** made by public administrations or consortia (e.g. with the support of a funded EU project) that are exploring some innovative possible uses of AI in the public sector though pilots that are not an integrated part of the digital infrastructure of the organisation.

Figure 9. Development Level of AI cases

Source: JRC own elaboration

There are some **cases planned (3%),** and most of them are targeting the concrete implementation. Of course, the limited number of planned cases also depends on the limited number of administrations that promote and make public cases already in this initial phase. However, it remains challenging to assess the real-time status of these AI cases with limited public information available and due to the rather novel status of most of these technologies. It is not uncommon for AI projects to stop entirely after a pilot or come back after a period of time when, for instance, ethical or data-governance related issues have been resolved. The status of the implementation of the AI use cases should therefore be seen as indicative.

In must be noted that **4% of the collected cases that are no longer in use** because the pilot experimentation is finished and there is no information about the effective adoption of the solution experimented, or it has been terminated for some other reason. For example in the Netherlands the District Court of The Hague stopped an AI system named SyRI for having violated privacy and transparency rights. Similarly, in France the Régie Autonome des Transports Parisiens (RATP) put a system monitoring the wearing of a mask on hold as it was considered too intrusive.

4.3.7. Process and Application Type

This indicator aims to measure with a coarse granularity the type of AI governance process inside the public sector for each specific case (**Figure 10**). Considerations regarding the results are:

- Adjudication tasks are extremely low in cases, indicating that AI solutions are seldom used for this type of process for automating the assignment of social benefits contributions. On the other side, there are many AI cases about automating or predicting enforcements on the assignment, so the ex-post approach is preferred to ex-ante decision-making.
- The larger size application type inside the generic Public Services and Engagement process is Service personalisation. This indicates that AI is mainly adopted for providing more tailored user-centric services when used for public service delivery.
- Internal management is an important area, and it is transversal to the government organisation, with several cases facilitating primary internal processes and also internal support process some of them crossing the singular public organisation, almost always with the aim of increasing efficiency.

The larger portion of cases is classified as **Public Services and Engagement** with **36%.** In other words, the government functions are directly aimed at providing services or at supporting communication activities towards external actors, mainly citizens and firms. Among those cases, the majority are related to the improvement of the service, both through **Personalisation 13%** and **Integration 9%**. A portion focuses on **Engagement 10%**.

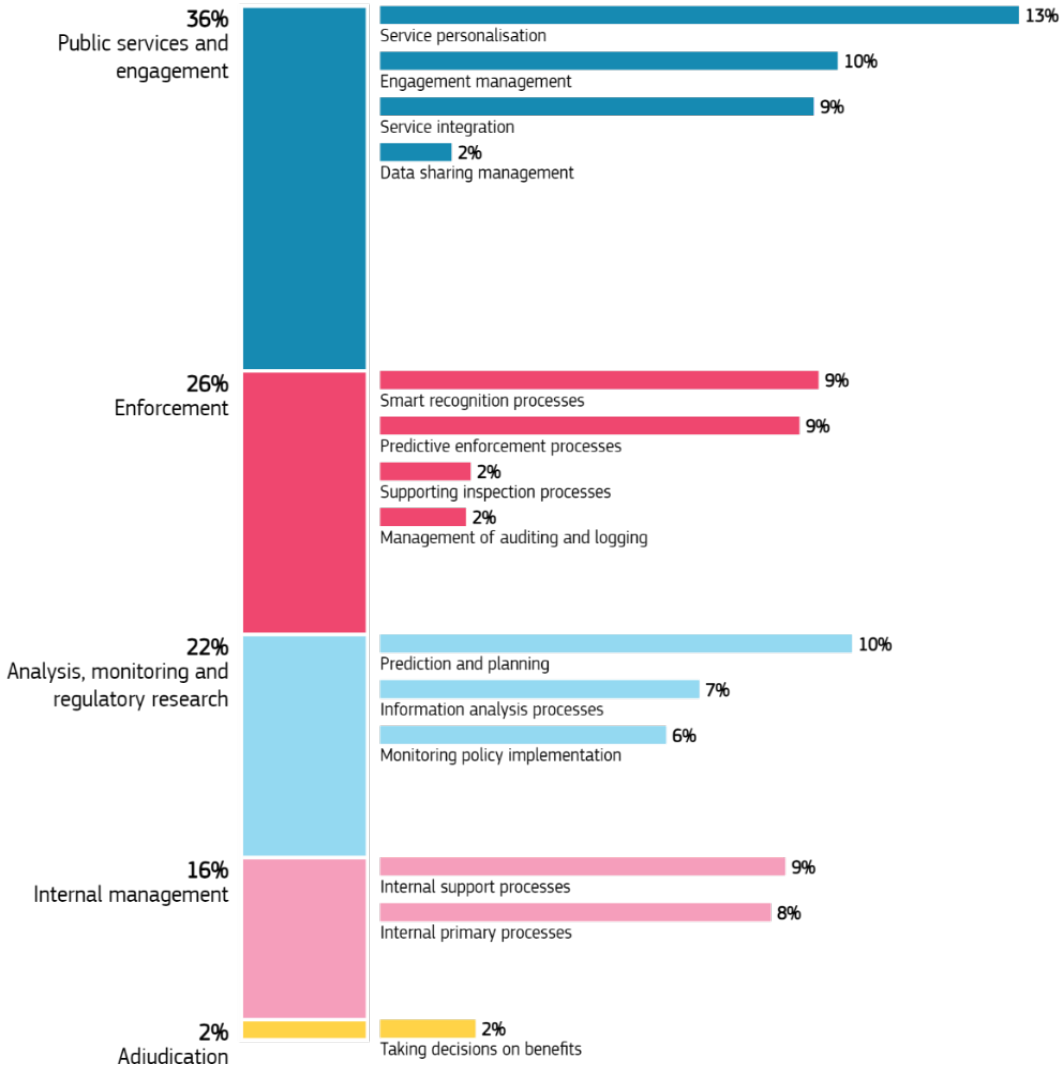


Figure 10. Cases by process and application type

Source: JRC own elaboration

The second type is **Enforcement**, with **26%**, which is quite recurrent among the cases, in **Supporting Audits (2%)**, **Smart Recognition Services** (e.g., biometrics systems, video surveillance, and object detections) with **9%**, and **Predictive Enforcement AI tools** (used for example to identify and sort through substantial amounts of historical data to determine people or places at risk), with **9%**.

The third type is the government demand for Analysis, Monitoring, and Regulatory research with 22%. This type includes solutions for making predictions (10%), general purpose information analysis (7%), and more peculiar monitoring policies implementation (6%).

Lesser cases have been detected in the remaining two governmental process types such as strictly **Internal Management with 16%**, where most of the cases are supporting various types of **Internal Support Processes** (e.g. financial, human resources, materials management) with **9%**, and **Internal Primary Processes** (e.g. assessing eligibility to a social benefit) with **8%**. Just a small set of cases (**2%)**, could be considered to be directly focusing on **Adjudication** of certain benefit.

4.3.8. Application Type by Functions of Government

In addition to analysing the single AI case attribute, the research also crossed some of them. In this analysis the Application Types are crossed with the Functions of Government, highlighting some interesting points:

- A peak of AI solutions based on smart recognition and predictive enforcement are especially popular for Public Order and Safety purposes. Examples include a camera system to discover mobile phone usage on vehicles used in Belgium; the detection of wrong value declarations at custom service in France; the prediction of traffic accidents on certain roads in the Netherlands.
- Service Personalisation systems coalesces around three sectors, namely General Public Service, Health, and Social Protection. Some examples are many cases implementing chatbots and recommendation systems to provide personalized different kind of information to users (health, travel, transport).
- Economic Affairs has a higher percentage of Prediction and planning, and System Integration application types. This shows how AI can be extremely useful in the economic area, offering predictions through a more complex and forward-looking data analysis. Examples include a system prediction the required supply of trucks in France, and the smart monitoring of bridges in the Netherlands.
- In the Education sector, the main relevant application types are Information analysis and Prediction and planning. Examples include the AI system made in Portugal to plan the education system student flow, and the detection of causes for early school leavers in Sweden.

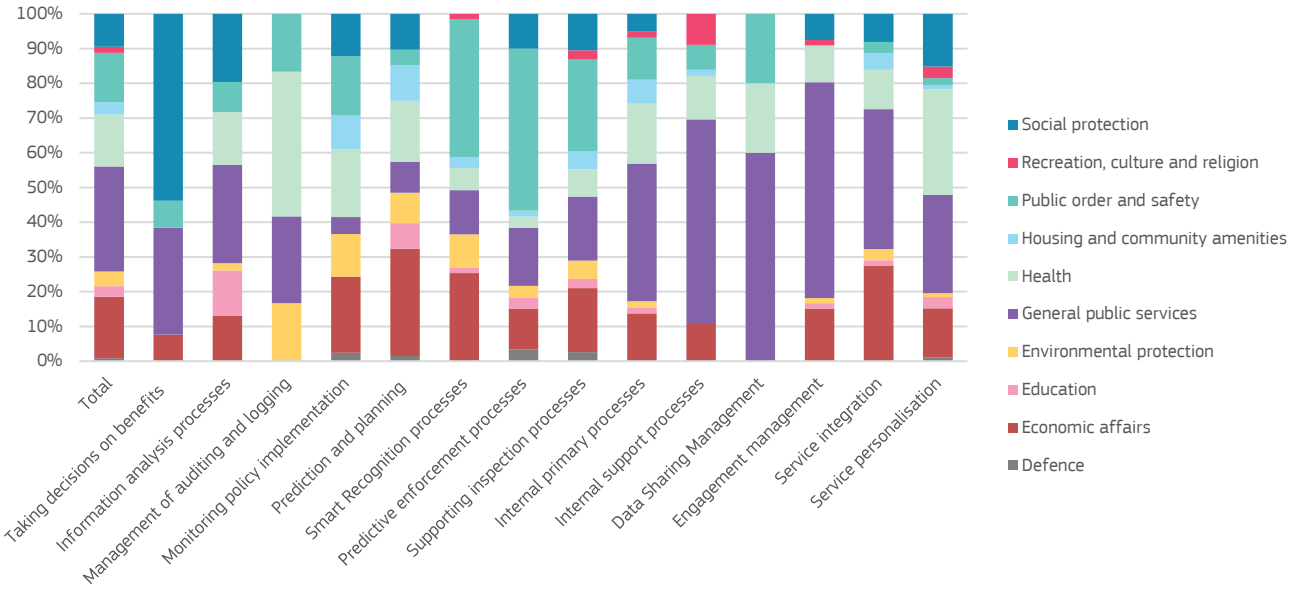


Figure 11. Application Type by Functions of Government

Source: JRC own elaboration

- The Environmental sector shows demand for AI applications that help Prediction and planning, Monitoring policy implementation and Digital Recognition. An example is the AI system to Identify forest tree species, forest clearing, and forest height that was developed in Estonia, or the Italian system that predicts rainfall events and their impacts on land.
- The recreation, culture, and religion sector appears just in some cases, and the most important type of application is facilitating internal organisation procedures, indicating the use of AI solutions to improve internal processes with more efficient tools. Examples are a virtual assistant for museums in Italy, the cultural heritage tools developed in Finland, and the historical image handling inside the National Archive in Hungary.

- The Defence sector is almost absent in the collected cases.
- Most of the AI solutions aiming at facilitating access to data are in the General Public sector, demonstrating that these are solutions transversal to all sectors and are important for the creation of specific public services.

4.3.9. Recipients of AI systems

The implementation of AI solutions implies an interaction among different actors. The public sector is mainly involved in three types of relations:

- Government-to-Government (G2G). Processes between and within public organisations, like services and information transactions between the central-state government, state-local governments, and between department-level and attached agencies and bureaus.
- Government-to-Citizen (G2C). Services and information transactions by the government interacting with private users (citizens).
- Government-to-Business (G2B). Services and information transactions by the government to private organisations and other economic activities.

It is interesting to note that AI solutions are designed to support both direct interaction with the users (45%) and the governmental backend interaction within and among public organisations (43%). Government-to Business applications on the other hand were relatively rare (12%).

Figure 12. Recipients of AI systems

Source: JRC own elaboration

4.3.10. Data Input Nature

The analysis also observed the type of data used. It is possible to notice that **24% of the cases use Location data**, **37% of the cases collected use Historical data** (static data or data rarely updated with new historical series) and 63% use Dynamic data as depicted in **Figure 13**. This latest concept is derived from the OECD.AI[45] and includes any type of data updated systematically and periodically (every day, week, etc., depending on the frequency of data collection) or real-time.

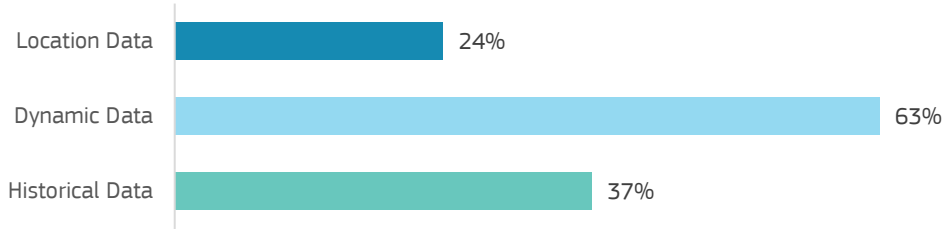


Figure 13. Data input nature

Source: JRC own elaboration

[45] https://oecd.ai/en/classification

4.3.11. Value drivers

By adopting a simplification of the taxonomy proposed by (Twizeyimana & Andersson, 2019), the AI cases have been categorised by the extent to which they carried public value.

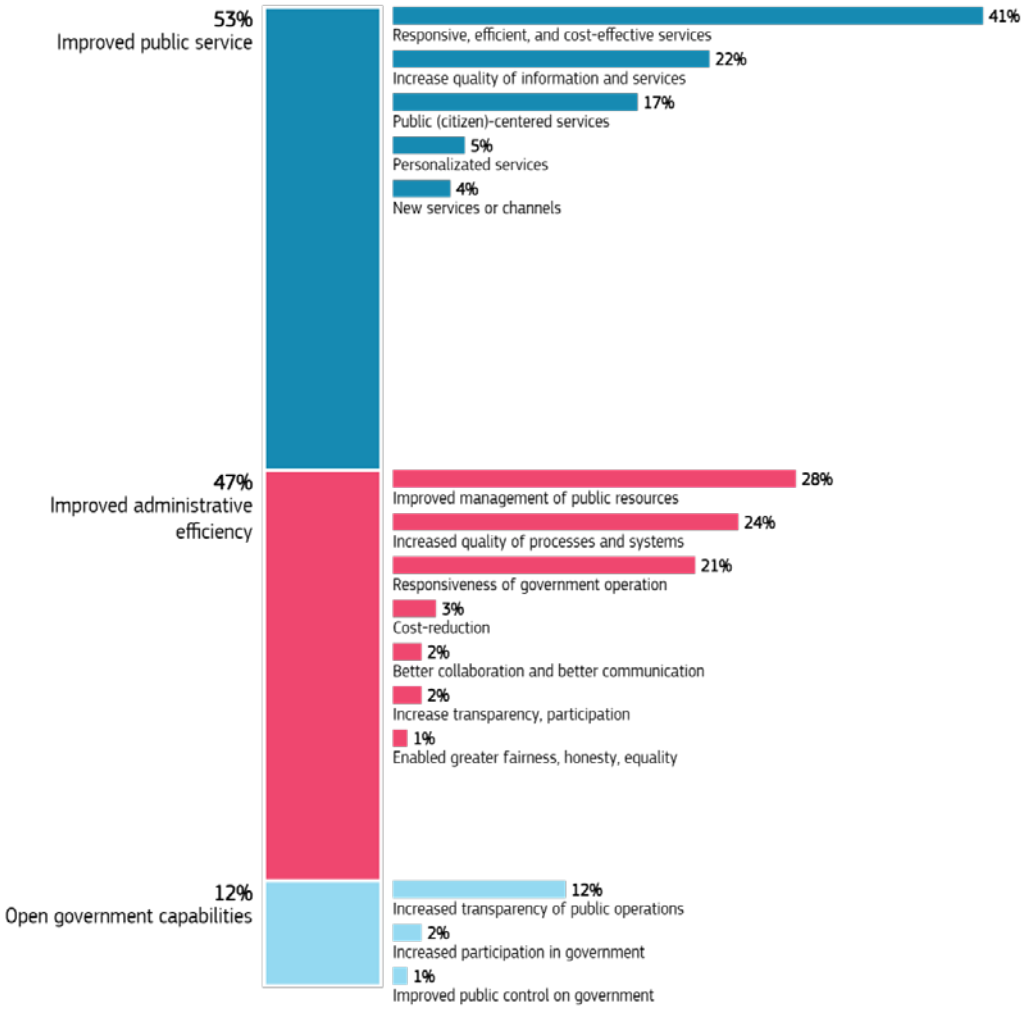


Figure 14. Public Value of E-Government AI Services

Source: JRC own elaboration
Note. Multiple options are allowed. The percentage of the first level has been calculated considering the cases for which at least one option at the second level has been flagged.

This classification focuses different value areas for the public service. The landscaping has considered these 3 aspects of value improvement on all cases collected that are covering different aspects of the service:

- Improved Public Service. This refers to initiatives that are aiming at enhancing the quality of public services for the final user (citizen or businesses) by for example improving accessibility, easiness of access to the service (e.g. with a new communication channel) or the overall quality of the provided public service.
- Improved Administrative Efficiency. This includes purposes of efficiency, effectiveness, increasing quality, and lower cost for administrative processes, systems, and services keeping government operations systematic, sustainable, flexible, robust, lean and agile, better management of public resources and economy.
- Open government capabilities. This refers to impacts on openness, transparency, participation, communication, and collaboration to provide personal or corporate influence and control on government actions or policy.

Looking at the data about the improvement values of the public services in more detail, the research measured that **more responsive, efficient and cost-effective (41%)** is the main value identified, followed by **improved service quality (22%)** and having **more user-centred services (17%)**.

From the internal point of view, better management of resources (28%) is leading, followed by the increased quality of processes and systems (24%), and the responsiveness of governmental operations (21%).

Horizontal to these two dimensions the third one is on open government capabilities, where the main ethical requirements that emerged is about increasing transparency of public sector operations (12%).

4.4. Analysis and takeaways

The landscaping research provided an improvement in understanding of what types of AI solutions are used and are being developed in the public sector in the EU. Although the list of cases collected is only a small proportion of all cases of use of AI, the data shows some interesting takeaways that are here summarised:

- A **constant increase of cases collected over time**, confirms a positive trend in the adoption and implementation of AI solutions in the public sector, which is now quite diffused and is moving towards the phase of production rather than pilots. At the same time, the linearity in the trend of the adoption suggest that the barriers are holding back more widespread AI adoption as it is not currently growing exponentially.
- More than a **third of the cases were found to be implemented and used in daily operations**, but a considerable number are still pilots or in development. This suggest that there remains some level of unclarity regarding the extent to which the cases that are now in development or are being piloted will end up being integrated in public organisations and contribute to the creation of public value.
- **The majority of cases are initiatives launched at the national level**, showing how AI development seems to be driven by national governments. While they have the human and financial capacity to sustain the development, a considerable number of initiatives are also developed by regional and local administrations, demonstrating that regions, cities and municipalities – even small ones – can play a key role in pushing, developing and using AI.
- There is also a notable **push for the adoption of AI by local public administrations**, in some cases even by small municipalities. This evidence demonstrates that the opportunities for AI development are not limited to a small portion of pioneers. This might be also related to the presence on the market of several opportunities from private companies or open-source solutions that can facilitate the adoption, even with a limited capacity.
- The largest category of **AI cases is based on Machine Learning (ML) techniques,** in several different usages, reaching a 58% of the cases. **Automatic Reasoning is 30%** overall. The number of cases using **Natural Language Processing (NLP) technologies** is also remarkable, and is one of the most relevant categories, standing at **24%.**
- As regard the purpose, which AI systems where adopted, **general support of public services & engagement is the largest segment**, followed, analysis, monitoring & regulatory research. Next came enforcement and internal management. Only a handful of cases relates to adjudication tasks, indicating that AI solutions are rarely (solely) used for the automation or assignment of social benefits.
- **AI is affecting both internal operations and public service delivery**, most of the solutions aim at increasing efficiency. Higher data quality, more efficient research, prediction of critical situations, and the intelligent exchange of information among the various offices all allow more efficient and effective management and delivery of public services. It is therefore not surprising to see that half of the AI solutions that have been collected are G2G type solutions.
- Almost half of the AI cases identified in the inventory are targeting internal government actors as the main recipient, while more than half target either citizens or businesses.

5. A deep dive into selected case studies

5.1. Rationale

The usage of AI within public administration should ensure benefits for society and minimise risks. This is, however, very challenging. Many innovations in the public sector often fail to materialise, or realise no value, despite large amounts of resources being dedicated to them – they either fail to be developed or lack integration within the organisation (Goh & Arenas, 2020). Within this context surrounding the process of AI adoption and implementation, it is exactly the "human element" which should not be overlooked. Innovation often requires an individual to spot the potential of AI for their organisation, convince others, break down barriers and ensure a first organisational adoption of an AI technology (De Vries et al., 2016). However, these capabilities to use and integrate technologies in organisations are often surprisingly overlooked and not discussed in depth during discussions about public sector innovation, or AI-enabled innovation in general. There seems to be a strong focus on the data-related and technological aspects of AI innovation, as these are the main requirements to kick-start the development process of AI technologies (Janssen et al., 2020). Whilst undoubtedly important, other organisational capabilities are strongly required to ensure that AI is not just developed – but will be integrated into the organisation (Mikalef et al., 2021; van Noordt & Misuraca, 2020).

As an emergent technology, Artificial Intelligence requires additional organisational skills and capabilities before it can be developed, applied, and integrated. Due to the persuasive nature of AI, and its complexity and risks the organisation wishing to deploy AI requires adequate skillsets and capabilities to use and integrate this technology. In fact, the use of AI requires looking beyond merely the development of new systems (Bailey & Barley, 2019). Without considering how new technologies are deployed in practice and taken up by the final users, little can be said regarding their value and their effects. A lot of consideration and effort is necessary to avoid ending up with "successful" pilots, which nevertheless do not see long term implementation – i.e. not surviving the "pilot purgatory" (Kuguoglu et al., 2021).

This importance of considering the post-development and adoption phase of AI has been first introduced by the first report of the AI Watch on public services (Misuraca & van Noordt, 2020): While understanding the perceived value of AI for the organisation within the pilot phase is crucial (also to facilitate the process of innovation within the organisation), the actualisation of this value can only be gained in the implementation phase after the AI is truly embedded into existing work practices. This distinction has been further explored in another report of the AI Watch (Molinari et al., 2021). In fact, this perspective is only becoming more crucial as the AI Watch has already witnessed that a significant amount of AI use cases seem to "disappear" following a short pilot, due to a lack of integration in the organisation, legal concerns or simply because after the pilot has ended no resources have been made available to make the solution part of the core organisation (Molinari et al., 2021)

In this previous AI Watch publication (Molinari et al., 2021), it is further stressed that now more attention should be given to a sustainable implementation of AI that goes beyond the mere realisation of pilots but looks at the permanent value that AI can bring to the public sector. Doing this means ensuring that staff have the appropriate skills to work with AI, as well as redesigning existing work practices. Similarly, it is in this phase that the use of the technology and its consequential use becomes part of the "regular" planning, budgeting, and scheduling of the organisation and moves beyond the project-related funding or resources dedicated to pilots. Furthermore, it is often also in this phase that the technology scales up and integrates with the existing (legacy) IT systems.

Keeping in mind the need to integrate new AI innovations in the "regular" organisational practices is particularly relevant in evaluating the successes and results of emerging technologies, as many of the developments as well as pilots take place in a small setting and often only temporarily (Kuguoglu et al., 2021). **Solely relying on measuring the effects of technology following a short pilot may be insufficient in understanding the effects of a "real" digital transformation, where the technology becomes part of the organisational work practices**. These effects may further be more difficult to anticipate as well. This is because there is an apparent gap between these two phases. There is often no guarantee that a successful trial of AI within public administration leads to an actual embedment of the technology later. If on the one hand this can be considered a normal practice for innovation, that needs to be open and accept trials and failures, on the other hand, times are now mature to start seeing some of these successful pilots becoming an integral part of the organisation as to truly capture the benefits of this technology.

Several contextual factors limit or facilitate the implementation of AI. Awareness of these contextual factors is of utmost importance to understand how and why a certain AI technology is (successfully) implemented. This topic is not new, generalist literature on digital government often highlighted that the value of technology is

often not the result of the technology *per se*, but its integration, embodiment, and the change it brings to the organisational practices. In these change processes – or also the digital transformation – technological factors often only play a minor role, but organisational, social, cultural, and economic factors play a much more important role. Even though, the implementation of AI differs from the implementation of "standard" digital technology those factors don't lose their importance, hence they need to be carefully considered. A previous report of the AI Watch made a first attempt to list some contextual factors that emerged from the existing literature (Molinari et al., 2021) (**Table 11**). Those factors have been now assessed through in-depth case studies.

Table 11. Tentative list of contextual categories of factors.

Category	**Examples**
Political factors	Elected officials endorsing the experimentation of that technology and/or its integration in the administrative or policy processes.
Organisational factors	Support by the top and/or middle management and/or the frontline staff involved in the technology trial and/or the permanent implementation of its results inside organisational structures.
Infrastructural factors	Availability of supporting datasets or IT equipment within the organisation adopting or implementing that technology innovation.
Demand related factors	Needs expressed by third parties, i.e. other organisations and/or their users interacting with the one engaged in technology acquisition.
Technical factors	Response to user needs offered by that technology and complementarity/interoperability with other IT solutions already in place of the same or similar kind.
Supply related factors	Integration of an external IT partner with functional expertise or specific capacity of the organisation's internal IT staff.
Financial factors	Availability of adequate, ad hoc funding to the project and/or the embedding of its results in the current business practice.
Legal factors	A clear framework incentivising technology innovation, early resolution of data privacy and/or security aspects, other legal or regulatory requirements.
Ethical factors	Expected/actual and especially unwanted consequences of technology implementation to people, social groups, the environment etc.
Domain factors	In addition to the factors listed above, there could be various other factors, more fragmented and partially overlapping, which are dependent on the specific application domain (e.g. Health) and on the specific geographic location (e.g. cultural factors).

Source Molinari et al., 2021

5.2. Overview of the case studies

To explore some of the aforementioned challenges, the research team conducted 8 in-depth case studies. The cases were selected from the landscape described in Chapter 4. For each selected case, all the information available on the web was reviewed, and followed by an interview with a person involved in the development of the selected project. The selection was done following a pragmatic approach starting from the identification of the potentially relevant cases with detailed information available on the web, then reducing the list by including only the cases where the contact details of at least one person working on the project were available. Given the described methodology, it is important to state that the 8 resulting selected cases do not represent the best practices in Europe but are simply 8 examples from which it is possible to extract some useful insight on how to deal with AI development, learning from the experience (and the failures and challenges) of those cases. In fact, **the purpose of the research was exploratory, with the aim of collecting "intangible" information on how public administrations deal with AI implementation**. That information can be collected only by listening from on-field experience.

The 8 cases are listed in **Table 12**. As for the strategy analysis (Chapter 3), the following sections reports the horizontal analysis across the 8 cases. Each case is further described in a dedicated sheet annexed to the report.

Table 12. List of cases analysed

#	Case	Country	Organisation	Short description	Status	AI Classification
1	Intelligent Control Platform	Denmark	Danish Business Authority	A digital platform that provides an automated assessment of how a selected company/businesses is more likely to commit fraud compared with others.	Implemented	Machine learning
2	Eva, targeted COVID-19 border checking	Greece	Greek National Government	Between August and November 2020, in the midst COVID-19 crisis, the Greek Government trialled an AI system in border control points that helps the selection of travellers to test upon arrival. The purpose was to effectively allocate scarce PCR tests during the summer tourism season.	No longer in use	Machine learning
3	Reducing night noise through nudging	Belgium	Municipality of Leuven	To solving an issue of too much noise in crowded streets sound meters were installed and an application for citizens reporting developed. This will allow proper corrective actions, also through nudging.	In development	Audio processing
4	Unlocking digitised documents and correcting OCR	Luxemburg	Luxembourg National Library	The Luxemburg National Library developed an AI system that operates on top of the results of the different OCR (Optical Character Recognition) used over the years for digitising historical newspapers and books. The system aims at improving the quality of the result, identifying and correcting mistakes.	Implemented	Computer vision
5	Object Detection Kit	The Netherlands	City of Amsterdam	The AI solution automatically identifies rubbish on the street and shares this with the garbage management services of the city to act and solve the issue. This is done by analysing imagery collected from the pictures taken by smartphones installed into vehicles driving around in the city.	No longer in use	Computer vision
6	OTT – decision-support tool for consultants	Estonia	Estonian Unemployment Insurance Fund	An AI system used in the Estonian Unemployment Insurance Fund which aims to assist its consultants with providing insights predicting the chances of an unemployed person getting a new job.	Implemented	Machine Learning
7	Automation of subtitling videos and audios	Finland	Finnish Tax Administration	The AI system is based on understanding speech and transforming it into text. It is used to provide subtitles on videos and is part of a wider initiative within the administration to use Speech-to-Text technologies in various use cases.	Implemented	Audio processing
8	Estimation of income for those paying by modules	Spain	Spanish Tax Agency	An AI system which estimates the income of Small and Medium Enterprises (SMEs) as well as of self-employed individuals who have decided to pay their taxes in phases rather than defining an exact income.	Implemented	Automated reasoning

Source: JRC own elaboration

5.3. Taking stock and sharing insights

Whilst these different examples of AI used in government vary greatly between their applications, their purpose, their policy domain and even the status of their implementation reveal a variety of insights that reinforce earlier suggested recommendations provided by the AI Watch team, as well as the latest academic literature. Based on the information collected through the cases a reflection is made on the various success factors as identified in a previous report (Molinari et al., 2021).

5.3.1. Reflecting on the influencing factors

As highlighted in the introduction of this report, several key influencing factors play a critical role in the development, adoption and (sustainable) implementation of AI within the public sector. In fact, these factors often go beyond the mere requirement of "developing the AI" and are made up of many social, organisational, cultural, and even economic factors. Whilst acknowledged in academic studies on the digital transformation of government, they are still often overlooked in the discourse on AI because it is predominantly focused on data, machine learning algorithms and the resulting AI systems and/or applications (Mikalef et al., 2021; van Noordt & Misuraca, 2020).

Table 13 synthesises the insight collected through the case analysis for each of the categories of factors identified in the previous report of the AI Watch (Molinari et al., 2021) and synthetically reported also in Table 11. For all the listed categories it was possible to identify one or more concrete factors that came from the cases analysed. Although not all the categories were observed in all the analysed cases, an overview is reported in **Table 13**. Finally, it is interesting to note how within the same category the factors that influenced the development of the project do not always coincide or have a similar magnitude.

Political factors. The involvement of political officials is not widespread. Often political support is seen as an important basis for supporting innovation, without a precise and direct involvement in a single project. In fact, the role of politicians was more to set the ground for AI innovation in general, such as providing the freedom to experiment and providing approval for the development of projects. Examples of this include Amsterdam (case 5) where the council endorsed the creation of a whole data science team, and Denmark (case 1), where political endorsement was useful for allowing the collection of relevant data. However, there might be exceptions for highly sensitive projects, like Eva in Greece (case 2) where the project relied on a strong involvement from politicians, starting from the Prime Minister.

Organisational factors. Several organisational factors influenced all the analysed cases. Managerial support was extremely relevant in the initiation and development stages, and following the integration of AI within the organisation. In some cases, where the support was not taken for granted, specific actions were conducted to raise awareness and convince the management of the value of the project. Moreover, the allocation of new tasks to domain specialists was necessary in several cases since domain-specific knowledge was essential for the training of the AI system. Hence front-line civil servants were often involved. For example in Amsterdam (case 5) employees usually tasked with collecting the rubbish on the street were allocated to train the AI system for proper image recognition. In some cases, it was also necessary to hire new people for increasing internal capacity or to fill a knowledge gap. The number of people allocated as well as the organisational structure for supporting the development of the system vary among the different projects. More complex projects of course require higher involvement, but the propensity of the whole public administration to support the innovation also plays a role – hence the strategic decisions on budget and resources allocation. The organisational structure varies among the different cases. There are cases with a whole team dedicated to AI development (like for example the city of Amsterdam – case 5), while others have only one person allocated to the project and rely more on external support.

Infrastructural factors. There are various technological requirements which include but are not limited to **the need for enough data (in quantity and quality) to base the AI**. The availability of data is always key for the development of an AI solution. How to get the data differs among projects. There are cases where data collection was one of the most difficult tasks (if not the most difficult), while data were already available for others. This distinction depends on the nature of the project and/or on the quality of the existing infrastructure. For some cases, the data collection was one of the main and most difficult activities. For example, Amsterdam (case 3) spent a lot of effort in collecting images, and the final database – which they are planning to publish as open data – is one of the main results of the project. Alternatively, in other cases, such as for the Luxemburg National Library (case 4) or the Finnish Tax Administration (case 7), the used data were already available (e.g. books, newspapers, videos) and the complexity lay mostly in the fine-tuning of the algorithm rather than getting

the required data. Finally, the need for proper IT equipment was not identified as one of the main factors influencing the project, probably thanks to previous developments in the digitisation. Overall, the cases reported equipment with enough quality to implement the AI system. Of course, the cases met a completely different situation regarding the quality of the equipment, but they are also dealing with AI projects with different characteristics and requirements.

Demand related factors. Some projects are affected by **pressure from outside and demand for changing the status quo**. The demand depends on the area of application. For some projects (mainly the G2G ones), they were serving a purpose of efficiency or the need of higher support to employees, and hence the demand was internal to the organisation. For other projects, the external demand was the trigger for the start, like in Leuven (case 3), where the municipality needed to solve a noise issue. The Luxemburg National Library (case 4) wishes to offer a better service to citizens and improve what they have been building on so far.

Technical factors. Technical factors are not only important *per se* (developing an AI system is complex from the technical point of view), but are strongly interrelated with the different systems in place in the organisation. Interoperability is key, especially when the project is moving beyond the pilot phase. For example, in Leuven (case 3) the administration is developing a data lake for making all the AI systems interoperable. Moreover, ensuring that AI was interoperable with the systems was a requirement of the tendering process, allowing the city of Leuven (case 3) to ensure the compatibility and integration of different data.

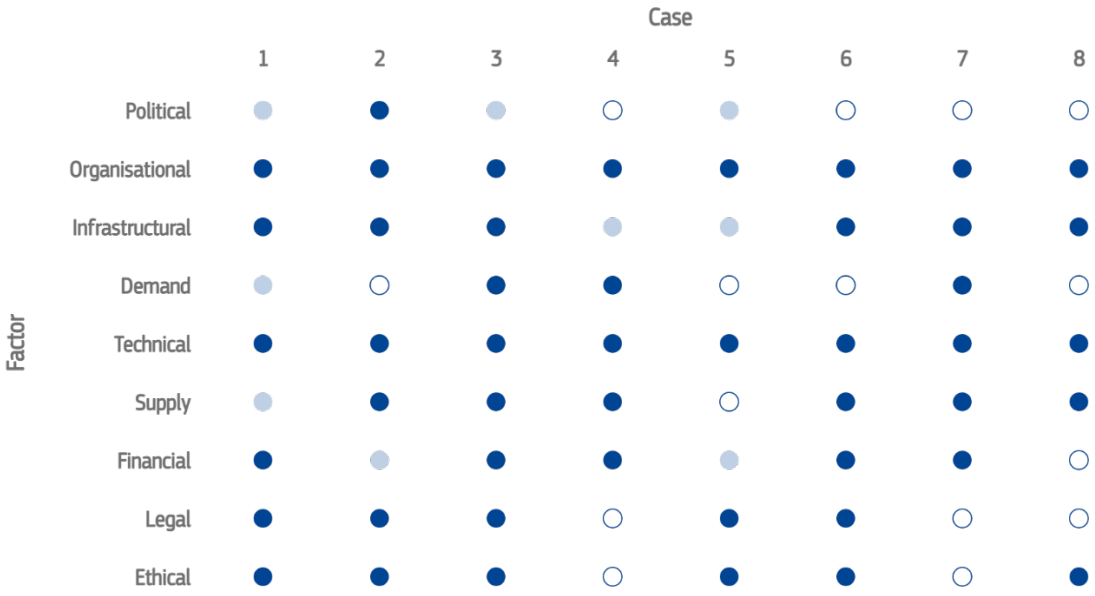
Supply related factors. The relationship with suppliers was extremely varied among the cases. Some cases developed the project entirely internally, with a minor contribution from external suppliers ((like Amsterdam – case 5). However, most of the cases rely on external organisations, albeit to different degrees. Some rely mostly on completely externalising the technical development (for example the Finnish Tax Administration, which relies on Microsoft Azure – case 7) whereas in others there is a collaborative approach between both the private and public partners. In addition to private organisations, collaboration with universities was a key factor in several projects – several cases found in university department the right attitude towards innovation as well as the missing competences, (as for the Estonian Unemployment Insurance Fund – case 6).

Financial factors. Dedicated funds were always allocated to the project. All the projects relied on ad-hoc funds for innovative projects. These funds often came either from national or regional governments. In other cases, funds came from the organisation's existing IT budgets, or a mix between funding programmes and the organisational budget was required. The limited amount of money reduced the scope of the project in some cases.

Legal factors. GDPR compliance was one of the main legal factors to be considered. For some cases there were no specific issues, hence this was not a barrier; for others, a legal check was needed to ensure the project was allowed, or whether the intended use of the data was lawful.

Ethical factors. Ethics was always a topic under discussion in the development of the project. **Ethical concerns always arose, and mitigation measures were put in place**. A variety of mitigating measures were used for avoiding any type of ethical risks. For example, none of the projects takes autonomous decisions as, depending on the characteristics of the project, a human control or action was always requested. Some organisations even developed an ethical checklist to follow for each project (like for example the Finnish Tax Administration – case 7). In general human oversight and discretion was put front and centre, for example in the Spanish Tax Agency (case 8), and in the Estonian Unemployment Insurance Fund (case 6). In both cases the system advised employees that they still had to decide how to act based on the suggestions it offered – but also on their own experience.

Table 13. Relevance of the factors in the analysed cases



Source: JRC own elaboration

Note. ● factor(s) impacting the project; ◐ factor(s) partially or indirectly impacting the project, ○ factor(s) not present

5.3.2. Key takeaways

These influencing factors provide a broad perspective on the factors needed to develop and use AI in public administrations. However, the case studies highlighted several new insights surrounding certain themes influencing AI adoption in government which require more deliberation and research.

Development and design factors. Several of the case studies highlighted the importance of **specific development and design factors that are unique to the public sector**. These are goals or constraints which take place during the development phase. For example, as highlighted in Eva (case 2), the **AI solutions which are designed for the public sector need to consider different values and approache**s compared with the private sector, something that data scientists may not always be aware of. Rather than pursuing the highest accuracy rate through opaque black box AI models, higher transparency and explainability – especially in high stake decision making –should be seen as more important. This as such, may require developers to use more explainable machine learning techniques which can be better understood by the decision-makers or for auditing purposes. Moreover, the public sector needs to take into close consideration how users will perceive the system. In developing OTT (case 6) the organisation had to face different expectations between the developers and the civil servants using the system, and so invested in making the system understandable and explainable as a way of supporting these professionals. This approach is crucial to ensure trust and adoption.

Moreover, public administrations are often also **bound by unique development challenges**, such as what kind of data they can collect, reuse, or obtain from other public administrations. There can be ethical and legal limitations to what data public administrations may collect. In the development of EVA (case 2) data were collected through a form (Passenger Locator Form) filled-in by the passengers. The Greek government decided to limit the amount of information required: for example, no information on the occupation was included, even though this would have been extremely relevant, for example for testing more exposed people (doctors, nurses, etc.). This example highlights the dilemma perfectly: more intrusive data collection may have potentially made the system better at predicting, but it would come up against considerable ethical constraints. Similarly, in the noise detecting project in Leuven (case 3), personal conversations were not allowed to be recorded, which required some tweaking in the approaches on how to train the AI system (running the potential risk of not having enough data to successfully classify noise disturbances). Along the same lines, the Danish Business Authority (case 1) and the Spanish Tax Agency (case 8), took considerable care about which data could be used for the development of the AI systems and the removal of personal information. The city of Amsterdam (case 6) did not allow the reuse of previously collected data or the reuse of cameras that had already been installed on cars for a different purpose.

Some highlighted the importance of using open-source solutions or making the source of the solution developed in-house open. For example, software open-source modules, libraries and engines were used by the Luxembourg National Library (case 4). Open-source software was not only crucial in reducing costs for AI solutions, but it also reduced reliance on external vendors and prevented potential vendor lock-in. Moreover, the analysed cases aim to make their AI solution publicly available as an open-source solution. For instance, as mentioned in the EVA case study (case 2), using as much open-source material, and making the AI open-source was a specific design consideration to increase trust and acceptance. Aiming to use as many open-source solutions may thus also contribute to a general culture of transparency and sharing across public administrations, as the output of one organisation may become the input of another public administration.

AI expertise factors. Another main takeaway from these cases was the necessity to gain AI-related expertise in one way or another. Apart from Amsterdam (case 5), all the other case studies highlighted the difficulty in attracting AI-related expertise which is a crucial requirement to develop AI. Organisations have used **different strategies to work with the limited availability of AI expertise**. Creativity and innovative approaches are key in this direction.

Firstly, a public administration may decide to **organise training** by themselves to gain the needed AI expertise in-house. The Spanish Tax Authority (case 8) provides training on AI to their (often IT) staff. Secondly, some organisations tried, despite the difficulties, to **gain AI expertise by attracting data scientists**. One person, usually an intern or a starter on the job market, was already sufficient to develop some of the AI solutions described. For example in the Luxembourg National Library (case 4), hiring an intern was the main requirement and driver to develop the system. However, attracting data science expertise is not easy due to cultural and financial mismatches between these experts and administrations. The two most advanced cases in our sample in this respect are Amsterdam (case 5) and the Danish Business Authority (case 1) which both have a whole team of data scientists. From these cases, it is possible to learn the importance of creating a suitable environment for these experts and making them welcome in the organisation. This includes, for instance, reducing the bureaucratic culture, but also some trivial measures, such as providing the right software on laptops and processing power. A good network with universities is also important for attracting a young workforce. For example, Amsterdam (case 5) every year supports around 200 master thesis students.

Another mechanism to work with limited availability is to **use external expertise**. **Table 14** offers an overview of how the different systems have been developed. Public administrations often have to work with complimentary private or academic organisations which provide the required IT or AI expertise. These collaborations highlight the importance of having a strong network, trust, and reliable partners – often through historical partnerships – for developing and implementing AI in government. These collaborations are often with local organisations, but as the development of EVA (case 2) shows, could even extend across borders and continents, as the Greek government was working with a data science team from an American university. There are limitations or even **risks with relying solely on external expertise** for the development of AI systems, as these case studies illustrate. Several of the experts interviewed stressed the concerns of not having enough internal AI capacity within public administrations, which leads to challenges in setting up the projects, managing the AI development and maintaining and evaluating the AI systems when they are in use. These risks are increased even more if private partners are involved, since they may not live up to expectations or be flexible enough for innovative AI projects. To this extent, it is interesting that the cases of the Luxembourg National Library (case 4) and the Finnish Tax Administration (case 7) decided to build a system on top of the AI system offered by their private partner in order to adjust the results to the need of the organisation. Both the cases considered this the optimal solution for achieving their goals without spending too much effort in innovating with the supplier. As such, there seems to be a need for a healthy balance between internal AI expertise and external partners. None of the cases solely relied on external suppliers (though they show different balances). Having internal expertise on AI available within the organisation is also a requirement to ensure that AI is used in an ethical way, and to mitigate any potential risks from both the start of the development as well as when it is actively used in organisational processes.

Table 14. Development method of the AI cases

#	Case	Development method
1	Intelligent Control Platform	Developed in-house with a data science unit
2	Eva, targeted COVID-19 Border Checking	Developed in collaboration with academia
3	Reducing night noise through nudging	Developed by an external company

#	Case	Development method
4	Unlocking digitised documents and correcting OCR	Developed in-house (on top of OCR developed by private vendors)
5	Object Detection Kit	Developed in-house
6	OTT – decision-support tool for consultants	Developed in collaboration with academia and private vendors
7	Automation of subtitling videos and audios	Developed in collaboration with a private vendor
8	Estimation of income for those paying by modules	Developed mostly in-house

Source: JRC own elaboration

Risk mitigation strategies. The cases offer several examples which could be followed to mitigate risks and ensure ethical use of AI. Significant differences can be found between what kinds of activities are conducted; this depends **greatly on the level of (perceived) risk of the AI system as well as the organisational maturity of working with AI**. The riskier and more impactful the AI system is seen to be, the more risk mitigation measures are conducted. Of course part of the risk is objective, and everyone can assess it: a project that treats personal data like EVA (case 2) is riskier than a project on the digitisation of books like the one in Luxemburg (case 4). However, our impression is that the level of risk is significantly affected by subjective factors, i.e. the perception of the organisation. In fact, organisations that have worked more with AI seem to have a greater awareness of potential risks and take appropriate actions to mitigate them.

In Annex II, which reports more details for each case, a specific section is dedicated to explaining how the different organisations put mitigating measures in place. Some clusters of actions emerged from the collected insights.

The first set of risk mitigation measures refers to **assessing legally what the system is doing or allowed to do**. This may result in conducting a legal assessment before the project begins. This type of assessment was for example done in Leuven (case 3) to understand privacy limitations; or during its development, like for example in Greece (case 2) where an assessment was done to explore how to use the collected data. These legal assessments often provide clarity about what data can be used and collected, specifically with reference to the GDPR, but possibly also including context-specific regulation.

Strictly related to this legal assessment, but in some cases going beyond the mere legal compliance, the cases put in place a series of practices for **ethical data governance** as a second set of mitigation measures. This often includes anonymizing the data, ensuring a secure data infrastructure, and raising awareness of the content and impact of the data collected. The most advanced practice in that respect was found in the Intelligent Control Platform (case 1), where the whole organisation had to follow a strong data governance practice to ensure the high quality of the data as well as the avoidance of potential risks and misuses.

The third set of risk mitigation actions refers to **the monitoring and evaluating of the AI system**. Systems often require close monitoring of their performance. In particular, predicting the issues and unwanted behaviours of the AI system might arise, for example when an event changes a trend and historical data might no longer properly reflect the current situation. EVA (case 2) is a good example in this direction. Fake news were circulating online suggesting to falsely declare Athens as city of birth in order to avoid being tested. Several people were following the fake suggestion creating anomalies in the data that needed to be monitored and adjusted by the government. The lesson learned from this example is that some form of monitoring is always needed as well as a continuous retraining of the AI solution for ensuring unwanted behaviours. This type of measure often requires human interventions, as suggested by the Estonian Unemployment Insurance Fund (case 6) where a team of experts periodically meets to assess the performance of the system and adjust the algorithm.

Given the importance of human oversight and intervention, a fourth set of mitigation measures should include training and awareness campaigns for staff. Employees should be able to identify and mitigate risks. In particular, the end-users of the AI system need to know how the system works and under which conditions and in which situations it can make false predictions and/or calculations – i.e. it cannot be unquestioningly trusted. This requires some technical knowledge of what AI is and how it acts. Hence public organisations should start

considering the basic knowledge of AI as a must-have for all employees, not only as a technical competence for IT experts.

Related to this is a fifth set of actions described in the case studies which refers to the definition of clear **governance and management models of the AI system**. For instance, a formal governance board tasked with monitoring and adjusting the AI system could be set up. Next, the responsibility for mistakes or the emergence of unwanted outcomes cannot be delegated to the developers but is instead taken on by the management. This is especially important for cases where the system was developed in-house.

Management awareness of the functionalities of the system and its risks is key for doing this. Finally, public administrations might create an independent team that assess the risk of the system from the outside and gives the green light for its use. This can also be done through the adoption of standard guidelines and checklists, which remain valid for each AI system.

The sixth and last set of actions that were often highlighted in the cases was the need to make the AI systems as transparent as possible. Both for internal purposes, (to make sure the civil servants trust and use the system), and for external purposes (to ensure that citizens and/or other actors have all the needed information to assess the action taken by their government). This could be done by providing information about the system on the website of the administration in a specific register, the project website or more technically detailed on specialised websites.

Moving from a pilot to implementation. A successful development or procurement of AI solutions does not necessarily mean that the AI system is successfully implemented within the organisation over a longer period. Failures are part of the innovation process; hence it is unrealistic to expect that all the projects will be implemented and used by public organisations. However, projects often do not move to the implementation phase for reasons other than failures in the project itself. In this case, the project risks becoming an unjustified waste of financial and human resources. The cases suggest some insights in this direction.

Firstly, the change from a pilot to implementation implies a shift from an innovation project to "regular" organisational practice. This means moving to the regular organisational political and budgetary constraints. During the initiation, development and piloting of an AI solution, there can be a general sense of enthusiasm and exceptionalism. Curiosity, innovativeness, and experimenting seem to be some of the main drivers of the pilots. **This, to a certain extent, changes when the piloting phase ends, as other considerations come into play, and a stronger focus on value for the organisation and balance with existing organisational interests occurs**. Sometimes, this also implies a change in how the AI will be funded – from the innovation budget towards the general IT budget. Implementation then depends on the costs of the AI innovation, the operational and maintenance costs and the available IT resources. In cases where this shift is more challenging, or no funding can easily be made available, it leads to the ending of the initiative. Moreover, constraints in resource allocation may obstruct sustainable implementation: **moving toward a sustainable use means also having permanent tasks related to the training of the system**, the monitoring of the results, and the evaluation of the performance – and this requires an organisational change.

A second challenge that has been identified in the case studies is that the implementation of AI solutions brings additional security and legal constraints to the organisation. While piloting and developing AI solutions are also bound by legal and ethical norms, AI systems often have to pass additional security and legal assessments before they are sustainably implemented in the organisation on a routine basis. This may include a security audit, as planned for the automation of subtitling in Finland (case 7) but must also take into further consideration wider ethical constraints. In Amsterdam (case 5) for example, going into production means automatically collecting real-time data on the street, hence the need for some more elaborate data protection actions.

The last challenge which could be identified in the cases studies is the general acceptance and diffusion of the AI solution to the civil servants who end up having to use the system. While some of the AI systems described require the acceptance of just a handful of professionals working with the system, others need the cooperation and use of the civil servants the AI systems are supposed to support. This diffusion can take considerable time and resources, and often cannot be taken for granted by the administrations. The mere fact that the AI system is available for civil servants does not automatically mean it is used. As such, a strong emphasis on ensuring take-up amongst the users outside the (small-scale) pilot is one of the factors which can make or break general adoption and integration of the AI system in the organisation.

6. Policy implications and recommendations

This chapter aims at drawing some policy implications and proposing some recommendations based on the analysis conducted and reported in the previous chapters. The evidence collected is mainly based on concrete examples and cases, hence the recommendations here drafted mainly focus on the elements public organisations should consider when approaching AI implementation. This is complementary to the other report of the AI Watch "Road to the adoption of AI by the public sector" (Manzoni et al., 2022) that is to be considered as the main reference from the AI Watch with regards to policy recommendations on AI in the public sector.

The next paragraphs will report the research team's main insights that the research team collected thanks to this research.

6.1. Diffusion of AI: where we are and what we expect

The collected data shows how interesting insights on how far AI is diffused in the public sector. Mostly looking at the information available online, the research team was able to detect 686 cases of AI in the public sector in Europe. Among those cases, 230 were collected before 2020 and published in a previous report (Misuraca & van Noordt, 2020) but the large majority was detected in 2021. **This means that the number of use cases is rapidly increasing**. Not only the absolute number but also a series of statistics allows us to conclude that AI is becoming a diffused technology. Here are some examples:

- 27% of cases are at the local level, meaning that every governmental level is involved, and AI is not only accessible to large national governmental agencies
- The solutions embrace different AI technologies in almost an equal percentage, from Machine Learning to Computer vision and Natural Language Processing
- Most of the governmental functions are involved in the usage of AI solutions, from public services to economic affairs and public order
- More than one-third of the use cases (38%) are implemented and in use in daily government operations

While acknowledging the limitations of the study, it is possible to state that AI is now a more mature technology. Hence there is the need to keep moving the research forward, identifying new trends, new possible applications, and new, more sophisticated techniques. On the other hand, some applications are already affecting daily government operations, and in future will affect them much more. This is simply following the trend in the usage of AI in wider society, where AI solutions are now everywhere (a simple example is the number of AI systems in every mobile phone). This trend is already prompting some evident changes in governmental structures, for example with the creation of a data science team or department that is separate from the ICT one (as described more fully below).

At the same time, the diffusion and uptake of AI is clearly not even among all public administrations. It is of paramount importance that the opportunities of AI are available to all public administrations when relevant to their tasks, no matter the country or the administrative level in which they are operating.

Public organisations should start considering AI not only as a research and innovation area but also as a set of solid and available technologies for improving the administrative machine. Moreover, they should start preparing themselves for a diffuse and common usage of AI in all public sector areas

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Moreover, researchers and practitioners are starting to undertake sectorial research, narrowing down the concept of AI and its application in the public sector, which is becoming broad, and embraces a lot of variety in the types of technology and the areas of application. For example, some studies focused on a specific AI technology, like Natural Language Processing (Barthélemy et al., 2022) or on a specific solution, like chatbots (Androutsopoulou et al., 2019; Aoki, 2020). It appears that these different types of technologies and/or application areas come with additional specific requirements and considerations on which "general" findings on AI may not always be applicable.

6.2. AI skills: what is needed

One of the first elements that appear from our analysis is a large reflection about the skills needed for developing an AI system and how to acquire them. This is widely recognised in the national strategies as most of them have specific actions in this direction. However, thanks also to the case studies, it is possible to start detailing which skills are needed and from whom.

First, obviously, technical, data science, skills are needed for the development of a project. However, nowadays this seems not to be the main challenge for the public sector. Public organisations seem to have identified various ways for developing a project from a technical perspective, from having an internal team to the externalisation of the development phase. However, from the cases, it seems quite clear that **public organisations cannot completely rely on external competences** (see also Kupi, Jankin, & Hammerschmid, (2022)). In fact, even if the system is developed by third parties there is a need for having someone within the organisation that can understand and direct the development or adjust the system to its needs. Moreover, procurement tenders and calls need to be properly written and monitored, ensuring that the supplier develops the required solution, both in terms of functionalities and ethical and transparency requirements. Finally a basic knowledge on AI is also needed for ensuring and transmitting the trustworthiness of the solution in front of citizens and other stakeholders.

It is clear that the AI-related skills for public administration are diverse and go beyond mere technical qualifications. There is room to study more in-depth what AI-related skills and competences are needed within public administration, but also to identify which skills are currently present, which are lacking, and what can be done to overcome these gaps.

Public organisations should ensure the presence of in-house knowledge on AI, for the – partial or complete – internal development of the solution, for the direction and adjustment of the system developed by external suppliers and/or for ensuring proper management of procurement activities

In fact, the research team identified that these skills are important beyond the initiation of AI in government. Public organisations might start considering general and elementary knowledge on AI as a basic knowledge for all their employees, or at least for all the employees that deal with a system that uses AI techniques. Algorithms are biased and this might lead to wrong suggestions – if not decisions – that require correcting when they occur. Hence public employees should have a general understanding of this concept to be able to act properly in a new routine based on the information given by an algorithm. They should be able to challenge the system, understand in which situation the system does not work properly, and be able to act accordingly. Of course, this responsibility cannot be fully in the hands of public employees, which is why legislation is needed (e.g. the AI Act) and structured mitigation measures should be put in place.

Public organisations should start considering AI as a technology that will affect the daily routines of most employees, hence start thinking about the wide diffusion of basic knowledge on how the algorithm works and how to deal with systems that use AI techniques

6.3. External collaborations: universities, start-ups and large-cap companies

The public sector cannot face the transformation relying solely on internal workforces. How to best cooperate and with whom remains an interesting topic that requires further investigation. From the strategy, analysis is clear that Member States are aware of this, as most of them included some form of partnership with academia and/or the private sector in their strategies. This element has been widely discussed in the aforementioned previous policy report (Manzoni et al., 2022) where an entire area of recommendation highlights the need to “Build a shared and interactive digital ecosystem”.

From our little piece of qualitative work, we observed that there is not a predefined recipe. While at the opposite the selection of the proper partner or partners for the specific project in the predetermined context is and should be a topic to carefully consider. This also depends on the type and degree of innovation in the specific AI involved. The selection of the partner and also the proper balance between internal and external development should all be carefully considered. Relying on external partners means do not generate internal knowledge and in some cases is dependent on the suppliers, but on the other hand, it gives access to capacity and skills not available internally.

Given that most likely public organisations would need support for developing an AI system, they should carefully select the proper partner(s) and/or suppliers and balance internal and external development

In particular, the research team observed interesting partnerships with academia from the national strategies and the cases collected and analysed. The national strategies mentioned several times that the public sector should strengthen its collaboration with academia and research centres. Several of the cases analysed in-depth in Chapter 5 have open collaborations with universities. From the perspective of the development of AI solutions, academia guarantees a high degree of flexibility and a more positive attitude to experiment. Moreover, it guarantees the forefront technical knowledge on AI techniques. From this perspective, standing long-term robust partnership with academia can support public organisations in attracting young talent, especially in technical subjects where the public sector is facing important challenges, given the high demand and competition and the low attractiveness of the public sector with respect to private companies. As mentioned above the public sector needs to consider the acquisition of in-house data-science capabilities and collaboration with academia is fundamental in this direction. The analysed case of Amsterdam can be considered an example of best practice as it demonstrates the positive results on talent acquisition thanks to the collaboration with academia.

Of course, there are other types of collaborations. For instance, cooperation with start-ups is extremely relevant as it fosters the so-called GovTech ecosystem (Kuziemski et al., 2022; Mergel et al., 2022). Regarding this, public administrations should be aware that the spread of AI is also bringing standard AI products offered by medium or large-cap companies to the market (for example chatbots, OCR or speech-to-text systems). This opportunity should be carefully considered as it might fulfil certain needs better than tailored solutions. Moreover, this trend might be expected to be even more evident in the future.

Another interesting insight on this is the balance between pre-trained systems developed by third parties or raw systems that need to be trained. Pre-trained systems are faster to implement but are likely to be trained with data not completely overlapping with what is at disposal of the administrations, so they might be more inaccurate. An example here might be the use of AI systems for all sorts of computer vision systems, like OCR. There are plenty of OCR pre-trained systems available, including in open-source, but public organisations should evaluate the accuracy of those systems in their specific context where, for example, the written language has unique and peculiar characteristics.

In this context, a proper and accurate procurement process is extremely relevant. This element is not directly touched by this report but has been carefully analysed by different researchers within and outside the European Commission (see for example the recent report on GovTech dynamics (Mergel et al., 2022)). Moreover, public procurement is the focus of the Adopt AI programme, an initiative that aims to support the public procurement of AI and the change of public procurement processes by assisting Member States in overcoming common challenges. The AI4CITIES project also supports local administrations in deploying innovative public procurement techniques to access AI in various policy domains.

6.4. AI-related risks: assessment and mitigation measures

A large part of the discussion around AI and the peculiarities related to AI implementation involves its risks. This becomes crucial in the public sector where, given its nature, unfair behaviours are unacceptable. Hence before starting the development of an AI project it is necessary to assess an AI project for its full compliance with EU public values like equality, non-discrimination, and transparency. These requirements are independent from any legislation and must be applied to any AI system. **Public administration is expected to be at the forefront**

with regards to a trustworthy and human-centric use of AI. Continuing with the narrative that AI is expected to become more and more widespread and extensively used, the public sector should start structuring a well-defined process for ensuring its fair and non-discriminatory use. Some countries already reflect this aspect in their national strategies. Moreover, some organisations already defined some sort of guidelines or checklist for assessing AI projects, and this process is expected to accelerate soon.

Given the risks, proper mitigation measures should be put in place. The case studies described in Chapter 5 reported some concrete examples in this direction, even though more research is needed to better understand and theorise AI risk mitigation. Transparency and explainability of algorithms and human oversight are probably the most discussed and applied mitigation measures, even though the spectrum of necessary measures is broader. For example, an extremely relevant discussion is the fair collection and reuse of data: understanding which data can be collected and which can be reused to train the machine is now one of the main concerns of public organisations dealing with AI.

Risks should be systematically assessed with a structured and well-defined procedure, avoiding any form of discriminatory and unfair use of the AI system. Proper mitigation measures should be identified for ensuring a human-centric use of AI. This needs to become a routine for public organisations

The AI ACT will allow a forward step to be taken, providing the framework for evaluating and classifying the systems based on their risk, and so fostering equal treatment in all countries and all sectors. By definition, the AI ACT will affect also the public sector. Based on our rough estimation, around 30-35% of AI cases in the public sector might fall under the high-risk category. This is not surprising as the public sector *per se* is one where several services and operations are dealing with people's lives, from health to social assistance. But this result implies that the level of attention should be high even before the effective application of the new legislation, also because – especially for the public sector – *in primis* it is not a law that has to determine the level of attention on values such as fairness and trustworthiness. On the other hand, the riskiness of AI should not be considered as a deterrent for using it in the management and delivery of public services. In fact, the data demonstrate that it is extremely rare for the level of risk of an AI system to be "unacceptable", and furthermore both the in-depth cases analysed, and the information collected from the large inventory support the evidence that AI can radically improve efficiency and effectiveness. Not using AI technologies to improve the functioning of public administrations could also be considered a risk, because resource constraints, time delays or the lack of personal care may also cause risks to citizens.

6.5. Organisational interventions: from tasks to cultural changes

Several elements collected through this research allow us to state that AI is making a rethinking of organisational practices necessary. "Intelligent" systems are a new class of agents within organisations, as they do not follow simple if-then logic but are instead agents that are capable of a sort of learning and training process. Hence the organisational lens is becoming extremely relevant.

The first important step is the creation of awareness within the organisation. Several national strategies are moving in this direction. Public managers should be aware of what AI is and what to expect from an AI system, while employees should enter into the mindset that under certain conditions a system can fail, can be biased, and make wrong decisions or propose wrong suggestions. This is above all a cultural change in the way humans see and interact with digital systems.

A **second interesting element is that AI requires in-depth domain knowledge in order to be trained**. Consequently, the development of an AI system requires an effort from domain specialists that needs to be allocated to the training and maintenance of the system. This element was evident in all the in-depth cases where there was always an involvement of employees with domain knowledge - from the people collecting the rubbish on the street that supported the classification of images, to the specialists in unemployment risks for assessing and improving the scoring algorithm. Therefore there should be an investigation of AI requiring humans to be accurate along side the narrative of AI replacing humans. This becomes even more relevant when the system is moving beyond the pilot phase. Maintenance and continuous training and performance evaluation of the system are tasks that need the involvement of domain specialists.

Moreover, all the aforementioned elements related to risk assessment and mitigation measures required a new task allocation and in certain cases also the creation of new public bodies or new positions within the organisations, as is also noted in some of the national strategies.

Public organisations should be aware that the technical effort for coding an AI system is only a –small– portion of the effort needed. Introducing an AI solution requires a general awareness of AI but also new task allocation and, when needed, new roles and positions within the organisation

7. Conclusions

The report aims at offering an overview on the adoption of AI by the public sector, collecting and analysing data from **(i) the national strategies, (ii) an inventory of use cases, and (iii) in-depth case studies**. The report offers a novel and fresh view, adding new insights in the existing body of knowledge on the topic mainly moving from a more theoretical and anecdotal outlook on AI in the public sector to a more systematic analysis.

To our knowledge, the database of **686** cases collected and here analysed is the only attempt of a large inventory of cases now available at the European level. It was the result of a collective effort of the AI Watch team during the whole duration of the project. The cases are also available in Open Data, and they represent one of the legacies of the research for any researcher or policymaker that wish to deep-dive, refine or integrate the analysis. In fact, more than a result, the database aims at being the starting point that can foster further analysis on the topic.

The introduction of the AI Act regulation is very important and precious to give to framing cases about the adoption of AI also in the public sector and it does not block or prohibit any of the AI-based solutions that have been implemented or are in development collected and analysed by the research.

In this direction, the research teams selected 8 cases for an in-depth analysis, with the idea of collecting on-filed experiences, challenges, barriers to and risks of AI development. The cases have been analysed in Chapter 5 but also described individually in dedicated sheets attached to this report. The idea behind this analysis is to collect and share practices that can support and inspire other public organisations in implementing AI. Given the current diffusion of AI in the public sector, sharing concrete practices is becoming extremely important. The 8 cases should be considered the first step in this direction that needs to be integrated with further research.

The analysis allows the research team to draw some policy recommendations, mainly at the organisational level. Those recommendations need to be considered as a partial view that complements the more complete overview of policy recommendations published in the dedicated report "Road to the adoption of AI by the public sector" (Manzoni et al., 2022). Compared with the other report, the current recommendations offer suggestions that addressed mainly public officials that aims at developing and using AI solutions within the organisations.

Several next steps can be listed starting from these analyses. The times are now mature to start considering AI not only as an extremely innovative set of technologies but also as a common practice diffused in the public sector, like in any other sector. **In this direction, research should keep collecting and analysing practices, fostering a sharing of experience among public organisations that this research only started**. There is a gap in the current body of research that needs to be filled. Moreover, more attention should be paid to the sustainable implementation of AI in daily operations, hence on how AI is changing organisational practices, tasks, processes and approaches.

This also requires a focus on AI risks and mitigation measures. Algorithm biases might bring unfair systems, inequality or discrimination that are unacceptable, especially in the public sector. Hence, mitigation measures need to be put in place. Despite that, scan research is dealing with this topic, listing, identifying but also theorising practices and attentions to deal with this new set of technologies. Some anecdotal evidence has been collected through the case studies, but further research in this direction is needed.

Finally, **the classification of AI cases is confirmed to be a challenging task**. This report makes the first attempt in this direction proposing a taxonomy that derived as much as possible from previous literature, but that has been also refined and integrated where the existing body of knowledge was not considered exhaustive for the analysis. Another important step in this direction has been done by OECD, with the OECD.AI Policy Observatory. Further research and community building should be undertaken to ensure sets and common taxonomies more stable and standardised.

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