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Science for Policy Report

AI Watch
Artificial Intelligence in public services

Overview of the use and impact of AI in public services in the EU

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Joint Research Centre

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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' COM(2018)237. The aims of the European AI strategy announced in the communication are:

- To boost the EU'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
- To ensure an appropriate ethical and legal framework.

Subsequently, in December 2018, the European Commission and the Member States published a 'Coordinated Plan on Artificial Intelligence', COM(2018)795, on the development of AI in the EU. The Coordinated Plan mentions the role of AI Watch to monitor its implementation.

AI Watch monitors 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 (https://ec.europa.eu/knowledge4policy/ai-watch_en).

From AI Watch in-depth analyses, we will be able to understand better European Union's areas of strength and 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 CONNECT).

This report addresses the following objectives of AI Watch:

- To provide an overview and analysis of the use and impact of AI in public services.

As part of this objective, this report presents the analysis of the current landscape of AI use in public services in the EU as a result of data gathering and survey of EU Member States, and identifies most promising public services using AI. It also presents the proposed approach for prioritisation of areas of focus of the analysis, discussing opportunities, threats, key enablers and barriers for implementation, by looking at relevant examples and available practices, as well as a review of the National AI strategies focus on the public sector.

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For the insights provided at the 1st AI Watch Peer Learning Workshop on AI use and impact in public services that took place in Brussels on 11-12 February 2020, we are very appreciative to all the almost 60 participants, including representatives of Government from about 20 Member States and colleagues of various Commission's Services and experts from academia and research centres, Civil Society Organisations and Industry.

The colleagues of the Department of Design of the Politecnico di Milano, Alessandro Deserti and Francesca Rizzo, who facilitated the design-thinking sessions, as well as Marzia Mortati and Ilaria Mariani who provided assistance in the graphic visualisation for the workshop and this report deserve also a special mention.

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Executive summary

- 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 as part of the Coordinated Plan on the Development and Use of AI Made in Europe.
- As part of the AI Watch, the role of AI for the public sector is addressed and the present study is set out to provide an **Overview and analysis of the use and impact of AI in Public Services**. The main goal of this activity is to gather information on EU Member States' initiatives on the use of AI in public services and develop a methodology to identify risks and opportunities, drivers and barriers of the use AI in public services.
- This report presents the **results of the first exploratory mapping of the use of AI in public services in the EU**, which contributes to landscaping the current state of the art in the field, and provides an overview of Member States efforts to adopt AI-enabled innovations in their government operations.
- As demonstrated by an emergent body of literature and the nascent applications in the public sector, there is **growing interest in the use of AI to support re-design of internal service delivery processes and policy-making mechanisms, to improve quality and engagement with citizens**.
- Indeed, **when used in a responsible way, the combination of new, large data sources with advanced machine learning algorithms can radically improve the operating methods of the public sector**, thus paving the way to pro-active public service delivery models and relieving resource constrained organisations from mundane and repetitive tasks.
- However, **there seems to be an imbalance between the transformative potential and the effective adoption and use of AI solutions in government**, and there is little evidence of the social and economic impacts achieved so far, in part due to the limited attention given to research on AI use in the public sector.
- This study therefore aims to shed lights on the actual use of AI technologies in the public sector, providing **a review of AI adoption in public services in all 27 EU Member States, as well as Norway, Switzerland and UK**, and building a first inventory of 230 cases that represents an unique reservoir of knowledge, from which to extract indications, emerging trends, and illustrative examples of current AI usage.
- Overall, **the analysis of the initiatives included in our mapping shows a wide range of AI typologies and use purposes, as well as of government functions and policy areas in which AI solutions are being implemented**. This evidence will serve as a possible baseline for further analyses and to promote the use of AI in the European public sector, by either co-developing new joint solutions or sharing successful practices from other administrations.
- The mapping results are globally confirmed by the findings of a Survey to Member States and a specific reflection conducted on current data and AI governance landscape, leading to conclude that **governments should see the governance of AI as an extension of existing regulatory tools**. Existing guidelines are often considered adequate to limit the unintended and unwanted consequences of AI deployment, however some additional evidence from the playground could bring to revise such diffused perspective.
- In this regard, **findings from some of the illustrative case studies analysed confirm that ethical and societal implications of AI adoption should be a matter of high concern for regulators**, as predicated by the policy documents recently delivered at EU and national levels.
- In this perspective, **whereas the expectations from the use of AI in government are high, positive impact is far from straightforward and should not be taken for granted**. A lesson learned from our analysis is to bear in mind that while small-scale pilot studies or experiments might be successful and the promises in case of broader adoption encouraging, providing significant efforts to ensure larger scale usage of AI inside the public sector may not be enough to accomplish the ultimate goal of sustainable take-up.
- In line with the overall scope of the AI Watch, this study has also carried out a **review of the AI national strategies of EU Member States, to assess the focus on public sector**, and showing that **most countries are taking several actions to stimulate the use of AI in their public services**. Many national AI strategies include a requirement for experimental projects to learn by doing and sharing experiences. Some strategies mention special funding programmes to provide financial resources to promote AI projects in government or to assist start-ups in developing GovTech solutions for the public sector.

- To address the **need of better understanding the positive and negative consequences of AI use in public services**, our research outlines a proposal for developing an original methodological framework for impact assessment that lays the foundations to support a future road-mapping of AI in public services throughout EU Member States at different levels of governance according to a **public-value perspective**.
- As illustrated by the findings of our analysis, **the scope, goals and practices of public sector use of AI are much diverse**: to make an example, an automated decision system to grant protection to asylum seekers is a task of a far higher delicacy and complexity than increasing the use of digital public services through predictive analytics. Thus it seems more practical to gear future thinking towards high-potential impact applications that may have consequences of particular relevance for the populations they target.
- Taking into consideration the complexity of innovation adoption in the public sector, **the approach proposed aims to define the contextual and individual factors that are crucial for assessing AI applications**, allowing for comparing *ex-ante* and *ex-post* impacts resulting from the introduction of AI.
- Clearly this is only the starting point of a learning journey, which requires an iterative approach, involving relevant stakeholders and Member States. In particular, **further 'deep dives' at country level through case studies and thematic analyses are needed to test and validate the proposed framework**, while gathering insights and recommendations for further extending it.
- In terms of policy implications, this exploratory research has demonstrated the increasing importance given to AI for the public sector, and the **recognition of the role of government as a crucial player in the design of the regulatory frameworks and tools for the governance 'with and of' AI**.
- Whereas **AI development and adoption is a cornerstone of the new Digital Strategy to shape the future of Europe**, there are differences between the Member States with regard to the variety of actions mentioned in the national documents, and the extent in which they may develop specific 'policy instruments'.
- In this respect, **there is a need to take a closer look at successful cases of AI implementation and learn from best practices to help further scaling out of AI solutions among Member States**. Elaborating on what works and what does not work is crucial to move the debate forward on the positive contribution of AI to public service delivery and the risks that may actually threaten the quality of services.
- **This effort resonates well with the Policy and investment recommendations for trustworthy AI developed by the High Level Expert Group on AI**. The document underlines in fact that '*AI has the potential to play a significant role in improving the quality and efficiency of public services*', and suggests giving to Europe's Public Sector the role of acting as a catalyst of sustainable growth and innovation.
- **The evidence gathered in this report confirms the need to focus on human-centric AI and the opportunity of approaching Member States' public administrations as a single platform**. This may be a real game changer, in our opinion, contributing to place the EU as a leading actor at the global level.
- The joint endorsement of statements of principle, however, is only **a first step in the direction of a common approach to benefit and cost sharing across different levels of government**, grounded on a reuse logic and huge investments in capacity building of prospective inside users of these innovation.
- This leads us to an important recommendation, related to **the use of innovative public procurement to stimulate and speed up AI adoption**, an activity that is likely to further extend the appropriateness and cost effectiveness of AI take-up in government, meeting the expectations of increasingly proactive service providers and policy designers to the changing global landscape, made more complicated by the Covid-19.
- **Future research should therefore go more in-depth to increase our understanding of the conditions for AI solutions to be implemented in public services and supported by coherent policy actions**. This will require gaining more information about the scope, depth, amount of resources and effects of such actions, also addressing questions of AI governance in different contexts, and providing suggestions on how to best coordinate the efforts of policy-makers and regulators within the data/algorithm sphere.
- **The insights gained from these in-depth studies will contribute to design a proposal of a framework for the use of AI in public services**, defining guidelines and a generic implementation roadmap, based on best practices and the analysis of re-use potential of AI based systems and solutions, identifying opportunities for collaboration among relevant stakeholders from various sectors.

1 Introduction

1.1 Background

Rapid advances in computing power, the increasing availability of data and of new algorithms, have recently led to major breakthroughs in the field of **Artificial Intelligence (AI)**[1] and let emerge the great potential of this 'new set of technologies' to transform our societies and economic systems, becoming one of the most important technologies of the century for citizens, industry and governments alike.

The potential benefits of AI technologies are massive, but risks must also be governed while democratic values and human rights respected. For this reason, 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. To this end, building on the declaration of cooperation on AI adopted by all EU Member States, Norway and Switzerland on 10 April 2018, the **Communication 'Artificial Intelligence for Europe'** of 25 April 2018[2] proposed a strategy on AI for Europe, which has been endorsed by the European Council in June 2018.

Further, the **Coordinated Plan on the Development and Use of Artificial Intelligence Made in Europe** was adopted in December 2018[3], to develop joint actions for closer and more efficient cooperation between Member States, Norway, Switzerland and the European Commission in four key areas: increasing investment, making more data available, fostering talent and ensuring trust.

The overall goal is for the EU to become the world-leading region in developing and deploying cutting-edge, ethical and secure AI, promoting a human-centric approach at global level. The Coordinated Plan provides a strategic framework for Europe and encourages all Member States to develop their **national AI strategies**. These are expected to outline investment targets and implementation measures, while adopting common indicators to monitor and analyse the success rate of the strategies in place. This effort is supported by the establishment of the **AI Watch**[4], the European Commission knowledge service to monitor the development, uptake and impact of AI for Europe., jointly implemented by DG CNECT and the Joint Research Centre.

As part of the AI Watch, the potential of **AI for the public sector**[5] is analysed through an extended overview of the use and impact of AI in Public Services, gathering information on EU Member States' ongoing initiatives and developing a methodology to identify risks and opportunities, drivers and barriers of the use AI in public services.

The role of the public sector in both exploiting - as 'user' - the potential of AI, but also - as 'regulator' – setting out the rules and policy directions for developing ethical AI has been further recognised in the EU 'Digital Package' launched on 19th February 2020, which includes the Communication on **Shaping Europe's Digital Future** [COM(2020) 67 final][6] and a combined set of policy documents to substantiate the proposed strategy.

Whereas the Digital Strategy underlines that promoting the digital transformation of public administrations throughout Europe is crucial to make sure 'technology works for the people', the **European Strategy for Data** [COM(2020) 66 final][7] emphasises that *'Europe aims to capture the benefits of better use of data, including greater productivity and competitive markets, but also improvements in health and well-being, environment, transparent governance and convenient public services*'. At the same time, it underscores that '*public policy can increase demand for data-enabled offerings, both by increasing the public sector's own ability to employ data for decision-making and public services and by updating regulation and sectoral policies to reflect the opportunities provided by data and ensure that they do not maintain disincentives for productive data use'.*

In this perspective, the **White paper on Artificial Intelligence - A European approach to excellence and trust** [COM(2020) 65 final][8] goes further to include a section on *Promoting the adoption of AI by the public sector*, where it is mentioned that '*it is essential that public administrations, hospitals, utility and transport services, financial supervisors, and other areas of public interest rapidly begin to deploy products and services that rely on AI in their activities*', '*with a specific focus in the area of healthcare and transport'*.

[1] For the definition of AI see the JRC Report of January 2020, 'AI Watch - Defining Artificial Intelligence'.
[2] https://ec.europa.eu/digital-single-market/en/news/eu-member-states-sign-cooperate-artificial-intelligence
[3] COM(2018) 237 final - Brussels, 25.04.2018
[4] https://ec.europa.eu/knowledge4policy/ai-watch_en
[5] https://ec.europa.eu/knowledge4policy/ai-watch/topic/ai-public-sector_en
[6] https://ec.europa.eu/info/publications/communication-shaping-europes-digital-future_en
[7] https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1582551099377&uri=CELEX:52020DC0066
[8] https://ec.europa.eu/info/publications/white-paper-artificial-intelligence-european-approach-excellence-and-trust_en

It is exactly around this dual dimension of **governance 'with and of' AI** that this study on the use and impact of AI in public services revolves. On the one side, it is important to explore and assess the effective use and value added of AI to redesign internal government operations and public services to better serve the citizens and businesses and enhance quality and impact of services, as well as create public private partnerships that help define the future shape of the 'digital market' in the EU and at a global level. On the other side, it is also crucial to better understand the potential benefits and risks of the use of AI in the public sector, and the governance mechanisms and regulatory frameworks needed to safeguard human rights and the ethical deployment of AI, especially in sensitive policy areas and domains of public interest that have direct and stringent implications on the trust-relationship between governments and citizens.

1.2 Objectives

Although many of the methodological developments in AI date back to more than 50 years ago, the reason why we now pay so much attention to AI in general and machine learning (ML) in particular is that the many applications embedding AI technologies have started to enter into our everyday lives, from machine translations of texts, to image recognition and music generation, and are increasingly being exploited in industry, commerce and ultimately government.[9]

AI in fact can contribute to better public services in a variety of ways, for example by enabling smarter analytical capabilities and better understanding of real-time processes, and deliver shorter and richer feedback loops for all levels of governance. The opportunities are many, in some cases not even foreseen. For instance, AI can enable doctors to improve diagnoses and develop therapies for diseases for which none exist yet; it can reduce energy consumption by optimising uses; it can contribute to a greener agriculture by lessening the need for pesticides; it can help improve weather predictions and anticipate disasters; and so on.

The list of possible applications is endless and is expected to bring solutions to many societal challenges, while at the same time introducing new directions of economic development. However, it is fair to admit that while the scope and potential of AI outside the public sector are quite clear and compelling, the same cannot be said for government and governance related applications. For this reason the AI Watch aims to provide an **Overview and analysis of the use and impact of AI in Public Services**.

The key objectives of this service are as follows:

1. To gather information on EU Member States' initiatives on the use of AI in public services;
2. To develop a methodology proposal to identify risks and opportunities, drivers and barriers of the use AI in public service provision and how to assess their impacts;
3. To define guidelines and a generic implementation roadmap for AI in public services.

As a result of these activities an **overview of the use and added value of AI tools supporting public service delivery** will be provided, looking at the most relevant examples in prioritized public services. Further, the analysis will develop a **framework to assess social and economic impacts of AI use in public services**, and will draw up recommendations for further development of AI-based systems and solutions in government. In doing so it will propose a **roadmap for the use of AI in public services**, based on best practices of the analysis of the re-use potential of AI-based systems and solutions, also identifying opportunities for collaboration among relevant stakeholders from various sectors.

This report presents the results of the first-year activities of the AI Watch in the area of AI for public sector. To this end, after this introduction comprising a brief overview of objectives and methodological approach (**Section 1**) the report is structured as follows: **Section 2** discusses the main findings of the landscaping of AI in public services in the EU, with a review of the literature and results of the mapping of AI use in the EU. This also integrates the insights from a Survey of EU Member States conducted in January 2020 and the knowledge gathered at the 1st Peer Learning Workshop of February 2020; **Section 3** provides illustrative examples and case studies of the use of AI in public services in the EU, focusing on priority services and AI governance aspects; this is followed by a review of the National AI strategies focusing on public sector (**Section 4**); **Section 5** outlines the rationale and approach for developing a framework to assess the social and economic impacts of AI use in public services. **Section 6** concludes with an overview of key findings, and a discussion on implications for policy and future research directions.

[9] For a complete review on the evolution and state of the art of AI see: JRC Flagship Report 2018 on Artificial Intelligence – A European Perspective, Annoni A., et al, (Craglia, M., Ed.) - https://ec.europa.eu/jrc/en/publication/artificial-intelligence-european-perspective

1.3 Methodology

The methodological approach followed to achieve the objectives of AI Watch is based on desk research, conceptualisation work, expert consultation within JRC and other EC services, industry, academia, think tanks, national and sub-national government representatives through workshops, focus groups, interviews with leading stakeholders, in-depth case studies, as well as impact modelling and simulation.

In particular, this report of the AI Watch delves into the following three main activities:

1) Exploratory research and landscaping of the use of AI in support of public services in EU Member States through mapping and case studies;
2) Proposal of a methodological framework for social and economic impact assessment, after the identification of the most promising public services using AI;
3) Design of a generic implementation roadmap for the use of AI in public services, with guidelines and evidence based recommendations.

1.3.1 Mapping and case studies of AI use in public services

Following the inception phase of the research, which defined the approach to be followed, an **exploratory analysis to identify the main challenges for the use of AI in the public sector** was conducted. The review of the evolving context of AI in the public sector allowed the research team to identify emerging strategies and practices across EU Member States so as to learn from concrete experiences of deployment of AI in public services. This resulted in the collection of information on **230 initiatives** of AI use in EU Member States, and an analysis of their main characteristics, technological dimensions and value drivers.

Building on this preliminary analysis, a number of **case studies were selected and investigated by looking at promising initiatives in priority areas**, such as agriculture, social services, healthcare, mobility and transport, as well as public administration in general. This included also a focus on AI and data governance, with specific case studies in different legal and administrative jurisdictions.

In parallel to this activity, an in-depth review of scientific and grey literature has been conducted, complemented by a **policy analysis of National Strategies of EU Member States with a specific focus on the use of AI in the public sector**, examining the strategic documents officially adopted by the end of 2019, particularly those of countries that are considered in the vanguard or are developing promising or innovative approaches.

After this preliminary overview, and with the aim of defining a common approach to data gathering, and identifying initiatives in priority public service areas, an **initial survey on the use and impact of AI in public services in EU Member States** was designed. Following an internal review and consultation with experts, the survey was launched in January 2020. The aim was to gather detailed information on all EU Member States' initiatives on the use of AI in public services and to provide an overview of the use and added value of AI tools supporting public service delivery by examining the most relevant examples in prioritized public services.

To this end, the way proposed in approaching AI in the delivery of public services is to better understand them as comprising three large categories, namely: government-to-government applications (or G2G uses of AI in applications within and between public administrations at different levels and for their own operations), government-to-business (or G2B uses of AI applications for the delivery of public services to businesses) and government-to-citizen (or G2C uses of AI applications aimed at delivering public services to citizens). Our research has thus built **a set of relevant illustrative examples and available practices** to support identifying most promising public services using AI in EU Member States, including through a review of the focus on the public sector of National AI Strategies officially adopted by Member States and available in English.

1.3.2 Developing a methodology proposal for impact assessment of AI in public services

Following internal discussions during the inception phase of the research, an **analysis of the state of the art** with regard to possible approaches to assess impact of AI was conducted. This included a literature and policy review, and the identification of main research gaps, theoretical frameworks and practical use cases.

As a result of this preliminary review, a first outline of a conceptual framework to assess the social and economic impacts of AI in public services has been developed. This is rooted in a 'public value perspective' to allow flexibility in the research approach, while providing rigorous assessments of the delivery of the expected effects of AI.

The research, in fact, revealed the need to have a better understanding of **what typology of AI is being used** and how it is possible to develop and adopt the different 'set of technologies' considered as AI in the public sector, what are the legal and ethical dimensions influencing both perceptions and use of AI in public services, and what are the existing organisational practices of the administrations using AI. Thus the proposed framework takes into consideration the **complexity of the adoption of digital technologies in general - and AI in particular** - in public administrations and the response to their introduction by civil servants and citizens alike. It follows the established understanding that AI does not have an impact on its own, but enables changes leading to impacts, which are also influenced by end users' response.

The analysis also identified the **need of further research on the broader social and economic impacts of AI in public services**, aiming at *ex-ante* and *ex-post* analyses of AI adoption and implementation, rather than focusing narrowly on technical characteristics *per-se*. This requires defining relevant social and economic indicators, being representative of the context in which AI is embedded and integrating in the analysis other direct and indirect factors that are also influencing impact.

For this purpose, a suitable **framework to assess potential social and economic impacts of the use of AI to support public services** was proposed, together with an analysis of the opportunities, threats, key enablers and barriers to implementation emerging from its application to a selected number of case studies. The results of the framework application will be discussed with Member States for further implementation.

1.3.3 Stakeholders engagement, peer learning and road-mapping AI in the public sector

The ultimate goal of this activity of the AI Watch is to **propose the development of a basic framework for the assessment of AI use in public services**, with guidelines and a generic implementation roadmap, based on best practices and the results of the analysis of the re-use potential of AI systems and solutions that could be further developed through piloting of joint initiatives across Member States in the European Union.

To this end, the research activities carried out so far have been reflecting on the technological, legal, economic and social implications derived specifically from the use of AI as well as the barriers that may prevent the full exploitation of the AI potential in the public sector. This analysis will serve to further substantiate the **design of the proposed roadmap for AI adoption in public services within the EU**.

To achieve this objective, a crucial aspect to consider for developing a roadmap that would combine scientific rigour with practical application potential and policy-relevance, is how to **engage with relevant networks of experts and stakeholders**, as well as access strategic partners, including Member States, at both policy and technical levels.

For this purpose, and in agreement with DG CONNECT and the AI Watch Steering Group, consisting of members nominated by the Member States Group on AI & Digital Europe Industry (DEI) (also known as the 'AI Sherpa Group'), it has been decided to involve actively the Member States representatives through the **'eGovernment Action Plan Steering Board'**. To this end, a presentation to the 10th Meeting of the eGovernment Action Plan Steering Board on 21st June 2019 marked the beginning of the engagement with Member States, which is crucial to gather information that would not be possible to collect otherwise and have first-hand knowledge of processes and impact creation, as well as identifying suitable case studies for in-depth qualitative and quantitative analyses.

Therefore, jointly with CONNECT/H4, a **Peer-Learning process with and among Member States** has been initiated to facilitate exchange of lessons learned and possibly faster adoption of AI-enabled systems and technological solutions in the public sector. This included building synergies with activities conducted by JRC with DIGIT as part of relevant actions of the ISA^2 Programme (i.e. ELISE and Innovative Public Services), also ensuring complementarities among the various tasks of AI Watch and other research of JRC.

The **1st Workshop on AI use and impact in public services** was organised on 11-12 February 2020 in Brussels, and discussed the preliminary results of the overview of AI in public services and the proposed approach to data gathering and development of the methodological framework for impact assessment.

The **2nd Peer Learning Workshop on AI and data governance** will serve to validate the results of the research, and in particular the proposed methodology for impact assessment and the suggested roadmap for introducing AI in the public sector. To this end the workshop will focus not only on the technological aspects of AI, but also on their implications in terms of quality, fairness and inclusiveness of public services. It will also consider the governance and policy-makers' dilemmas stemming from possible, emerging alternative regulatory mechanisms, ultimately aimed at enhancing transparency, strengthening trust and generating public value.

2 Landscaping AI in public services in the EU

2.1 A journey in an unchartered territory: between myth and reality

As we have mentioned above (see **§1.1**) **Artificial Intelligence (AI) is considered a 'new set of technologies'** which have (re)gained great attention recently among academia, policy makers, businesses and citizens alike. Growth in computing power, availability of data and progress in algorithms, have in fact turned AI into one of the most important technologies of the 21st century. As indicated by the Communication on AI Made in Europe, *'Like the steam engine or electricity in the past, AI is transforming the world'*. However, socio-economic, legal and ethical impacts have to be carefully addressed. Deployed wisely, AI holds the promise of addressing some of the world's most intractable challenges. But the significance of its positive impact is confronted by its potentially destabilising effects on some key aspects of economic and social life.

Public administration plays a vital role in the development and uptake of AI. However, most of the current debate tends to place government either in the role of 'regulatory actor' or at best 'facilitator', i.e. setting out the framework conditions for private actors and citizens to deploy and use AI in an ethical manner. This leaves the alternative role of the public sector as 'first buyer' and direct beneficiary of AI take-up and implementation rather obscure, if not neglected. In other words, **the current policy discourse focuses on the governance 'of' AI, far less on the governance 'with' AI**.

Indeed, under the first respect, the EU Member States have taken a firm direction with the signature, already in 2018, of the **Declaration on Cooperation on AI**, containing the commitment of joining forces and the engagement in a common policy approach, to leverage on the achievements and investments in AI of the European research and business community, while at the same time dealing with related social, economic, ethical and legal issues appropriately. This adds to the intense policy design work at national level, the results of which will be presented later in this publication. Such efforts document the intention of European governments to be the main actors in regulating the use of AI in society and stimulate its development through e.g. a clearer discipline of access to valuable data sets.

However, and mirroring a trend that has fastened its pace in the last 3-5 years in the private sector worldwide, the adoption of AI within public administration processes and internal operations has the potential to provide enormous benefits in terms of improved efficiency and effectiveness of policy making and service delivery to business and citizens, ultimately enhancing their level of satisfaction and trust in the quality of governance and public service. Nevertheless, **the role of government as 'user' of AI technologies has received far less attention than the 'regulator' role in the strategies** – as the analysis presented in **Section 4** will describe further, by looking at the focus on the use of AI for the public sector in the current policy documents of EU Member States.

This imbalance of interests is echoed in the AI research field. As a recent literature review highlights, the focus of research on AI take-up lies - almost exclusively - in the development and applicability of AI in the private sector. Only a very small portion (59 out of 1438) of the articles published between 2000 and 2019 discuss AI for and in the public sector (Desouza et al., 2019). Empirical studies on the use of algorithmic models in policy making processes have been scarce so far, which has limited the academic understanding of the use and the effects of them (Kolkman, 2020). Now, while it is quite likely that the number of publications on AI in government will increase in the near future, this will probably not be enough to fill in the gap with the private sector. Arguably, to ensure that AI provides benefits to all citizens and ensures the public value of its use, there ought to be more attention to its use in the 'business of government', also at academic level.

In fact, many current applications of AI – such as those presented in this report – have been designed to solve a number of problems of e.g. resource allocation, large dataset intelligence, scenario building and prediction, or customer relation management that are typical of both business and government settings (Mehr, 2017). Ultimately, with the progress of take-up, the need will also arise to produce impact assessment models and instruments to examine the consequences of AI adoption in the various policy and service domains and to the respective constituent and beneficiary communities. An exercise in that direction is proposed as part of this research (see **Section 5**).

In this respect, as we will discuss later on, it must be noticed that despite a general understanding of the potential benefits and risks of AI, the term itself is still not clearly defined and often used with different meanings, sometimes also changing over time. For instance, data scientists attach a different meaning to what they refer to as AI than citizens who commonly see it as a tangible technology - e.g. a machine or a robot (Krafft et al., 2019).

Not surprisingly, already the first definition of AI, proposed almost 65 years ago by John McCarthy et al.[10] and which is echoed also in the European Commission's 2018 Communication on AI[11], considered the term both from a technology and an application standpoint. Several definitions have been proposed since then and are currently under discussion, including those advances by the High-Level Expert Group on Artificial Intelligence[12] and the OECD[13], as well as other proposals at national level[14]. Within this context, **an operational definition has been proposed as part of the AI Watch** to provide guidance in researching AI (Samoili et al., 2020).

In this report, for the purpose of the analysis of the use and impact of AI in public service, we consider AI as a 'special form' of ICTs, capable of displaying intelligent behaviour and completing tasks normally said to require human intelligence, and we propose to define its perimeter by the terms Perception, Reasoning and Action, each identifying a (relatively) distinct and separate cluster of research and application strands.[15]

- **Perception** stands for the capacity of an intelligent machine, be it a piece of software or a robot, to understand (give meaning to) the signals coming from the external world - such as images, either still or in motion, and sound, e.g. music or speech. Evidently this strand has been quite successful in its achievements, not only for the business, but also for the consumer market: prominent implementation examples include ambient recognition systems for the unmanned driving of vehicles, virtual assistance (Siri, Cortana, etc.) on computers and smart phones, but also stand-alone speakers (Alexa, Google Home etc.), as well as tune and score identifiers and generators (Shazam, Soundhound, etc.).
- **Reasoning** is probably both the rationale and the unattained (many would say, unattainable) goal of AI development: the goal to replicate/improve a human being's capacity to analyse and draw inferences from the data and information received from the external world. The progress made on this front is epitomized by the performance of IBM's Deep Blue chess playing computer in 1996, when it defeated the world champion Garry Kasparov in game 1 of a 6-game match, but ultimately lost by a score of 2-4 as Kasparov won three and drew two of the following five games.[16] About a quarter of century later, a big gap still exists between expectations and reality, as far as the reasoning capacity of intelligent machines is concerned.[17] This is a very important note, which can be consistently retrieved from the evidence provided in the remainder of this report.
- **Action** is at least as relevant as the other two fronts in the diffusion of AI solutions as 'game changers' in a wide variety of application domains: progress in that direction can be measured both in software industry (examples abound of chatbots and recommendation engines, which have automated first level Q&A within online Customer Relations Management - CRM systems or brought personalised advertising to higher sophistication in suggesting purchasing options based on past behavioural history) and in hardware manufacturing (think of the prosthetic limb technology in medicine and of the limited capacity, yet already available on the mass market, robotized lawn mowers or vacuum cleaners). To this cluster, the recent surge of the 'Industry 4.0' movement should be appended, leading to the proliferation of new and advanced solutions integrating Internet of Things (IoT) with digital technologies – with AI as a prominent part of them – into the robotized and unmanned 'Factory of the Future'.[18]

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[10] John McCarthy et al (1955) Proposal for the Dartmouth Summer Research Project on Artificial Intelligence: '*For the present purpose the artificial intelligence problem is taken to be that of making a machine behave in ways that would be called intelligent if a human were so behaving.*' The suggested topics for study included: 'automatic computers and programs for them; programming computers to use a language; neuron nets; machine self-improvement; classifying abstractions; and two areas (that) (…) would not be part of AI for many years — how to measure the complexity of calculations, and randomness and creativity. http://raysolomonoff.com/dartmouth/dartray.pdf

[11] *'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).* Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions on Artificial Intelligence for Europe, Brussels, 25.4.2018 COM(2018) 237 final .

[12] https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=56341

[13] OECD (2019), Artificial Intelligence in Society, www.oecd.org/going-digital/artificial-intelligence-in-society-eedfee77-en.htm

[14] See for instance the French AI Strategy: https://www.aiforhumanity.fr/pdfs/MissionVillani_Report_ENG-VF.pdf

[15] For an extended list see e.g. https://www.ed.ac.uk/informatics/research/artificial-intelligence-research-edinburgh/strands-ai-research. Incidentally, our definition complies with that used in the 2018 EC Communication on AI [COM(2018) 237 final] – see footnote 11.

[16] Wikipedia (2020) Deep Blue (chess computer). Retrieved 22 March 2020 at: https://en.wikipedia.org/wiki/Deep_Blue_(chess_computer)

[17] Despite the term ''intelligence'' to describe these applications, they frequently do not embody any form of intelligence as humans do as they frequently struggle to distinguish between cause and effects. However, due to their ability to complete (specific) difficult tasks or find insights in large volumes of data, the term intelligence has been associated to them.

[18] On this see for instance 'Factories of the Future', the European Union's €1.15 billion public-private partnership (PPP) for advanced manufacturing research and innovation, which is the EU's main programme for realising the next industrial revolution: materialising Factories 4.0 - https://www.effra.eu/factories-future

Over the past 3-5 years, the perception of an increasing maturity and reliability of AI has led many observers to speak enthusiastically in terms of an upcoming revolution, highlighting the need to fast move towards the implementation of credible business cases for its take-up, particularly in the enterprise market. To a great extent, Google Trends confirm this fastening and widening of interest for AI as a field of study, which has reached the all-time peak of popularity (:100) right in the current months, as the following graph displays.

FIGURE 1 AI INTEREST OVER TIME, WORLDWIDE. SOURCE: TRENDS.GOOGLE.COM

However, as multiple studies have confirmed, the specific AI technologies (not to speak about custom solutions) belonging to the three clusters above are so numerous and diversified that only by narrowing the focus on each of them it becomes possible to assess their actual time to market. This is recognised by the conceptual distinction between three forms of AI: **Artificial Superintelligence, General AI and Narrow AI**.

Artificial Superintelligence refers to a hypothetical situation in the future where technology outperforms human intelligence. This is more present in the realm of science fiction, but researchers and ethicists are already discussing what steps could be taken today to avoid a scenario where AI surpasses the point of ''technological singularity'' and turns against the interests of humankind. **General AI** refers more to ICT systems having similar forms of intelligence as humans, and the debate here is more focused on duplicating the inner workings of the human brain and applying this to a machine. However, just as the superintelligence scenario, General AI is far from being real and might take decades (or longer) to manifest. Finally, **Narrow AI** comprises robotized systems and applications that are considered to be 'intelligent', not because they imitate human behaviour, but more modestly because they are capable of carrying out tasks that would otherwise require human intelligence, effort and time to an unsustainable extent – due to unfavourable environmental conditions for human work or the slow pace at which our brain could perform large scale data analyses.

The focus of this research is set on applications which are currently present in our societies – notably in government and public service – and **considered as part of Narrow AI**, while the other forms are not taken into consideration due to their futuristic nature, impossible to study in a practical or empirical context. However, even with this narrower focus on existing or viable, rather than future or hypothetical solutions, the term remains extremely broad and difficult to operationalise. This is confirmed by a recent overview made as part of the AI Watch, highlighting the large variety of keywords associated with AI as a research theme (Samoili et al., 2020).

Our working definition of AI complies with the proposal from AI Watch[19] and is aligned with that of the OECD AI Policy Observatory[20]. We also build on the recent EU White Paper on AI published in February 2020, which refers succinctly to AI as *'a collection of technologies that combine data, algorithms and computing power'*[21] and on the OECD general reference to AI as *'A machine-based system that can, for a given set of human-defined objectives, make predictions, recommendations or decisions influencing real or virtual environments'*. For the scope of this report, we suggest to consider these proposals in combination with the definition of algorithmic system by the Committee of Experts MSI-AUT in the 2018 Draft Recommendation of the Committee of Ministers to Member States on the human rights impacts of algorithmic systems entitled 'Addressing the impacts of Algorithms on Human Rights': '*Applications that, often using mathematical optimisation techniques, perform one or more tasks such as gathering, combining, cleaning, sorting, classifying and inferring (ed. personal) data, as well as selection, prioritisation, recommendation and decision-making. Relying on one or more algorithms to fulfil their requirements in the settings in which they are applied, algorithmic systems automate activities in a way that allows the creation of adaptive services at scale and in real time.'*[22]

[19] https://ec.europa.eu/knowledge4policy/ai-watch_en
[20] https://oecd.ai
[21] European Union White Paper on Artificial Intelligence – A European approach to excellence and trust, COM(2020) 65 final, https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020_en.pdf
[22] https://rm.coe.int/draft-recommendation-of-the-committee-of-ministers-to-states-on-the-hu/168095eecf

These AI applications have a variety of capabilities already noted as critical by extant literature, which include, but are not limited to:

- **Collecting, processing and analysing information from large numbers of digital images or videos** (Centre for Public Impact, 2017).
- **Interacting with service users or citizens/customers** in a semi-automated manner through chatbots and virtual assistants or **conducting sentiment analyses** based on the interpretation of textual data (Chui et al., 2018; Eggers et al., 2017) supported by Natural Language Processing (NLP) to understand audio and text.
- **Analysing huge volumes of data to make predictions** which are way more comprehensive and accurate and/or support human or automated (e.g. algorithm-based) decisions (Centre for Public Impact, 2017; Eggers et al., 2017) including for the prevention of crime or an enhanced intelligence of future trends in our economies and societies.
- Receiving **case-based guidance** from past experiences as well as **support in the automation of processes and tasks** (both at individual level – think of surgery operations – and at organisational level – such as for monitoring and reporting).

The difficulty of operationalising such high-level definitions is evident, though, even more so when dealing with AI use in the public services. In fact, machine learning techniques or predictive models do not interact *per se* with the world around them but only as embedded in existing software or hardware. Studying the development and use of algorithmic models in the public sector is worthwhile, but only shows a narrow view of the algorithms themselves and not how they are embedded into existing infrastructure and work practices. Further to that, the decision to adopt an AI solution within a public organisation is not a straightforward process, with even more difficulties lying in the use of the AI solution with the end users, be they civil servants or citizens or businesses. There can be indeed a great difference between what developers aim to achieve with their AI and how it is functioning in practice.

To clarify this aspect, **Figure 2** acts as an illustration to highlight the various steps AI innovation must undertake before it is able to provide impact to society. Each of these steps come with their own challenges: high quality data is required before trustworthy and accurate AI models can be developed; adoption of AI solutions requires an innovative mindset; and adoption of AI solutions by the end users will require significant trust and understandability of the results, just to name a few. In this report, the scope lies primarily into the last two steps: the adoption of the organisation (e.g. the testing of pilots of AI or the decision to procure a solution) and the adoption by end users (routine-based use of AI in processes). It does have to be noted that this illustration is a simplification of reality, since in practice many of these processes overlap, interact with each other and are not linear as the figure may suggest.

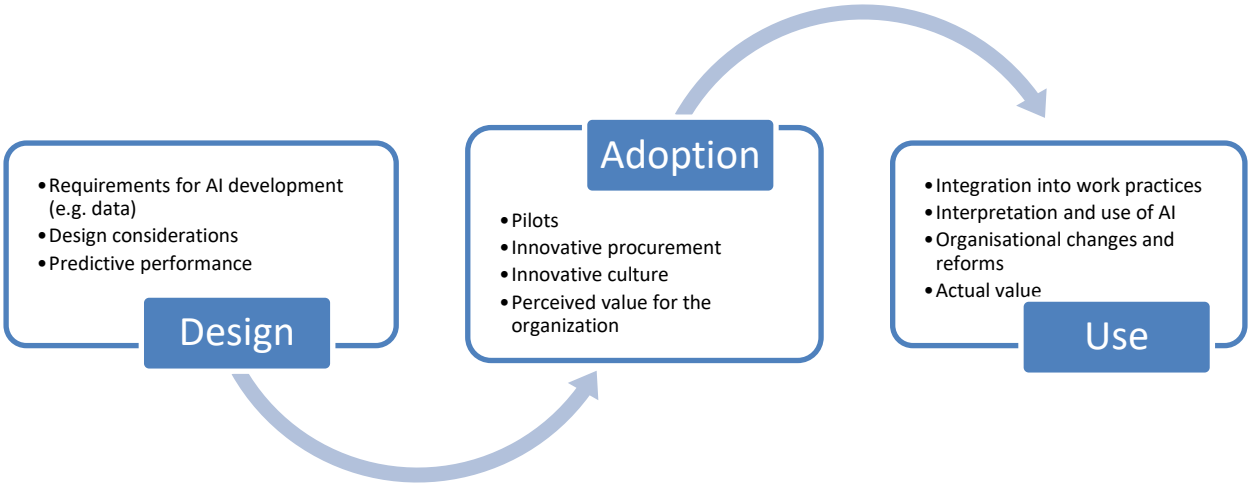

FIGURE 2 AI: FROM DEVELOPMENT TO PRACTICE (AUTHORS OWN ELABORATION)

Furthermore, when new technologies are adopted in the public sector, grasping their full potential is challenged by the difficulty of aligning it with the required changes in organisational processes and structures, not to speak of staff acceptance and skills. With the adoption and use of AI technology, it is likely that this process is not going to be any different. In line with this recognition, **most of the literature on AI in the public sector also recommend to focus on the quick wins, before tackling more structural challenges** (Desouza et al., 2020; OECD, 2019). While some of these quick wins can already provide value and convenience to citizens, only time will tell us whether the use of AI will help bring more transformative impacts or suffer from the same issues faced by earlier waves of government digitalisation.

Consequently, **it is the combination of software and hardware with human behaviour that possibly leads to an impact**, however measured, or to a transformative change of the previous external conditions. In other words, most of the AI described in this report is embedded in applications that are the result of a development process where machine learning – but also traditional programming – plays an important role. Researching the use of a single machine learning algorithm is likely to be too narrow, since most AI applications use a variety of algorithms (Sousa et al., 2019). Since our analysis aims to unravel the consequences and impacts of the use of AI systems in public services, an approach that examines **how the AI as a system works in real world** is therefore preferred (Kitchin, 2017) and our research focus differs from other studies dealing with the use of machine learning algorithms, the algorithms themselves or the difficulties of gaining a high enough accuracy rate on a specific model.

As a matter of fact, the combined datafication of society with the digitalisation of public administration worldwide, has led to an **increasing effort to use massive volumes of data available to improve governmental practices**. However, as often, the promise of ICTs does not truly lives up to its expectations (Bannister & Connolly, 2020). To a great extent, **the application journey of AI in the public sector fits the more established research tradition of eGovernment**: the use of ICTs to improve government services. Since the 1990's there has been great enthusiasm worldwide about introducing new digital technologies within governmental organisations to improve effectiveness and efficiency of service delivery, make organisations more citizen-centric and improve trust in government. However, many researchers have questioned whether the great investments in ICTs by governments over the past decades have actually achieved the significant impact they were supposed to bring [for a review on this see (Misuraca et al., 2013) and (Savoldelli et al., 2014)].

Indeed, the potential benefits are massive but, so far, **there is limited empirical evidence that the use of AI in government is achieving the intended results successfully.** Understandably, often the developers of the AI systems would describe great properties to their AI, backed up with technical assessments of the models' performance and accuracy. Despite this, there have been mentions that the predictive accuracy of some AI solutions is not much better than 'simple' logistic regressions based on only a few variables, especially when trying to predict social outcomes (Christodoulou et al., 2019; Salganik et al., 2020). Moreover, these assessments tell us very little on how AI technologies are used in practice and how consequently they could lead to improvements in public services. Thus, in order to understand the effects of AI use in governments, an approach which takes into consideration how the technology is used will give more insights on how AI provides impact (Cordella & Iannacci, 2010; Rahwan et al., 2019). This approach should keep in mind that while AI technologies can be the same, previous research on the use of technologies in organisations highlights that similar technologies can in fact provide very different outcomes in organisations, potentially leading to unanticipated outcomes in some settings (Bailey & Barley, 2019).

In fact, as a recent JRC report on Exploring Digital Government in the EU has highlighted, **most digital transformations in the public sector seem to be guided by hopes and dreams, rather than confirmed by empirical evidence** (Barcevičius et al., 2019). Exploiting available information and advances in ICTs and infrastructure across the various eGovernment waves, public sector organisations have strived to become more data-driven and use digital transformation to extract value from large datasets, so as to increase their capacity for problem-solving and ability to tackle major societal challenges. However, significant barriers and constraints have prevented a more diffused adoption of ICTs – and potentially also AI – by governmental organisations so far, notably including lack of dedicated resources, knowledge, organisational resistance and other specific factors, such as quality of available datasets. This has led to a significant gap in the take-up rates between private and public sector organisations, where the former are usually much faster in using best of breed solutions to improve their products and services and stay ahead of competition. In fact, even when the technologies do get adopted by the organisation, public workers may use the technologies in ways not imagined by the developers or the managers, such as treating AI with scepticism or ignoring it recommendations entirely (Bailey & Barley, 2019).

Technology wise, this report proposes a classification based on 10 application domains – called '**AI typologies**' (see **Table 1**)– which is broadly aligned, despite some naming differences, with both the operational taxonomy proposed by the AI Watch and an earlier one – specific for AI in government - also based on 10 domains, by Wirtz et al., 2019. Naturally, as the development of AI is ever ongoing, this may make the classification proposed here very quickly outdated. However, as shown in the following table, speaking in terms of application areas allows overcoming the limitations of too technology-oriented taxonomies, focusing on the various machine learning algorithms and other approaches also considered to be part of AI. Another merit of the proposed classification is that if one looks at the last column on the right, the observed number of cases in the European public sector shows an interesting variety among:

- A relative majority (51 cases) of 'Chatbots, Intelligent Digital Assistants, Virtual Agents and Recommendation Systems';
- An interesting number (36 cases) of applications in the domains of 'Predictive Analytics, Pattern Recognition Simulation and Data Visualisation';
- Other two typologies, both of the same size (29 cases), which are related on the one hand to 'Computer Vision and Identity Recognition' and on the other hand to 'Expert and Rule-based Systems, Algorithmic Decision Making'.

Taken together, these four AI typologies constitute about two thirds (143 of 230) of the current database under investigation and therefore communicate a clear orientation of the surveyed initiatives in terms of adoption.

TABLE 1 AI IN GOVERNMENT. CURRENT AND PROSPECTIVE TECHNOLOGIES AND USES

AI typology	Description	Example	No. of cases
Audio Processing	These AI applications are capable of detecting and recognizing sound, music and other audio inputs, including speech, thus enabling the recognition of voices and transcription of spoken words.	Corti in Denmark is used to process the audio of emergency calls in order to detect whether the caller could have a cardiac arrest	8
Chatbots, Intelligent Digital Assistants, Virtual Agents and Recommendation Systems	This AI typology includes virtualised assistants or online 'bots' currently used in not only to provide generic advice but also behaviour related recommendations to users.	In Latvia, the Chatbot UNA is used to help answer frequently asked questions regarding the process of registering a company	52
Cognitive Robotics, Process Automation and Connected and Automated Vehicles	The common trait of these AI technologies is process automation, which can be achieved through robotized hardware or software	The use of self-driving snowploughs in an airport in Norway in order to improve the clearing of snow on runways.	16
Computer Vision and Identity Recognition	AI applications from this list category use some form of image, video or facial recognition to gain information on the external environment and/or the identity of specific persons or objects.	In Estonia, the SATIKAS system is in used which is capable of detecting mowed (or the lack of mowed) grasslands on satellite imagery	29
Expert and Rule-based Systems, Algorithmic Decision Making	The reason why these apparently distant AI developments are joined into a single application is their prevalent orientation to facilitate or fully automate decision making processes of potential relevance not only to the private but also to the public sector.	Nursery child recruitment system used in Warsaw. The algorithm considers data provided by parents during the registration, calculates the score and automatically assigns children into individual nurseries.	29
AI-empowered Knowledge Management	The common element here is the underlying capacity of embedded AI to create a searchable collection of case descriptions, texts and other insights to be shared with experts for further analysis.	In Slovakia, an AI system is used in the government to assist in the browsing and finding of relevant semantic data	12
Machine Learning, Deep Learning	While almost all the other categories of AI use some form of Machine Learning, this residual category refers to AI solutions which are not suitable for the other classifications.	In Czechia, AI is used in social services to facilitate citizens to stay in their natural environment for as long as possible	17
Natural Language Processing, Text Mining and Speech Analytics	These AI applications are capable of recognising and analysing speech, written text and communicate back.	In Dublin, an AI system analyses citizen opinions in the Dublin Region for an overview of their most pressing concerns by analysing local twitter tweets with various algorithms.	19
Predictive Analytics, Simulation and Data Visualisation	These AI solutions learn from large datasets to identify patterns in the data that are consequently used to visualise, simulate or predict new configurations.	Since 2012, the Zurich City Police have been using software that predicts burglaries. Based on these predictions, police could be forwarded to check these areas and limit burglaries from happening.	37
Security Analytics and Threat Intelligence	These refer to AI systems which are tasked with analysing and monitoring security information and to prevent or detect malicious activities.	In the Norwegian National Security Authority a new system is used based on machine learning is enabling the automatic analysis of any malware detected to improve cybersecurity	11

As any classification, this also is prone to discussion and refinement, as some AI applications could be part of multiple categories. For example, most AI applications put in other categories can also be named expert and rule-based systems, based on machine learning or a combination of both. Therefore, the proposed taxonomy should not be regarded as a conclusive determination of the types of AI existing in nature. Rather, its implementation provides an understandable groundwork to help define which AI applications are part of the inventory of cases gathered so far and to assist in the future understanding of new AI use cases. Thus, the goal of this exercise is not to have absolute ontological rigour, but to provide a heuristic tool, useful in interpreting the variety of AI solutions currently in use.

In future iterations of the study, the taxonomy may be further refined as to also include the various machine learning algorithms used in the development of the AI systems. This could enable additional analysis on the main dominant algorithmic techniques used in the development such as various regression algorithms, classification algorithms, clustering algorithms, association rules, principal component analysis and various neural network approaches[23] (Sousa et al., 2019) in combination with the resulting capabilities and applications made available through these AI techniques. Such adaptive approach seems more in line with the emergence of **AI in the delivery of public services**. While still in its infancy in many countries, this phenomenon is expected to nurture the development of applications at national and local administration level as the further digitization and datafication of the public sector. Such evolution, in line with the planned setting up of EU-wide data and computing infrastructures, will allow for the creation of enhanced capabilities and novel applications over time.

These capabilities and applications could also play a significant role in various governmental tasks related to **policy making**. For example, and based on the evidence gathered from the case studies reported herein, an early data intelligence exercise can assist public decision makers in detecting emergent societal problems or citizens' concerns much promptly, enabling **more timely and accurate policy responses**. This is being experimented in the analysis of business data from tax declarations or patient behaviour according to medical prescriptions. For policies or services already in implementation, activities like the sentiment analysis of citizens during interaction with government websites or simply on social media could assist in the measurement of satisfaction rates and in the promotion of further participation. As far as customer care and service improvement are concerned, the profiling and therefore classification of users according to their interests or needs can lead to more tailored and appropriate deliveries and quality targets. Finally, semi-automated CRM systems using online chatbots and intelligent agents can be pushed to the limit of integrating general or specific advice with recommendations on how to further improve the user's experience.

However, this overview of the general challenges of AI adoption and effective use in the public sector would not be exhaustive, if we did not mention the debate linked to the concerns on **possible downsides and misuses of AI**. Among these, one of the biggest challenges is the characteristic of machine learning technology being considered as a **'black box'**. It is extremely challenging, even for the programmers, to understand how machine learning algorithms function. Whereas it is possible to understand which kind of data is used and to define the outputs of the system, the inner workings of the algorithm are incomprehensible for many, if not all, lay people, posing challenges in terms of accountability, liability and trust (Craglia et al., 2018).

There is also a risk, when AI systems use historical data, to import and amplify **biases** which users might be unaware of (Wirtz et al., 2019). Additionally, the exclusive reliance on online data for policy making exposes to the risk of **excluding the voices that are not captured by digital means**, further enlarging the digital divide that exists in our societies. A further risk of AI relates to the **protection of privacy** due to the fact that many devices and services gather data without the user's full understanding of what is done with it afterwards (Wirtz et al., 2019). This risk is increased when an extended use of algorithms allows to infer information about individuals they have not even voluntarily shared, such as sensor or location data, leading for instance to the detection of health conditions, a private and sensitive data, from apparently public or non-sensitive information, and to inform potentially discriminatory treatment (Floridi, 2017).

Finally, there are **economic and social concerns** linked to the deployment of AI in general, and specifically in the public sector. First, the fear of job losses once AI takes over many tasks previously conducted by humans is of particular interest in public administration, with regard to the debate on the changing nature of work due to the rapid advancements in technology and automation, which are increasingly substituting both routine and cognitive tasks, leading to concern especially in older generations.

[23] One could for example search for the various online machine learning 'cheat sheets" shared by data scientists online with an overview of all the mathematical equations and purposes of the different machine learning algorithms and methods.

Recruitment systems, career models, and job organisational structures are already being transformed by AI and will be even more in the future, raising a number of questions for researchers and policymakers, with regard to the emergence of new educational and lifelong learning needs, or the perspective to re-engineer social protection and healthcare systems, as well as the entire organisation of the economy and society, with clear impacts on the way public administration operates and public services are provided.

2.2 Results of the first mapping of AI use in public services

For the reasons explained in the previous Section (**§2.1**), and particularly to pave the ground for the development of our AI impact assessment's conceptual and methodological framework with an extended state of the art analysis, the first empirical activity conducted as part of the AI Watch has been that of **landscaping the use of AI in public services across Europe**. To this end, during the period May 2019 – February 2020, we have collected a set of **230 initiatives** using AI in public services (broadly defined, as reported hereunder) across the European Union, as illustrated in the map of **Figure 3** below[24]. It is to be noted that this inventory is based on the use of AI in public services by government agencies, which had the consequence of not gathering AI use cases used for the public good but provided (solely) by private actors, without collaboration with government actors. In fact, there are many exciting AI applications made available in the social domain by private organisations – especially in public health services or transportation – which have fallen outside of the scope of this inventory. In addition, it must be stressed that the current inventory is by **no means a representative sample** of the current use of AI in government due to biased data collection methods to obtain the current inventory.

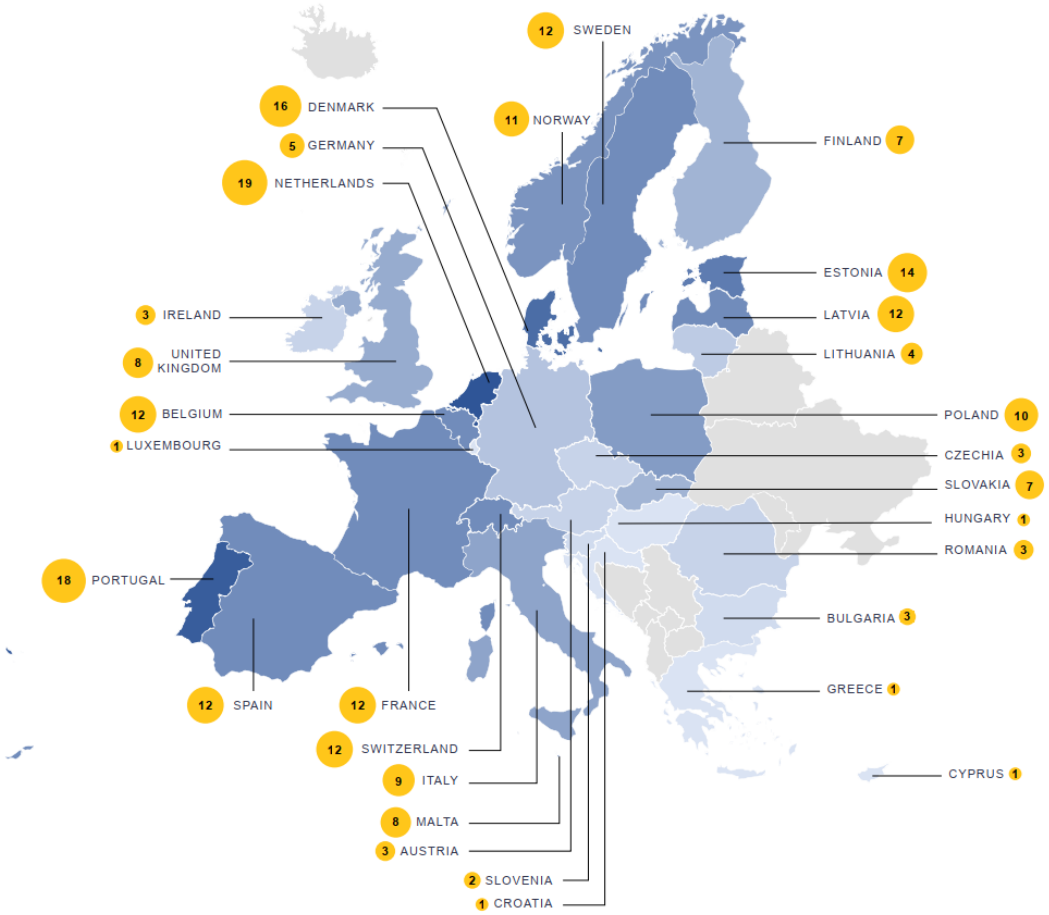

FIGURE 3 MAPPING THE USE OF AI IN PUBLIC SERVICES ACROSS EUROPE

[24] The scope of our analysis are the countries who are part of the AI Coordinated Action Plan for Europe, which includes all EU Member States, Norway and Switzerland. In this first round of mapping information were gathered for all 28 EU Member States as of 2019 (including UK which was still part of the EU), as well as Norway and Switzerland.

Rather than sticking to any 'ontological' definition of public sector organisations, the team relied on the COFOG functional classification of government originally developed by the OECD in 1999 and published by the United Nations[25], now fairly well established in statistical research. This focuses on a 'business oriented' definition of activities of public relevance and therefore (although only in few cases, such as in healthcare) leaves room for the inclusion of a limited number of entities that are not actually governed by public law. This aspect should be borne in mind when discussing the evidence that follows.

The **initial exploratory mapping** was based on a high level review of the main policy and strategic documents of all European countries, complemented by a grey literature search including consultancy reports, datasets and other practitioner-generated information on AI use in public administration found on public websites such as the European AI Alliance Forum and similar. The preliminary list of initiatives identified in this way have been further complemented with additional cases sent to the AI Watch team by Member State representatives, which served both as a validation instrument for the initial mapping as well as instrumental to provide additional cases that may had been overlooked in the first phase of the research.

Whereas a considerable number of initiatives have been identified in most European countries, the approach followed did not lead to a fully representative geographical coverage yet. This should not be considered as evidence of relative lack of projects in either country. Instead, it is quite likely that our approach with its inherent limitations has globally underreported the number of existing projects on location. Crucial limitations include: **translation issues**, for the documents not available in English language; **definition issues**, whenever the consulted source did not use the term 'AI' or similar terms, but more generic expressions like data science, or too broad definitions of involved technologies[26] to characterise their initiatives; and **coverage issues**, as there was no guarantee that the list of projects provided in each government report was comprehensive enough or not too constrained in terms of information availability.

Finally, it should be noted that several AI initiatives featured to be part of this census were in a quite early stage of maturity, such as at proof of concept stage or in a pilot testing phase, with comparatively fewer examples of full steam implementation and mainstream adoption. As our survey aimed to isolate a majority of cases of effective AI use, **some initiatives that were too immature were excluded from this mapping**. Still, it is also possible that **some other initiatives** retained to be part of the census and mentioned as running at the time **may have been later discontinued for various reasons**, which will require more in-depth analysis in the future. We have noticed that throughout our research activities, some implementations of AI have received significant public outcry, political disapproval or court orders forcing its discontinuation, thus highlighting the complexities of adopting and achieving (positive) impact through AI technologies as a result.

Despite all the above limitations, the mapping exercise conducted provides a very rich **preliminary overview of interesting cases to landscape the use of AI in public services in EU countries** as will also be demonstrated in the illustrative analysis presented below. This overview will be further complemented with a more structured review and, in the next phase of our research, through the engagement of Member States, various governmental actors and relevant stakeholders, we expect to increase the current number of 230 and reach in particular AI initiatives at local and municipal level that we believe are widespread in the EU territory.

2.2.1 AI location at country level across Europe

The following **Table 2** shows the distribution of surveyed initiatives across the various EU Member States and Associated Countries surveyed. What can be noted here is **the lack of correlation between country size** in terms of population/GDP **and the number of surveyed initiatives**: Portugal and The Netherlands hold 8% of total case studies each, followed at short distance by Denmark with 7% and then Estonia with 6%. The first larger sized countries in the ranking are France and Spain, both with 5% of the collected initiatives represented.

Therefore, the current inventory is by no means a representative picture of the current state of AI usage in the public sector, but should be perceived merely as illustrative and as a starting point for future research.

[25] Presented in detail at: https://unstats.un.org/unsd/classifications/Family/Detail/4

[26] For instance, as all spam filters of email clients use some form of machine learning, and such email clients are quite popular in the EU public sector, considering these as examples of AI initiative would have distorted the survey results.

TABLE 2 ARTIFICIAL INTELLIGENCE IN PUBLIC SERVICES: LOCALISATION OF SURVEYED INITIATIVES

Country	Level of governance of public service delivery				Total	AI Strategy Published
	National	Regional	Local	Multi-country		
Austria	3				3	
Belgium	2	10			12	
Bulgaria			3		3	
Croatia	1				1	
Cyprus	1				1	Yes
Czechia	3				3	Yes
Denmark	7	2	7		16	Yes
Estonia	11	1	2		14	Yes
Finland	5		2		7	Yes
France	11		1		12	Yes
Germany	2	2	1		5	Yes
Greece			1		1	
Hungary	1				1	
Ireland	2		1		3	
Italy	2	3	4		9	
Latvia	11		1		12	Yes
Lithuania	3		1		4	Yes
Luxembourg	1				1	Yes
Malta	4		4		8	Yes
Netherlands	10	1	8		19	Yes
Norway	7		4		11	Yes
Poland	8		2		10	
Portugal	12		6		18	Yes
Romania			3		3	
Slovakia	7				7	
Slovenia	1			1	2	
Spain	3		7	2	12	
Sweden	5	1	4	2	12	Yes
Switzerland	6	3	3		12	Yes
United Kingdom	3		5		8	Yes
Total	**132**	**23**	**70**	**5**	**230**	

The following table shows the ten categories of public service whereby at least one AI initiative is represented. **The most recurrent functions are General Public Services (with 76 cases), Economic Affairs (with 40) and Health (with 41)**. All of them, and especially the former two, are typical examples of central government functions. Where there is any correlation with the size of the country it is too early to say at this stage.

TABLE 3 ARTIFICIAL INTELLIGENCE IN PUBLIC SERVICES: FUNCTIONS INVOLVED IN SURVEYED INITIATIVES, PER COUNTRY

Country	General Public Services	Social Protection	Defence	Public Order & Safety	Economic Affairs	Environment Protection	Housing & Community...	Health	Recreation	Education	Total
Austria	2	1									3
Belgium	5		1		2	2		2			12
Bulgaria	1								2		3
Croatia								1			1
Cyprus							1				1
Czechia	1	1					1				3
Denmark	4	1			2		4	5			16
Estonia	6	1		2	3			2			14
Finland	3				1			3			7
France	3	1		3	3		1			1	12
Germany	2			2	1						5
Greece					1						1
Hungary	1										1
Ireland	2							1			3
Italy	3	1			1			2	1	1	9
Latvia	3		1	2	5			1			12
Lithuania	1			1	1			1			4
Luxembourg	1										1
Malta	2				2		2	1		1	8
Netherlands	3	4		8	3		1				19
Norway	5		1		3			1		1	11
Poland	2	1	1	1	2		1	1		1	10
Portugal	2	1			4	1		8		2	18
Romania	1			2							3
Slovakia	6							1			7
Slovenia	1				1						2
Spain	3			1	2		1	4	1		12
Sweden	3	2		1			2	4			12
Switzerland	9			2	1						12
UK	1			2	2			3			8
Total	**76**	**14**	**4**	**27**	**40**	**3**	**14**	**41**	**4**	**7**	**230**

Based on the evidence gathered, we conclude that a majority of EU Member and Associated States are indeed using AI already in a good number of cases within their daily operations, across a variety of government functions involved. As indicated earlier, however, this analysis is not fully representative of the current European scenario of public administration, due to national cases that may be missing because of limitations in data gathering or source availability or breadth of the technology definitions adopted. It is, therefore, likely that some underrepresented countries do have already more numerous AI technologies in use or at least some proofs of concept under evaluation but were overlooked in this preliminary analysis. Their position will be re-evaluated in the next stage of the research, in view of developing a more comprehensive overview of the use of AI in public services in the EU, which will benefit of more direct interaction with Member States and representatives of relevant stakeholders at national level involved in the peer learning process (see **§1.3**).

However, we believe that with all its defects, **this preliminary census is an illustrative sampling of AI initiatives currently in action in Europe**, and in a few instances also across the country borders. In fact, Slovenia, Spain and Sweden give evidence of a 2% of cases showing some form of a multi-national exploration or adoption of AI solutions, often related to a funded research or innovation project being active in multiple locations.

2.2.2 AI typology and purpose in public services

In order to assess what typology of AI – and for what purpose – is being used in the surveyed countries, a tentative classification was adopted to group the different use cases, which has been presented in **Table 1** of **§2.1** that precedes. The following text provides a more elaborated description of the **ten 'AI typologies'** shown therein.

- **Audio Processing:** These AI applications are capable of detecting and recognizing sound, music and other audio inputs, including speech, thus enabling the recognition of voices and transcription of spoken words.
- **Chatbots, Intelligent Digital Assistants, Virtual Agents and Recommendation Systems:** This AI typology includes virtualised assistants or online 'bots' currently used in CRM environments, both in the private and the public sectors, not only to provide generic advice but also behaviour related recommendations to users.
- **Cognitive Robotics, Process Automation and Connected and Automated Vehicles:** The common trait of these AI technologies is process automation, which can be achieved through robotized hardware (such as prostatic limbs or precision surgery equipment) or software (either following rule-based, machine-learning or mixed approaches). We have also included here the use of unmanned vehicles to deliver services (e.g. for independent mobility of disabled people).
- **Computer Vision and Identity Recognition:** AI applications from this category use some form of image, video or facial recognition to gain information on the external environment and/or the identity of specific persons or objects.
- **Expert and Rule based Systems, Algorithmic Decision Making:** The reason why these apparently distant AI developments are joined into a single application is their prevalent orientation to facilitate or fully automate decision making processes of potential relevance not only to the private but also to the public sector.
- **AI-empowered Knowledge Management:** The common element here is the underlying capacity of embedded AI to create a searchable collection of case descriptions, texts and other insights to be shared with experts for further analysis.
- **Machine Learning, Deep Learning:** While almost all the other categories of AI use some form of Machine Learning, this residual category refers to AI solutions which are not suitable for the other classifications.
- **Natural Language Processing, Text Mining and Speech Analytics:** These AI applications are capable of recognising and analysing speech, written text and communicate back.
- **Predictive Analytics, Simulation and Data Visualisation:** These AI solutions learn from large datasets to identify patterns in the data that are consequently used to visualise, simulate or predict new configurations.
- **Security Analytics and Threat Intelligence:** These refer to AI systems which are tasked with analysing and monitoring security information and to prevent or detect malicious activities.

The results of this mapping are displayed in the following **Figure 4.**

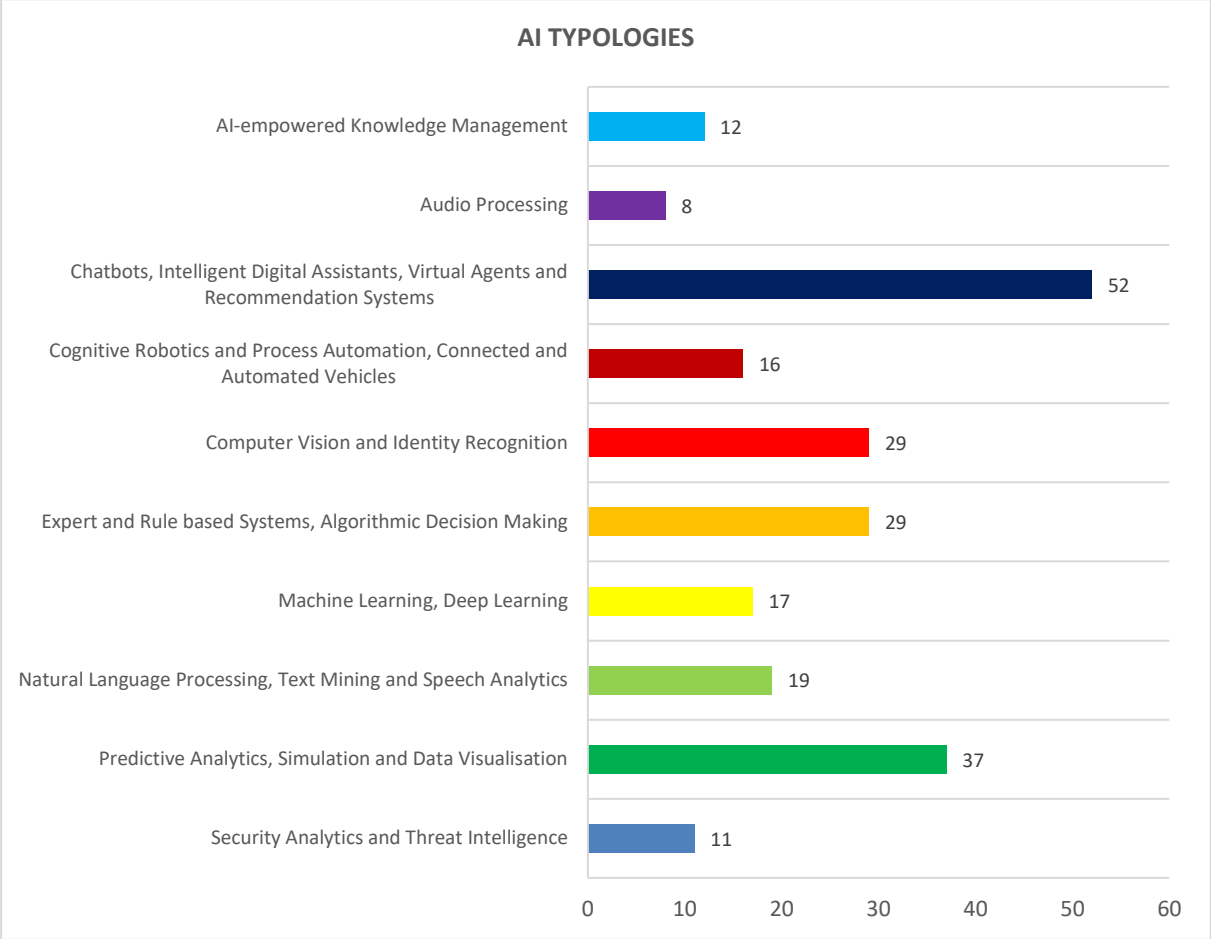

FIGURE 4 DISTRIBUTION OF SURVEYED INITIATIVES ACROSS AI TYPOLOGIES

As shown in the **Figure 4**, the two single classes more frequently appearing in the census are live interaction with the 'clients' of public administration – for the **provision of online support through chatbots** and the like – and the **exploitation of available data by means of visualisation, simulation and predictive tools**, however relatively disjoint from the immediate support to decision making: for instance, aimed at drawing scenarios that improve human understanding of complex, societal or organisational, issues.

Respectively, these two 'AI typologies' occur in 23% (52) and 16% (37) of surveyed cases. Then at some distance, follow two more classes: the Expert and Rule Based systems, facilitating Algorithmic Decision Making (13%, 29 of cases) – a complement to the previous one – and the use of computer vision (13%, 29 of cases).

It is also quite interesting to note which COFOG functions the above AI typologies are mostly concentrated in, as shown in the following **Table 4**.

TABLE 4 ARTIFICIAL INTELLIGENCE IN GOVERNMENT. AI TYPOLOGY PER COFOG CATEGORY

AI Typology / COFOG Categories	GPS	SP	DEF	POS	EA	EP	HCA	HLT	RCR	EDU	Total
Audio Processing	6			1				1			8
Chatbots, Intelligent Digital Assistants, Virtual Agents and Recommendation Systems	36	1			7			7	1		52
Cognitive Robotics, Process Automation and Connected and Automated Vehicles	1	1		3	6		1	4			16
Computer Vision and Identity Recognition	5		1	3	9	3	3	4	1		29
Expert and Rule based Systems, Algorithmic Decision Making	5	3		5	4		2	8		2	29
AI-empowered Knowledge Management	4	2		2				1	2	1	12
Machine Learning, Deep Learning	4	1		4	3		1	2		2	17
Natural Language Processing, Text Mining and Speech Analytics	10	1	1	2	1		1	2		1	19
Predictive Analytics, Simulation and Data Visualisation	4	4		1	9		6	12		1	37
Security Analytics and Threat Intelligence	1	1	2	6	1						11
Total	**76**	**14**	**4**	**27**	**40**	**3**	**14**	**41**	**4**	**7**	**230**

The most striking combinations are Virtual Assistants in General Public Services (with 36 cases) and Predictive Analytics (for scenario building) in Healthcare environments, with 12 cases. Other noteworthy combinations are the use of Computer Vision and Predictive Analytics in the Economic Affairs Domain, both with 9 cases.

More generally, this data collection exercise does suggest the existence of **differences between Member States in the amount and typology of AI used within their countries**. However, due to the aforementioned methodological limitations, it is too early to say what may cause those differences, but with the progress of AI Watch activities, and a more reliable and encompassing dataset, there will be room for deeper inspection and drawing more stable conclusions in that regard too.

With regard to the **purpose of AI up-take**, we adopted the classification developed in a recent study by (Engstrom et al., 2020) on the use of AI within the Federal Government of the USA, which classifies it according to **five categories of governmental tasks**:

- **Enforcement:** These use cases of AI relate to the enforcement of existing regulation, such as those that identify or prioritize targets which require enforcement or inspections.
- **Regulatory research, analysis and monitoring:** This category refers to AI use cases which assist in the policy making processes, such as collecting, monitoring and analysing data to augment policy-makers decision-making capabilities and make them more evidence based.
- **Adjudication:** These AI systems are used in order to assist or conduct the granting of benefits or the entitlement of rights to citizens.
- **Public services and engagement:** These AI solutions include those that are used to support the provision of services to the citizens and businesses or to facilitate communication with and participation of the general public are part of this category.
- **Internal management:** These AI use cases are used to assist in the management of the internal organisation, such as human resources, procurement, ICT systems or other utilities.

Naturally, some AI technology could be used for more than one purpose and so the above categories are very likely to overlap in practice. However, their headcount does allow a better understanding of the purposes for which European government bodies and agencies are currently using AI. In fact, some people are worried about the risk that the AI substitutes for the human decision maker at all in some delicate government activities such as granting of social benefits to people in need.

However, as shown in **Figure 5**, only in 12 (5%) cases AI was used for this purpose. Possibly, many government agencies themselves worry about delegating this discretion to AI systems in full and therefore prefer to see further maturing of this kind of technological solutions before undertaking such commitment.

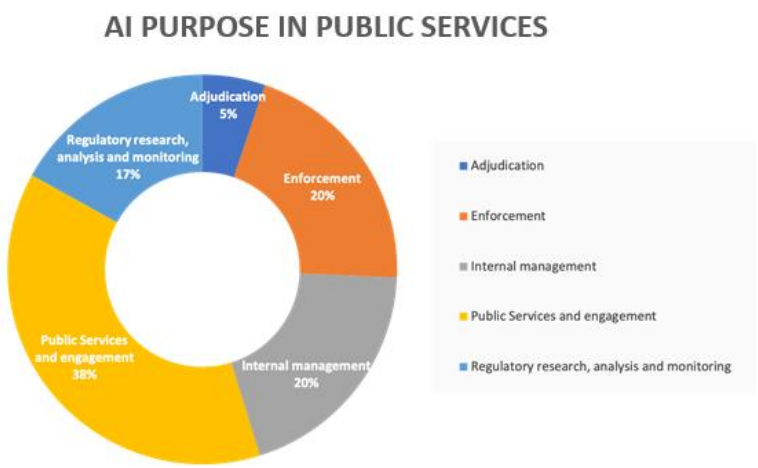

FIGURE 5 PURPOSE OF AI IN PUBLIC SERVICES

Instead, most of the AI systems identified are used to assist the human decision maker in the provision of public services or engagement building activities (87 out of 230 cases, 38%). Here one could retrieve, for example, the use of chatbots and recommenders already outlined above, or the delivery of matchmaking services to facilitate e.g. unemployed persons to find more fitting jobs, or the provision of transcriptions of political hearings for people with hearing difficulties. Other AI solutions (in 47 out of 230 cases, 20%) are used to assist public administrations in the enforcement of existing regulation or to prioritize targets requiring policy attention, mostly to detect fraud, monitor social media behaviours or for example detecting the plate numbers of irregularly parked cars.

AI systems are also well suitable to improve the internal management and operations of government agencies, which many are currently exploring. In 45 out of 230 cases (20%), such systems are used to assist internal management processes, gain insight in Human Resources (HR) data, optimise utilities such as for energy consumption, or support the users in the search of digitalised documents and maps, such as in the Swedish Land Registry case. There, an AI system is also capable of reading older, handwritten documents and transforming them into a digital format.

Furthermore, AI systems are used in order to assist the civil servants engaged in the collection and visualisation of data from many existing sources (39 out of 230 cases, 17%). This support can enable the policy makers to draft new policies which are more based on evidence or the new insights gathered within the data. As an example, the municipality of Tallinn is using AI-powered computer cameras in order to recognise which kind of

and how many vehicles are travelling on the road. This data and the resulting scenario description would then be used to enable better decisions regarding the city transport planning.

Finally, as already mentioned, based on our inventory, **only 12 out of the 230 (5%) AI cases are used for the granting of benefits or similar rights to citizens or businesses**. One of these is the Electronic Declaration System in Latvia, which uses AI in order to verify submitted declarations automatically, freeing up time for civil staff to devote to declarations that are non-compliant. Another example is a use case in Warsaw which automatically assigns children to nurseries based on data referring to their parents.

2.2.3 AI by policy sector

In addition to what was already mentioned in Table 3 of **§2.2.1** it is worth narrowing the focus on the relationship between the COFOG functions and the five categories proposed in the study by Engstrom et al., 2020. This can be done with the help of the following **Table 5**.

TABLE 5 ARTIFICIAL INTELLIGENCE IN GOVERNMENT. POLICY SECTOR OF SURVEYED INITIATIVES

COFOG Categories	GPS	SP	DEF	POS	EA	EP	HCA	HLT	RCR	EDU	Total
Adjudication	4	1		3	1			1		2	12
Enforcement	4	4	1	14	8	1	3	11	1		47
Internal management	20		2	5	6	1	7	2	1	1	45
Public Services and engagement	44	6			12		1	21	1	2	87
Regulatory research, analysis and monitoring	4	3	1	5	13	1	3	6	1	2	39
Total	**76**	**14**	**4**	**27**	**40**	**3**	**14**	**41**	**4**	**7**	**230**

Considering the governmental tasks in association with the COFOG taxonomy also makes sense in light of the ongoing work of coordinated by DIGIT with Member States and experts, for the definition of a full categorisation of public services, which is preparatory to the release of a **European taxonomy of public services**.[27] This helps keep some distance from the often too abstract COFOG functions in relation with the need to reduce the level of ambiguity regarding certain policy sectors.

One of these is **Health**, which include both the activity of robotized precision surgery and the management of e.g. past diagnostic and X-ray evidence as guideline for future prescriptions. While the former use case can hardly be adjusted in a narrow definition of public service, the latter comfortably does. For instance, after the outburst of the **Covid-19 crisis**, the Polish government has developed a Home Quarantine app to check the health status of citizens without the need for police and medical staff to conduct such inspections manually. This activity and the related AI support can easily fall within the Enforcement typology introduced in **§2.2.2**.

As it can be noted, **19% of AI use cases** (44 out of 230) **fall at the crossroad between Public Services and Engagement within the General Public Services domain**. This includes services from executive bodies, legislative organs, financial and fiscal affairs, R&D related to general public services as well as transfers

[27] See https://joinup.ec.europa.eu/sites/default/files/news/2019-09/ISA2_European%20taxonomy%20for%20public%20services.pdf

between different levels of governments, among others. Some of these are supported by AI systems, which assist citizens in finding out the correct information on government websites.

Quite interestingly, another 9% (20 out of 230 cases) can be referred to the internal use of AI to deliver those services in the different public administration bodies and agencies. With the same incidence, 9% and 21 cases, it is interesting to note that the same cluster of governmental tasks with reference to Public Services and Engagement is also represented in the Health domain.

Other use cases follow **in the Economic Affairs domain**, which includes general economic, agriculture, energy, manufacturing and other services related to stimulating the economy. The **prevailing AI supported activities are still related to supporting, regulating or monitoring some part of the economy by the public administration** (5,5% and 13 cases), although AI could also be used to stimulate economic activity within the country, by e.g. easing the process of setting up a business. This is part of the cluster including, once again, cases referring to Public Service delivery and citizen/business Engagement (5% and 12 in number).

2.2.4 AI innovation potential in the public sector

AI is often mentioned to be capable of transforming the fabric of our economy and society, which government is part of. However, as the earlier literature review on eGovernment done in **§2.1**has highlighted, despite the disruptive potential of new technologies, ICT-enabled innovations are often solely incremental, changing only the processes which can easily be adjusted. Radical innovations have not happened so far, as they require large scale public management reforms frequently impossible to conduct.

With respect to the gathered AI initiatives in our inventory, an overview of their innovative potential could be done with the help of the following definitions (adapted from Misuraca 2012, and Misuraca & Viscusi, 2015).

- **Technical/Incremental Change**: Including AI in public services without a clear follow-up in organisational processes, for example the use of predictive analytics without any accompanying action or of chatbots with limited functionalities.
- **Sustained/Organisational Change**: Occurring whenever AI manages to alter existing organisational practices, changing organisational processes and/or tasks of government staff, such as when robotic process automation is used handle large requests, freeing up time for other tasks.
- **Disruptive/Transformative Change**: Associated to new models of public service delivery that could not be possible without AI technologies, such as the pre-emptive social protection services or the use of chatbots with advanced functionalities for citizens.
- **Radical/Transformative Change**: Occurring whenever AI enables large scale changes in existing policy and governance practices, reforms of policy and service creation models, inter-organisational reforms etc.

The following **Table 6** associates the above definitions of innovative potential to the 10 'AI typologies' introduced in **Table 1** of **§2.1.**

As it can be seen, more than a half of the AI solutions currently in use (127 out of 230) bring only incremental or technical changes to the government body or agency adopting them. Among these, chatbots and predictive analytics confirm their primacy in European public administration. The second cluster, including 58 out of 230 cases, and third cluster, with 42 cases, taken together almost equalize the number of instances in the first group. This is encouraging, as one is about sustained and organisational changes while the other group concerns the disruptive and transformative changes in the organisation. What emerges with utmost clarity is that **the radical and transformative changes induced by the adoption of AI are far less common**.

In addition, it is important to consider that the most disruptive innovations are often under scrutiny or criticism, as citizens might not always appreciate the pro-active service delivery style of their governments, for instance due to serious privacy concerns. A long term study therefore, might show that some of the disruptive usages of AI might be cancelled, halted or reversed by new regulations, restricting the amount of disruptive cases of AI in government.

TABLE 6 ARTIFICIAL INTELLIGENCE IN GOVERNMENT. ESTIMATES OF INNOVATION POTENTIAL

AI typology	Incremental / Technical Change	Organisational / Sustained Change	Transformative / Disruptive Change	Transformative / Radical Change	Total
Audio Processing	4	2	2		8
Chatbots, Intelligent Digital Assistants, Virtual Agents and Recommendation Systems	34	8	9	1	52
Cognitive Robotics, Process Automation and Connected and Automated Vehicles	2	8	6		16
Computer Vision and Identity Recognition	18	9	2		29
Expert and Rule based Systems, Algorithmic Decision Making	11	8	9	1	29
AI-empowered Knowledge Management	8	1	2	1	12
Machine Learning, Deep Learning	12	2	3		17
Natural Language Processing, Text Mining and Speech Analytics	10	4	5		19
Predictive Analytics, Simulation and Data Visualisation	22	12	3		37
Security Analytics and Threat Intelligence	6	4	1		11
Total	**127**	**58**	**42**	**3**	**230**

The following **Table 7** proposes a geographical assessment of the innovative potential of the AI initiatives in our census.

TABLE 7 ARTIFICIAL INTELLIGENCE IN GOVERNMENT. LOCALISATION OF INNOVATION POTENTIAL

Country	Incremental / Technical Change	Organisational / Sustained Change	Transformative / Disruptive	Transformative / Radical	Total
Austria	3				3
Belgium	9	1	1	1	12
Bulgaria	3				3
Croatia	1				1
Cyprus	1				1
Czechia	3				3
Denmark	11	3	2		16
Estonia	5	4	4	1	14
Finland	4	1	1	1	7
France	6	4	2		12
Germany	3	1	1		5
Greece		1			1
Hungary	1				1
Ireland	1	1	1		3
Italy	7	1	1		9
Latvia	4	2	6		12
Lithuania	3	1			4
Luxembourg	1				1
Malta	4	2	2		8
Netherlands	4	11	4		19
Norway	8	2	1		11
Poland	3	6	1		10
Portugal	14	3	1		18
Romania	1	1	1		3
Slovakia	5	2			7
Slovenia	1	1			2
Spain	2	3	7		12
Sweden	7	2	3		12
Switzerland	6	5	1		12
UK	6		2		8
Total	**127**	**58**	**42**	**3**	**230**

The countries with the broadest orientation towards technical and incremental change are currently Portugal and Denmark. That with the biggest focus on sustained and incremental change is The Netherlands. Finally, the two countries more aligned with the concept of disruptive and transformative change are Spain and Latvia.

The next and final **Table 8** overviews the connections of innovation potentials with the now familiar five categories of AI purpose proposed in the study by Engstrom et al., 2020.

TABLE 8 ARTIFICIAL INTELLIGENCE IN GOVERNMENT. GOVERNMENTAL TASKS VS INNOVATION POTENTIAL

AI Use type	Incremental / Technical Change	Organisational / Sustained Change	Transformative / Disruptive Change	Transformative / Radical Change	Total
Adjudication	3	5	4		12
Enforcement	13	21	13		47
Internal management	32	9	3	1	45
Public Services and engagement	54	12	19	2	87
Regulatory research, analysis and monitoring	25	11	3		39
Total	**127**	**58**	**42**	**3**	**230**

To assess which use cases are associated with more innovative potentials, we notice than most adjudication or enforcement use cases of AI could be regarded as sustained and to a very good extent, disruptive. Such evidence can be explained because most of the adjudication use cases in our census deal with the granting of benefits and rights, which are commonly transformed into proactive services where no citizen has to make a request, but the government does so automatically. This brings to a substantial shift in how public services are delivered, which is made possible by the capabilities provided by AI.

Likewise, many disruptive innovations are taking place in the enforcement use cases. This because enforcement practices can be changed significantly by the use of satellite imagery, object recognizing cameras or other AI solutions. Rather than only being able to enforce the rules in a handful of cases due to limitations of staff resources, governments adopting AI technologies can reinforce existing enforcement practices such as checking parked cars, and potentially also the rules to an extent that was not possible before, as documented in **Section 3** with the SATIKAS system in Estonia, which is monitoring the mowing of farmers' grasslands.

The provision of internal management services could also be changed significantly, especially when AI solutions are used in combination with additional public reforms that enable a One-Stop Shop government (e.g. by having a Chatbot capable of finding relevant information across multiple agencies). Most of the AI solutions used for research, analysis and monitoring and for internal management purposes have been classified as incremental or technical changes.

Often, it is not clear what kind of changes, innovations or reforms are the consequence of the use of these new AI technologies. While commonly the use of the AI could reveal new insights, which could be acted upon, it is not always clear if and how. There could be intervening factors such as political interests, interpretability and understandability of the insights, reducing the possibilities of new policy design by the AI's insights, etc.

Additionally, as noted by some observers[28], implementing AI in any organisation, including from public administration, certainly requires roadmapping and a cost benefit analysis, but also an assessment of technical feasibility and a holistic consideration of all tactical 'make, buy or partner' options available. This is in part what has been presented at the beginning of this Section, when discussing about the 'maturity level' of the AI initiatives in this census. To some extent, regardless of their actual implementation status, all of them were initiated by a purposeful act or decision to explore, identify and then grasp the potential transformative benefits of AI for service delivery or policy making processes.

As we will discuss further in **Section 3** and **Section 5**, the next stage of this research will comprise the specification and empirical testing (on a significant number of case studies) of an original AI implementation model including a detailed list of factors that facilitate or prevent AI implementation (use) in public sector organisations. In so doing, the relative weight of each factor within the model will be assessed and a final, streamlined and validated theory will be delivered.

2.2.5 Value driver orientation

As a final contribution to this preliminary analysis of the 230 AI initiatives in our census, we propose to reflect on their value orientation as it can be inferred from the reading of available descriptions of the cases.

Generally speaking, every innovation implemented by an organisation aims to achieve some kind of goal, which is in turn based on one or more higher level value(s). At this stage, the different AI initiatives have been assessed for the extent to which their goals align with *Performance, Inclusion and Openness* as relevant value targets.

The definitions used for these three targets are rather straightforward and builds on Misuraca 2012 and Misuraca & Viscusi, 2015, further elaborated also in Misuraca et al. 2017:

- **Performance** can be evaluated through efficiency and effectiveness dimensions at three level of analysis, for legal framework, services, and technology. Besides efficiency considered under an economic perspective at service and technology level, we believe it is worth to point out the effects of efficiency at legal framework level on administrative procedures. Turning then to effectiveness, reliability is relevant at service level, including accuracy and completeness of information requested for the service provision.
- As for the **Openness** dimensions we first considered accessibility at technological level, in terms of diffusion of standards and technological infrastructures and systems for interoperability, and information level as the ability of administrations to access data by means of the shared back office, and the possibility for external users to access administrative data via, e.g., open data portals or apps. As for transparency we are interested in service and organisational levels in terms of the volume of information that the public administration provide to users describing their internal functioning and informing them on what they can expect or claim while using the service. Moreover, accountability dimensions refer to legal framework and organisation as the levels to be considered to evaluate the degree to which, for example, users' opinions and feedback influences service policies and decision-making.
- Finally, **Inclusion** includes accessibility dimensions for the service and technology levels (for example the existence of different channels for service access and delivery); whereas equity dimensions are considered at organisation and information levels to evaluate, for example, the ease of access for minority or disadvantaged groups. It is worth noting that accessibility in this case relate to capabilities enabled by the services and technologies from a welfare oriented perspective; whereas accessibility in the openness case allows to identify how interoperable is a public administration digital initiative, thus accessibility refers to an administrative perspective rather than to a social one.

The next **Table 9** compares the AI-enabled innovation potentials described in the previous sub-section with the three aforementioned targets of value creation.

[28] E.g. Michael Hu, https://www.jp.kearney.com/documents/20152/4977451/Unleashing+the+Power+of+AI+for+Enterprise+Automation.pdf

TABLE 9 ARTIFICIAL INTELLIGENCE IN GOVERNMENT. VALUE TARGETS VS INNOVATION POTENTIAL

Value driver	Incremental / Technical Change	Organisational / Sustained Change	Transformative / Disruptive Change	Transformative / Radical Change	Total
Inclusion	23	14	10	2	49
Openness	14	4	6		24
Performance	90	40	26	1	157
Total	**127**	**58**	**42**	**3**	**230**

Judging from the table, **most of the current AI is being used to achieve performance related goals**, such as doing governmental tasks quicker, faster, or more efficiently. In fact, 68% (157 out of 230) of our initiatives pursue mainly performance-based goals, while **only 21%** (49 out of 230) **pursue inclusion driven goals**. This means e.g. to make public services more accessible for citizens who have challenges in using the traditional versions of them or those who do not feel at ease with an all too large amount of digital information to be consumed. Almost paradoxically, **in a mere 10% of the AI initiatives** (24 out of 230), **the goal of improving the openness of government comes to the forefront**, e.g. in increasing the amount of information available for citizens and other stakeholders.

The following **Figure 6** compares the policy sectors described in the previous sub-section with the three above targets of value creation.

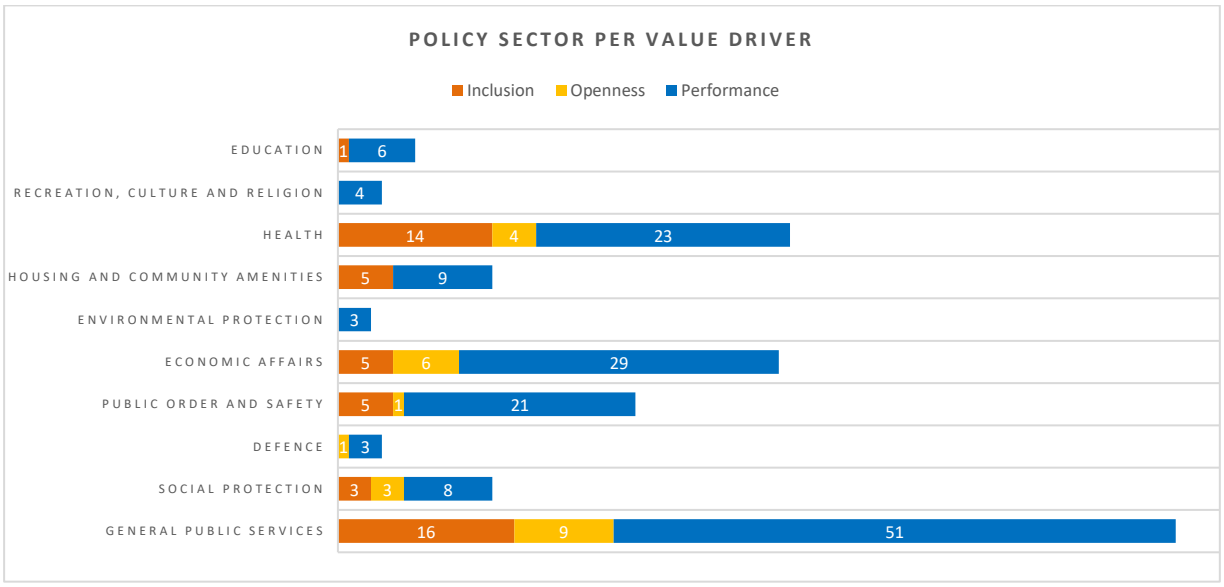

FIGURE 6 ARTIFICIAL INTELLIGENCE IN GOVERNMENT. FUNCTIONS INVOLVED VS VALUE TARGETS

The most frequently attended COFOG functions are General Public Services, Economic Affairs, Health, Public Order and Safety (the four of them related to Performance targets). Then we notice in relation to Inclusion, the reiterated importance of General Public Services and the Health sector. The remaining six government functions and residual value target (Openness) are less evident in terms of frequency of occurrences.

We conclude the discussion by analysing the correlations between each of the three value targets and the 10 'AI typologies' utilised for categorising the initiatives in our census. The results are presented in **Figure 7**.

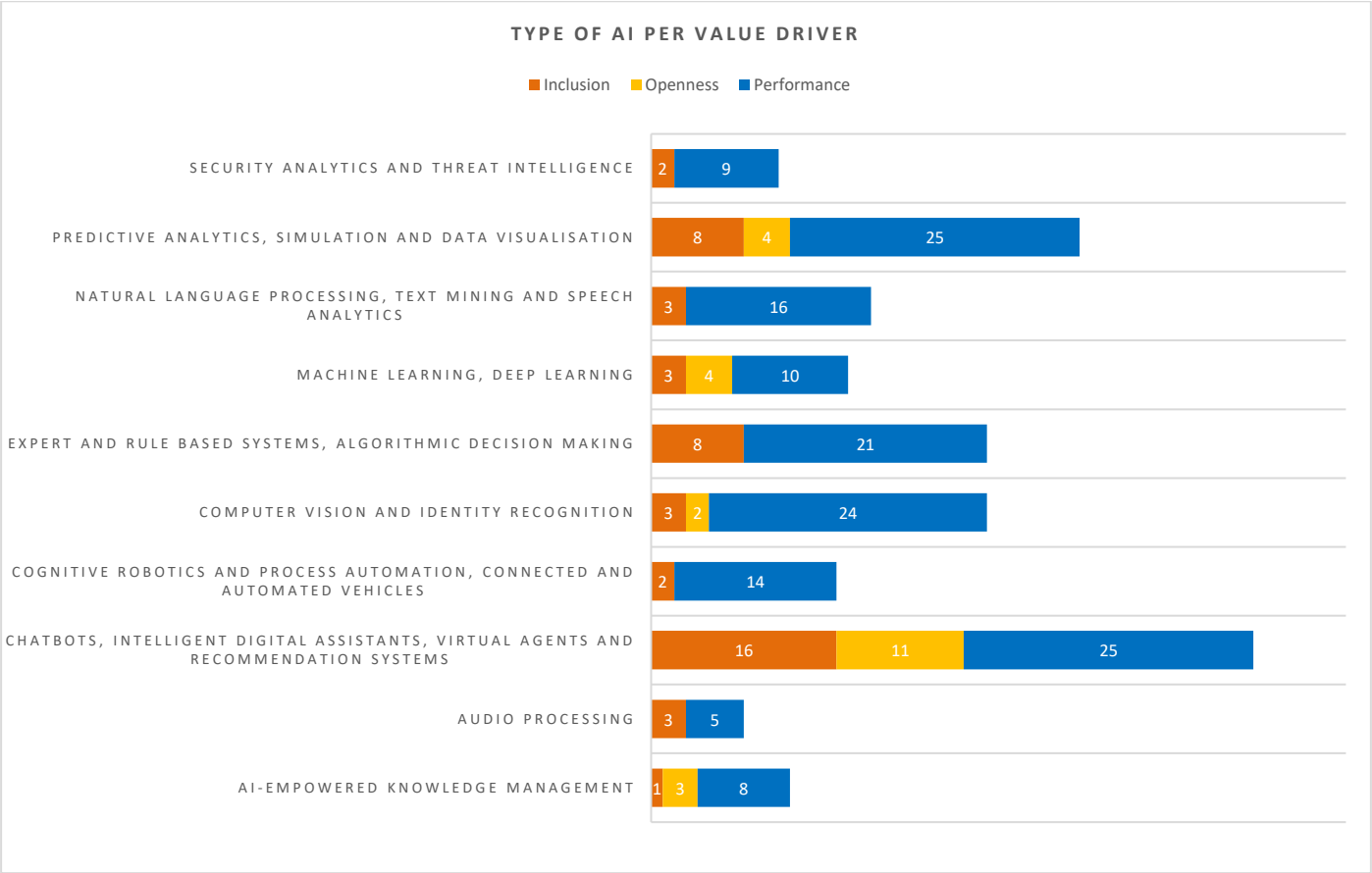

FIGURE 7 ARTIFICIAL INTELLIGENCE IN GOVERNMENT. AI TYPES VS VALUE TARGETS

As noted while commenting previous tables, the two most significant 'AI Typologies' in relation to Performance are Chatbots and Predictive Analytics, followed at short distance by Computer Vision and Expert and Rule based Systems, always in relation to Performance. Then again Natural Language Processing and Cognitive Robotics. The only significant correlation can be noted between Inclusion and Chatbots, again see as means to facilitate some convergence of interests between citizens and public sector organisations.

2.3 Insights from the initial survey of Member States use of AI in public services

Building on the existing experiences and analysis of AI initiatives identified in the mapping, a survey was designed and launched for gathering insights from Member States in view of the Peer Learning Workshop on AI use and impact in Public Services held in Brussels on 11-12 February 2020.

The survey was completed by 18 European countries, with respondents including head of departments, CIO's, (senior) policy officers and consultants. In many cases, the survey was answered by a coordinated group of experts from the Member States to ensure the most valid and recent information. See **Table 10**.

The survey was structured around three main goals: first, to gain unique knowledge regarding the existing use of AI in the Member States, gathering information to enrich the ongoing mapping; second, to obtain an outlook of the different policy initiatives Member States were planning or already executing in order to facilitate and boost the adoption of AI in government and, finally, to receive insights on what Member States are expecting from AI Watch, so as to lay the foundations for future research collaborations.

TABLE 10. COUNTRIES RESPONDING TO THE SURVEY ON AI USE

#	Country
1	Czech Republic
2	Denmark
3	Estonia
4	Finland
5	France
6	Germany
7	Ireland
8	Italy
9	Latvia
10	Malta
11	The Netherlands
12	Norway
13	Portugal
14	Romania
15	Slovak Republic
16	Slovenia
17	Sweden
18	Switzerland

Here below we report a selection of key findings gathered from the Member States survey. As mentioned, only part of EU countries completed the survey and a more comprehensive picture is expected to be gained in the next phase of the research, not only ensuring all EU Member States will respond to the survey and be represented, but also deepening the analysis with in-depth reviews at country level.

However, already from this preliminary analysis of the survey responses some interesting trends and examples can be identified - though clearly they may embed a cognitive bias as they represent self-reported answers - and grouped in the following areas.

- Funding and Training;
- Organisation and regulatory frameworks;
- Methodology to assess impacts and priorities.

2.3.1 Funding and Training

Of the responding countries, **67% indicated to have allocated funding to stimulate the development and the adoption of AI for use within the government.** Many countries highlighted the availability of resources between 5 and 10 million euros, although there were some with more. Both France and Denmark mentioned they had funding available between 50 and 100 million euros. See **Figure 8**.

One example of large funding programme in **France** is the **Public Action Transformation Fund** (FTAP-Fonds de transformation de l'action publique). This is a funding programme amounting to a total of 700 million euros for the transformation of public agencies and 13 AI projects have been already funded since 2018.

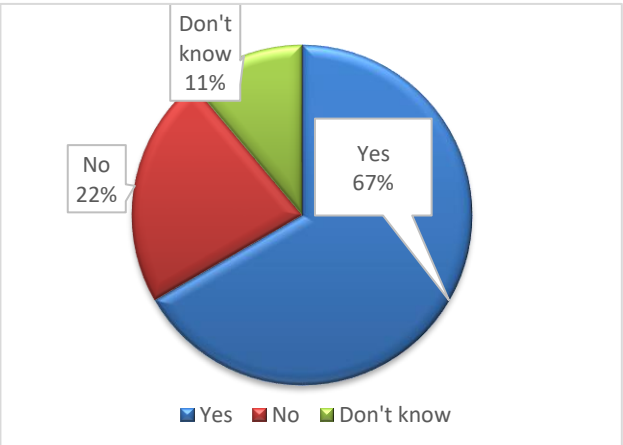

FIGURE 8 AI FUNDING IN MEMBER STATES

This information should however be further investigated and contrasted with the estimate of investments in AI (in both public and private sectors) that each Member State is outlining as part of their own National AI strategies, and which is a specific focus of the AI Watch.[29] Nevertheless, the specific focus of this research activity on the use of AI in public services will also require a 'deep dive' in the amount of financial resources that public administrations and governmental agencies at different levels have at their disposal to implement AI initiatives and make the use of AI effective and mainstream.

Strictly connected to the funding on AI is the **availability of specific training in AI related topics**, such as data analytics, machine learning and automated decision making among others. The capacity to manage AI techniques and understand their implications on policy and governance mechanisms is in fact crucial for the successful adoption and uptake of innovative solutions. See **Figure 9**.

In this respect, of the 18 countries responding to the survey, 7 (39%) highlighted having internal AI training programmes for civil servants, whereas **11 countries (56%) mentioned they did not have any specific training programme on AI in place**. All countries with a training programme reported having less than half million euros available for the training programmes. In many cases, the Finnish free online course the **Elements of AI** is often mentioned to be part of the training programme of civil servants. Furthermore, some countries are planning to develop separate courses for senior management, technical specialists and policy makers with different training contents.

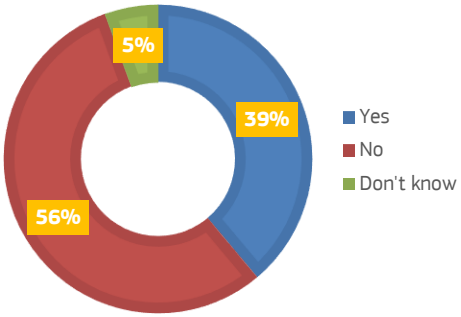

FIGURE 9 AI TRAINING IN MEMBER STATES

The **Elements of AI** is a free online course already used in many countries and now being translated by Finland, with the support of the European Commission in all EU languages. The course teaches the basics of Artificial Intelligence to a broad audience. At the moment, it is already available in English, Finnish, Swedish and Estonian. Over 370.00 people have already signed up for the course, with 40% of the participants being female.

2.3.2 Organisation and regulatory frameworks

Another aspect of central importance for effective adoption and use of AI in public services refers to the **organisational structure and processes** that public administrations and government have defined.

In this regard, many countries (13) mentioned to have at least one department, unit or dedicated team working on stimulating the uptake of AI in the public sector, researching the effects of AI or preparing new AI-specific regulations. Of these 13 countries, 9 reported to have more than one of these units. Some of these teams are relatively new (started in 2018 or 2019), while others are more established teams who were previously tasked with ICT regulation such as existing IT bodies or specific departments for emerging technologies.

For example, in **The Netherlands**, the Ministry of Justice and Safety now has a number of people working in the Justice and Law Enforcement department tasked on focusing on AI. In Finland, there is a new Expert Group on New Technologies since 2019 which are tasked in exploring the implications of AI.

Malta, for example, is developing a business template for the procurement of emerging technologies (including AI) and will enact a training and awareness programme for civil servants in order to equip them with the required AI-related skills.

In terms of financial frameworks to manage AI development and uptake, 3 countries reported having defined specific **guidelines or principles for the procurement of AI in the public sector**. These procurement guidelines aim to either stimulate the development of ethical and trustworthy AI in both the public and the private sector, or to provide civil servants with the necessary expertise to ensure that common issues while dealing with in AI procurement can be avoided.

[29]. See https://ec.europa.eu/knowledge4policy/ai-watch/topic/ai-landscape-indicators_en

In this respect Norway mentioned that the AI they were using was made possible through new innovative public procurement services. In addition, the procurement processes themselves could be amplified using AI technologies, making the process more inclusive, accessible, faster and robust.

Another policy action that is emerging as a key element to enable adoption and use of AI is the **implementation of regulatory sandboxes** to test AI solutions in a safe setting, before they are deployed in society at large.

For instance, in **Norway**, a selected area in the country has been dedicated to the safe testing of autonomous vehicles and vessels.

Based on the replies of the survey, 7 (39%) countries indicate to have some form of a regulatory sandbox in place. Commonly, these sandboxes aim to do a quality assessment of AI (e.g. for healthcare or security and policing applications) to gain a better confidence in the performance and capabilities of the AI solutions. See **Figure 10**.

Furthermore, 9 countries indicated to have an **ethical framework** to act as a guiding set of principles for the development and usage of AI within the public sector. However, of those that at the moment do not have such a framework, 7 respondents mentioned that their government aimed to develop such an ethical framework in the near future.

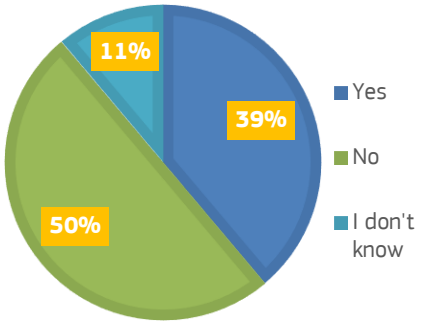

FIGURE 10 REGULATORY SANDBOXES

Finally, none of the respondents mentioned that their government had published an **AI law** which regulates the use of AI in the public sector in the last 5 years. However, many (10) respondents highlighted that some new regulation would be implemented shortly or was currently under review or consultation. Most of them, in fact, indicated that a specific 'AI-law' was not planned but rather existing laws (e.g. on Data Protection / Data Sharing) might be revised whenever this was regarded as necessary. In the next stage of the AI Watch research, an analysis will be conducted on a case by case basis, to determine whether the introduction of new technologies really requires significant changes to existing legislation.

In **Estonia**, for example, after a thorough review of the existing regulatory framework, the majority of laws was considered technology neutral enough, so that there was no need for fundamental changes or the adoption of a specific AI law.

2.3.3 Impacts assessment and priorities

The final section of the Survey aimed to gain practical knowledge and information on methodological aspects and approaches used by Member States to analyse and assess use and impact of AI in public services, so to identify possible complementarities and synergies with the AI Watch research in the public sector.

In this regard, 9 countries indicated having already completed or being conducting landscaping studies on the use of AI in the public sector and in public services in order to get an overview of what kind of AI is being used within their own administrations. Existing AI cases currently in pilot status or already in use have been shared with the AI Watch research team and some of these examples will be discussed further in this report (see **Section 3**).

In **Sweden**, the government developed a framework to measure potential effects and value of AI, as well as collect and document use cases so as to scale-up local initiatives at a national and/or European level. Collaboration with AI Watch initiated as part of the peer learning and knowledge exchange process with and across other Member States of the EU.

A number of countries also shared information on the fact that they already had or were in the progress of developing a methodology to assess the impact of AI solutions: either by using existing impact assessment frameworks and indicators as commonly done in all pilot projects, or by following a new approach more specifically suited for AI, somehow related to their national strategy.

In order to assist in the **prioritization of public services to focus on** in future research activities (through e.g. in-depth case studies, thematic analyses and impact assessment), respondents were asked to suggest which policy domains were regarded as priority in their country for AI. For this, a five point scale was used from very low importance to very high importance.

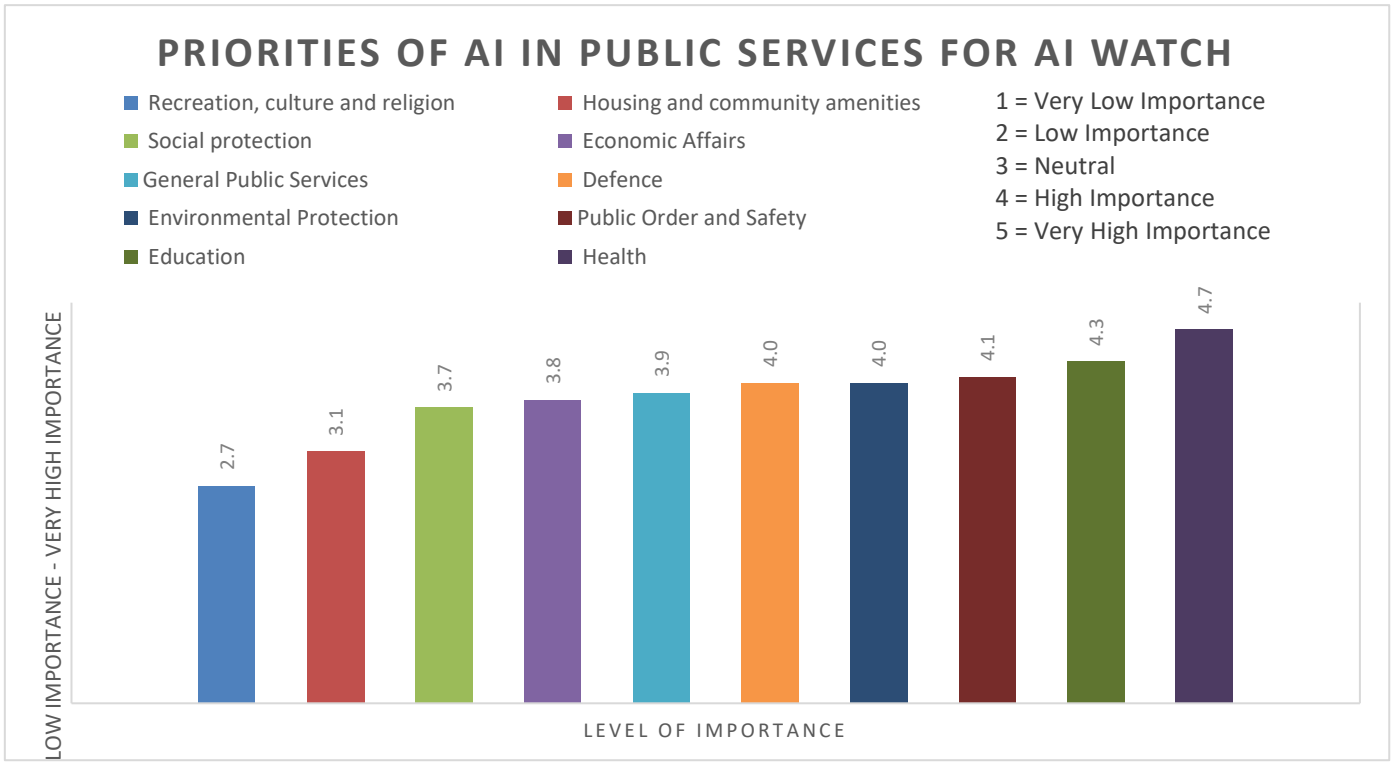

FIGURE 11 PRIORITY PUBLIC SERVICES TO FOCUS ON ACCORDING TO MEMBER STATES

As shown in **Figure 11**, respondents stated the following preferences for priority public services in the following policy domains:[30]

- **Health** (4.6/5 level of importance)
- **Education** (4.4/5 level of importance)
- **Public Order and Safety** (4.1/5 level of importance)
- **Defence and Environmental Protection** (4/5 level of importance)
- **Transport and Agriculture**, as a specific subdomain of the **Economic Affairs** policy domain.

Finally, the survey asked respondents to express their **expectations on what AI Watch could contribute** and whether there was interest in cooperating with the European Commission's Knowledge Service managed by JRC and CONNECT. Based on the responses collected the AI Watch should act mainly as a platform to share existing use cases across the EU. This should allow Member States to learn from each other, exchange experiences, applications and best practices with regard to the use of AI in the public sector.

The publication of studies, guidelines, peer-learning and capacity building may serve as a mechanism to share expertise and knowledge across Europe. Complementing this, the respondents also expressed interest in gaining comparative overviews of the state of the use of AI in the public sector, so as to better understand their own strengths and weaknesses. Such a comparison, however, should be based on practical and useful benchmarking tools to assist policy makers.

[30]. According to the Classification of the Functions of Government (COFOG) See: https://unstats.un.org/unsd/classifications/Family/Detail/4

Lastly, many respondents highlighted the need to define jointly what is truly meant by AI in the public sector, as many independent observers are currently struggling with the operationalization of the term (see also **§2.1** above). The AI Watch therefore should provide the first steps to a better, coherent understanding of what is to be considered AI in the public sector (and what is not).

In summary, while there is a general excitement about what AI can do to help governments move forward, and AI optimists believe that, in support of the right policies and if deployed with care, it can bring about better outcomes for everyone, there are also many challenges and grey areas which require attention and further research to better map the reality of use and impact of AI in public services, especially when it comes to setting up policy and service experimentations and transparent solutions, appropriately communicated to the citizens.

FIGURE 12 WORDCLOUD OF EXPECTATIONS FOR AI WATCH

Globally, there is still **limited understanding on how to harness the power of AI** and how to ensure sustainability, fairness, control of information asymmetry and risk of failure in these environments. Along this line, to better understand the potential of AI to support the digital transformation of government, **AI deserves an extensive assessment in the realm of public administration operations and related public service provision** (see more on this in **Section 5**). Literature and practice in the field show in fact that even when the latest technologies are introduced, critical barriers encountered in the eGovernment experience are still present and much of the research on AI often focuses solely on technology, failing to take into consideration the complexity of implementation within public administration. Insufficient consideration of the complex interactions between humans, institutions, politics and AI technologies may lead to overambitious statements of AI's potential not reflected in reality.

This is particularly relevant in light of the **COVID-19 pandemic crisis**, where many governments have been stimulating the development and adoption of AI technologies to tackle various aspects of the spread of the contagion. Some highlight the possibilities of AI technologies for developing medical applications to fight the virus (Bullock et al., 2020; Wang & Tang, 2020), while others notice the use of AI applications to monitor and enforce social distancing protocols (Naudé, 2020).

Although, at the moment of writing, the adoption and active use of AI technologies by government agencies to tackle the spread of the virus has been limited, with applications available being mainly Chatbots to provide information regarding health situation and safety guidelines, most of the applications are still under testing or initial adoption, leaving little room for studying the achieved effects of their implementation for the time being.

However, the current inventory does include a few AI use cases in Europe, such as the plans to use AI to assist in monitoring the beach capacity in Fuengirola, Southern Spain or an app developed in Poland which uses facial recognition to assist enforcement of quarantine rules. Nevertheless, preliminary findings let emerged the warning that too much trust and hope is placed in AI technologies to solve the crisis, which effectiveness may be heavily reduced if not combined with 'traditional' policy responses such as improved testing capabilities.[31] Careful assessment of these AI-driven solutions is therefore advisable, as to avoid situations where surveillance and monitoring of citizens is increased without substantial value for citizens in coping with the pandemic crisis (Kitchin, 2020).

[31] For example, Natalie Kofler & Françoise Baylis argue there are still too many practical issues limiting the effectiveness of any technological solution: https://www.nature.com/articles/d41586-020-01451-0, while Evgeny Morozov argues that widespread intentions to use surveillance technologies might do more harm than good https://www.theguardian.com/commentisfree/2020/apr/15/tech-coronavirus-surveilance-state-digital-disrupt

3 Use of AI in public services in the EU

3.1 Approach to case studies prioritisation and selection

As anticipated in the previous Section, notwithstanding its limitations, the preliminary exploratory mapping conducted has allowed us to gather a **unique inventory of initiatives of AI across Europe**. In fact, information on the use of AI in government and public services is not easy to find and collect, especially considering the nascent stage of development and the widespread scope of the investigation.

As already mentioned, not all initiatives claimed to be of AI implementation are actually so. Quite the contrary, often some cases do not go beyond the pilot or testing phase. For this reason, the review took into careful consideration the context in which AI-enabled services are being implemented or planned, as the aim of the analysis was to provide an overview of the state of the art and a prospective view, rather than an assessment.

Thus, the inventory built incrementally over the course of 2019 and the beginning of 2020 (now including about 400 initiatives altogether) has been screened and streamlined. For example, many pure research projects solely attempting to develop AI solutions, mainly based on machine learning models, without any prospective use in public services, have been excluded from the initial inventory. Similarly, all claimed AI initiatives for which it was not clear if they had ever been used or were still in operation, were also removed. This resulted into the selection of 230 initiatives that formed the sample for the analysis in **Section 2.**

Out of this sample, we went more in depth to identify the **effective use in public service**, so to discriminate what is not yet mature enough from what is instead 'happening'. Using the current COVID19 crisis as an analogy, we are not interested in solutions that cannot be immediately implemented, rather in AI-enabled services that are proving to be effective, or – at another extreme – generating e.g. social or ethical concerns while they are impacting – sometimes disruptively and perhaps even radically - the way government operates.

For this purpose, we defined an approach for selecting case studies and priority services to focus on, which is represented in the **Figure 13** below.

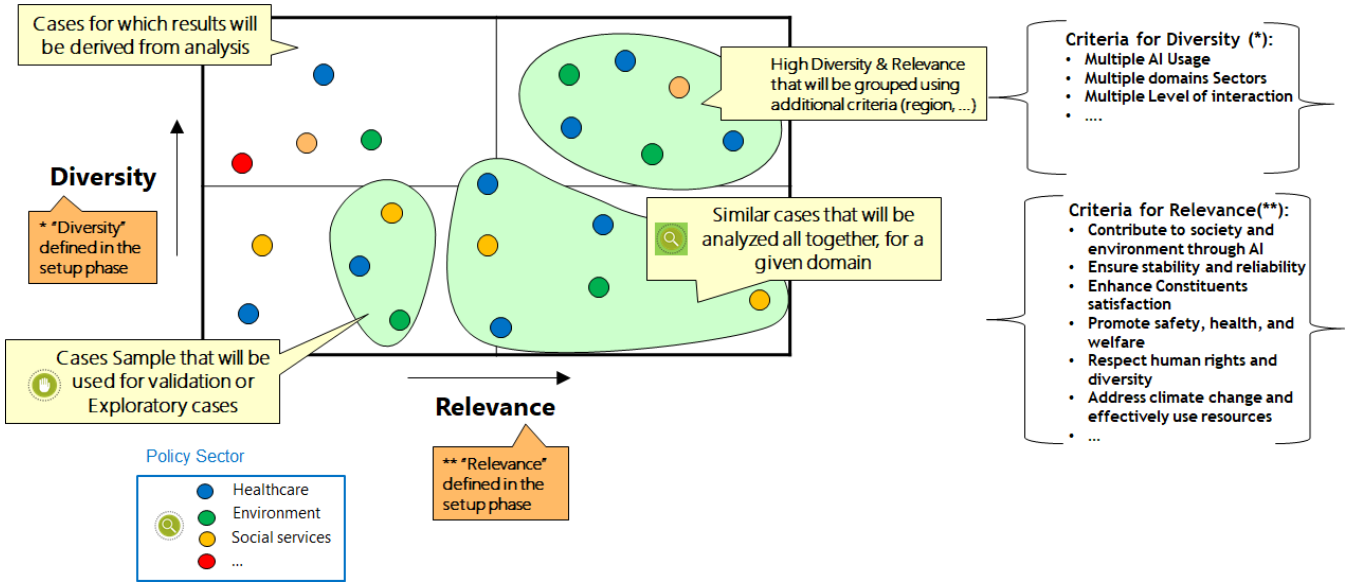

FIGURE 13 APPROACH FOR PRIORITISATION AND SELECTION OF CASE STUDIES

The figure shows the two main dimensions used for identifying the use cases as axes of a (x,y) plan: these are:

- The **'relevance'** of the use cases. This means that we are only interested in studying the use of AI in connection with government operations and public services delivery.
- The **'diversity'** of the use cases. This refers to a diverse set of AI technologies used in government and for public services provision.

The **illustrative use cases of AI in government and public services** have been selected out of a shortlist of initiatives lying on the top right corner of the (x,y) plan, i.e. meeting a number of criteria ensuring diversity of the AI technology types and relevance of the purpose of use. These two criteria have been complemented by a certain degree of representativeness of the European landscape.

However as the figure shows, use cases holding similar traits can be clustered by proximity. This has two advantages: 1) avoiding duplication of efforts in commenting all too close initiatives, and 2) identifying 'representative' cases for each cluster, which we will further analyse through in-depth case study analyses and focus groups, involving the responsible authorities and other relevant stakeholders at national and local level.

The main assumptions underlying the approach are that the AI typologies and the policy sectors represent the first mapping criteria, while the purpose of the AI use for different public services define the value drivers for indicating the potential policy impact. At the same time, the in depth analysis of case studies will serve to pave the way for a definition of the key drivers and success factors for overcoming barriers to AI use in public services, as element of a roadmap and guidelines to support AI strategic enablement in the public sector in Europe.

As a first step in this direction, in the following sub-section (**§3.2**) we describe a set of cases as illustrative examples of the landscape of AI use in public services. Each illustrative case has been assessed qualitatively based on a number of questions, such as: Which use cases are most relevant for the different policy sectors identified? What are the typologies of AI used? What are the innovation types? Which drivers and AI purposes can be identified in particular?

This exercise is also preliminary to identify the requirements required for building the modelling approach and estimating social and economic impacts according to a public value perspective, as indicated in **Section 5**.

3.2 Illustrative cases of AI use in public services

In **Table 11**, we provide an overview of the **eight (8) selected illustrative cases of AI use in public services**, summarizing the AI typologies, the policy sectors, the enablers and the expected impacts they may generate.

While these examples are not representative of all the possible types of use in public services, they do reveal the variety of AI currently being developed within the public sector, as well as the different purposes, challenges and consequences of their usage.

As illustrated earlier, these AI systems have been regarded to be diverse in their innovation potential. Some of these AI systems bring incremental changes to the public service delivery, while others aim to have much more disruptive changes, by redesigning existing work practices, sometimes enabling new forms of public service delivery which would not have been possible without the AI implementation.

At the same time, some of the more radical cases of AI-enabled innovation raise concerns and fears from citizens and regulators, as they may redefine the power relations within the governance arena and bring new risk unbalances in the democratic settings of European societies.

Among the cases described, in fact, we have also chosen to include some controversial cases of AI use, which have been halted or are under judicial scrutiny, due to ethical, legal and social concerns. These cases highlight that the introduction and use of AI systems in public sector organisations and environments is not as straightforward as the technological requirements alone might suggest. The perception of citizens and civil servants using these AI-technologies is to be considered a crucial element for the sustainable use and implementation of AI in public services and policies.

TABLE 11 LIST OF SELECTED CASES FOR ILLUSTRATIVE ANALYSIS

#	Initiative	AI Typology	Country	Administrative level	Purpose(*)	Policy sector (COFOG)	Key enablers	Expected impact
1	SATIKAS	Computer Vision and Identity Recognition	Estonia	Central	Enforcement	Economic Affairs	Satellite data, resource/data sharing, funding, trust	Improved administration and resource use, improved subsidy compliance
2	Predictive system	Predictive Analytics, Simulation and Data Visualisation	Belgium	Central	Enforcement	Health	Sharing of data/resources, high data quality, convincing staff of value	Improved inspection capabilities, improved welfare of children
3	Automated public services	Cognitive Robotics, Process Automation and Connected and Automated Vehicles	Sweden	Local	Adjudication	Social Protection	Developed online services, political leadership	Reduced waiting time, increased efficiency, improved citizens' experience
4	Chatbot UNA	Chatbots, Intelligent Digital Assistants, Virtual Agents and Recommendation Systems	Latvia	Central	Public services and engagement	Economic Affairs	Data on FAQ, external consultancy providing expertise	Reduced administrative burden and workload, improved public service, improved citizens' experience
5	Tengai	Predictive Analytics, Simulation and Data Visualisation	Sweden	Local	Internal Management	General Public Services	Consultancy assistance, Existing recruitment practices, culture for innovation	Unbiased recruitment services, higher quality personnel, lower recruitment costs and length
6	SyRi (Systeem Risico Indicatie)	Predictive Analytics, Simulation and Data Visualisation	Netherlands	Central/Local	Enforcement	Social Welfare	Sharing of data/resources, high data quality, political leadership	Improved inspection capabilities, improved social welfare, reduced misuse of public funds
7	Unemployed profiling	Expert and Rule-based Systems, Algorithmic Decision Making	Poland	Central / Municipal	Adjudication	Economic Affairs	Political leadership, Available data on unemployment, drive for modernization	Personalized public services, reduced unemployment, improved efficiency
8	VeriPol	Natural Language Processing, Text Mining and Speech Analytics	Spain	Central	Enforcement	Public Order and Safety	Collaboration with university, corpus of digital reports, integration into existing information system	Higher detection of false reports, higher productivity, reduced submission of fraudulent reports

(*) See in Figure 5 § 2.2.2.

The cases selected are further described in more detail below, discussing the specific features and elements of interest with regard to their use and potential impact.

3.2.1 SATIKAS, Estonia

Country	Estonia
AI typology	Computer Vision and Identity Recognition
Level of administration	Central
Policy Sector	Economic Affairs
Purpose	Enforcement
Main enablers	Satellite data, resource/data sharing, funding, trust
(Expected) Impact	Improved administration and resource use, improved subsidy compliance by farmers

In the Estonian Agricultural Registers and Information Board (ARIB), **AI is used in order to detect whether the agricultural grasslands have been mowed or not using image recognition**. This system, called SATIKAS[32], uses deep learning methods and convolutional neural network approaches to analyse the satellite data coming from the European COPERNICUS programme to automatically detect whether mowing has taken place on the Estonian grasslands. The optical satellite images from Sentinel 1 and 2 are analysed together with reference data of farmer fields, historical inspection logs and meteorological data from the Estonian Weather Service. This AI system is now regarded as one of the first AI applications used by the government in Estonia.

The mowing or grazing of the grasslands is one of the most mentioned requirements for all the different agricultural subsidies and has one of the highest amount of non-compliances in Estonia. Naturally, not all the fields could be inspected by manual labour, so in the last inspection for instance, only 5-6% of the cases were visited. Due to rising labour costs and regulatory requirements, an innovative solution using Artificial Intelligence was considered to optimize the inspection capacity and prevent farmers from missing the subsidy requirements.

While SATIKAS has been implemented since 2018 in ARIB, it originally started as a research project back in 2011 with the Observatory of the Tartu University. The development and implementation of the system was funded by the European Regional Development Fund to assist the development of public services with ICT. Various public and private actors have been working together in the development and adoption of the system within the ARIB organisation by sharing different data, sharing (machine learning) expertise and technological infrastructure to store the different data sets.

Civil servants working with the AI-system see the value of the system, although many were somewhat sceptical of the project at first, fearing the creation of a Big Brother state or the disappearance of jobs. However, after project pilots were conducted and trainings given, trust in the AI system has increased. The training had to ensure that the staff is aware that the system is not 100% reliable and have to combine their existing expertise with the recommendations of the AI. Furthermore, field inspectors have also realized that their jobs will not disappear but have changed as a result of the system.

The SATIKAS system is still under development and will expand its features and capabilities in the near future. While at the moment the system is able to detect mowing of grass, in the future it will be used for identifying different types of crops and trees as well.

3.2.2 Predictive System, Belgium

Country	Belgium
AI typology	Predictive Analytics, Simulation and Data Visualisation
Level of administration	State
Policy Sector	Health
Purpose	Enforcement
Main enablers	Sharing of data/resources, high data quality, convincing staff of value
(Expected) Impact	Improved inspection capabilities, improved welfare of children

[32] SATIKAS stands for SATelIlidi andmete KAsutamise Süsteem which translates to 'A system that uses satellite data'.

In 2014, the Flemish Agency for Child and Family (Kind en Gezin) developed an **AI system which enables more accurate predictions to detect day-care services which require further inspection**. These inspections enable the agencies to keep the quality of the day-care services high and to improve the wellbeing of children. The Child and Family agency does not carry out the inspections itself but works together with the Regional Health Care Inspection Unit of the Department of Welfare, Public Health and Family.

However, there is limited capacity available to conduct all the inspections. For a long period of time, there has been an interest to figure out how to optimise the inspection capacity. The use of data had been considered as way to enhance existing inspection practices and optimize the scarce amount of inspectors. The predictive system developed uses a supervised machine learning method (logistic regression and XGBoost) to analyse various internal and external data from the Health Care Inspection Unit. Combining the recommendations of the predictive system with existing staff experience and expertise enables more targeted and data-driven interventions.

During the development phase, the Agency worked closely together with the Data Science team of the Department of Welfare, Public Health and Family because there was already some expertise in text mining therein. In addition, a close collaboration was established with the Health Care Inspection Unit as they provided the data to be used in the system. A small budget of the Child and Family Agency for IT data science projects was used, but employees had to work on the model in their spare time as volunteers.

Now, the system is valued by civil servants, but it was noticed that there was still a need to convince colleagues of the value of the model. In particular, staff had to be convinced that the use of the model was meant to empower them, not to replace their expertise or control their work. In the end, the combination of showing statistical proof of the validity of the system as well as an emphasis on supporting human workers, rather than replacing them, further improved the acceptance and support of the public sector end-users.

Another important insight from this case study is the need for public organisations to provide continuous maintenance of the model and the underlying data in order to make AI adoption permanent. The AI system has had constant maintenance and improvement of the model in order to ensure its accuracy and reliability: if this maintenance was ignored, the accuracy of the model might decrease, which would reduce trust in the model and in other future data related projects.

3.2.3 Automated public services in Trelleborg, Sweden

Country	Sweden
AI typology	Cognitive Robotics, Process Automation and Connected and Automated Vehicles
Level of administration	Local
Policy Sector	Social Protection
Purpose	Adjudication
Main enablers	Developed online services, political leadership
(Expected) Impact	Reduced waiting time, increased efficiency, improved citizen's experience

In the municipality of Trelleborg, **AI technologies are used to automate various social assistance decisions** since 2016. That was the first municipality to use Robotic Process Automation (RPA) to handle various applications of social assistance. At the moment, the automated decision-making system is able to process applications for homecare, sickness benefits, unemployment benefits and taxes and has been regarded as a successful example for others to follow. Various other Swedish municipalities are exploring how to implement the Trelleborg model to gain access to the same kinds of benefits.

Previously, employees had to manually assess the applications received, which took considerable amounts of time and costs. With more than 300 applications of social benefits in the municipality every month, citizens sometimes had to wait an average of 8 days on the decision on their welfare-payments, sometimes up to 20 days. As a result of this waiting time, citizens would frequently contact the department about their applications, further increasing the workload of the staff. The decision to use AI to improve the process was taken to limit the waiting time and also various concerns related to delayed payments to citizens. However, the rejected applications are still handled by the case workers themselves.

The automation of the welfare services was not possible until an online process was made available for people to submit their welfare applications to. In 2015, Trelleborg was the first Swedish municipality to digitalize the

administration of social benefits. Now already 75% of the citizens use the online platform to access welfare payments, which enabled the acquisition of significant data and information to automate this process with RPA technology. Without the data coming from the self-service portal, it would not have been possible to automate these processes. Valcon, a local consultancy, helped to develop and implement the RPA platform.

As a result of the automation process, the waiting time for citizens on their welfare applications has been significantly reduced. It has been mentioned that in many cases the handling times for people in economically vulnerable situations has been reduced from 10 to 1 day, with all financial assistance decisions done within 24 hours. In addition, two employees in the Trelleborg administration have been reallocated to spend more time on other, value added tasks such as handling more complex cases. An early study on the use of automation found that there was a positive attitude from the staff towards the use of the AI-system as it made their work more effective and brought more legal certainty.

Despite these positive effects, there are also concerns with the use of automation. Already at the start of the implementation phase, many social workers were hesitant on using the system due to fears of losing jobs or passing sensitive social tasks on to computers. Other Swedish municipalities aiming to follow the automation of Trelleborg also met resistance from some of their local staff, some members of whom were even led to resign. Case reports mention the strong need for making the automation process trustworthy. If there is no trust in the use of AI, staff will be obliged to double check all processes, which might lead to a decrease in efficiency and effectiveness. Furthermore, some observers expressed concerns on the risk of excluding some more vulnerable citizens when all processes are automated online, as this makes it more challenging to assess individual needs.

While the AI-system enabled various social welfare benefits decisions to be automated, many other processes of the Trelleborg municipality still operate as in a traditional bureaucratic system. There are still many paper-based processes within the organisation which could lead to double documentation and inefficient processes, as well as existing software with very poor interfaces and usability levels. Hence. Process Automation in general and AI systems in particular can strongly improve one specific government process, but the interoperability with other organisational processes should never be forgotten.

3.2.4 ChatBot UNA, Latvia

Country	Latvia
AI typology	Chatbots, Intelligent Digital Assistants, Virtual Agents and Recommendation Systems
Level of administration	State
Policy Sector	Economic Affairs
Purpose	Public Services and Engagement
Main enablers	Data on frequently asked questions, consultancy assistance
(Expected) Impact	Reduced administrative burden and workload, improved public service, improved citizen's experience

In 2018, the Register of Enterprises of Latvia introduced a **Chatbot to answer frequently asked questions regarding the process of enterprise registration**. The name UNA has a symbolic meaning as it stands for Future Support of Entrepreneurs in the Latvian language. This way, UNA acts as an indicator for the future of the Latvian public administration. Chatbots are available 24/7 and thus able to make communication between citizens and the state more accessible and user friendly. UNA is available on both the website of the Register of Enterprises as well as on the Facebook page and as part of the Messenger application. UNA is able to answer frequently asked questions about the registration and liquidation of businesses, merchants, companies and organisations. If citizens already have an application in progress, they can also ask information about it.

UNA, which at present works only in the Latvian language, has been developed because the organisation had to respond to a lot of calls and emails, which were more or less the same each time. The high engagement of organisational resources dedicated to answering the same kinds of questions could easily be lessened by using Artificial Intelligence, especially Natural Language Processing techniques. A Latvian company, Tilde, specializing in AI technologies cooperated in the development of UNA. The usage of a conversational agent was argued to be highly successful and UNA has been nominated for numerous awards such as the OECD's Public Excellence, World Summit Award and others. According to some performance indicators, 44% of the questions asked on UNA are considered to be of general nature and easily taken care of by the Chatbot. Other non-standard issues are still handled by the support staff, but now they have more time to focus on more complex tasks.

3.2.5 Tengai, Sweden

Country	Sweden
AI typology	Cognitive Robotics, Process Automation and Connected and Automated Vehicles
Level of administration	Municipal
Policy Sector	General Public Services
Purpose	Internal Affairs
Main enablers	Consultancy assistance, Existing recruitment practices, culture for innovation
(Expected) Impact	Unbiased recruitment services, higher quality personnel, lower recruitment costs and length

The Swedish municipality of Upplands-Bro has started experimenting with the robot Tengai in their recruitment processes since June 2019. Tengai is one of the first **interviewer robots developed with the aim to make the recruitment process less biased than traditional interview practices would do**. The robot is adopted by the recruitment and staffing agency of the municipality, which has already made their recruitment processes less biased. For the last 10 years already, the agency have not used resumes in their recruitment process and growingly taken an interest in data-driven recruitment tools. Consequently, having a physical robot was regarded as the next step in preventing biases in hiring decisions. The idea behind the use of the robot was to avoid that a human person was present at the beginning of the recruitment process in order to neutralise any psycho-social prejudices.

The Tengai robot is the result of a collaboration between the municipality staff and the AI consultancy Furhat Robotics. After the Tengai robot was released, within a week, it was decided to adopt its services permanently. For the company this was also a first time, the municipal recruitment and staffing agency being their first public sector client.

The Tengai robot is seen to complement the recruitment process nicely, having been designed not to perceive the age, gender, clothing, background or other looks of interviewed persons. The municipality is using Tengai to first identify candidates with the highest general performance score, in order to make a shortlist for future selections. Here, Tengai works in collaboration with existing staff, as the recruiters analyse competency checks and schedule an interview appointment with Tengai. The robot then conducts the interviews to assess the candidates by analysing their behaviours, problem-solving capacities and other skills. If needed, the robot is able to ask follow up questions. The interviews are then analysed, combined with the competency scores. Tengai then makes a first selection of promising candidates. The recruiters of the municipality will conduct the final interview with candidates to assess their motivation.

The first results following the adoption of the Tengai robot have been regarded as successful and brought significant media attention to the municipality due to the innovative approach to recruitment. According to one of the directors of the municipality, the Tengai robot has made the selection and hiring processes faster, cheaper and more unbiased, freeing up crucial resources to be spent on other tasks.

3.2.6 SyRi (Systeem Risico Indicatie), the Netherlands

Country	The Netherlands
AI typology	Predictive Analytics, Simulation and Data Visualisation
Level of administration	Central/ Municipal
Policy Sector	Social Protection
Purpose	Enforcement
Main enablers	Sharing of data/resources, high data quality, Political leadership
(Expected) Impact	Improved inspection capabilities, improved welfare of children, reduced misuse of public funds

Various municipalities in the Netherlands have been using the SyRi **system to detect welfare fraud more effectively**. SyRi has been developed by the Dutch government and uses various risk indicators from existing governmental systems such as taxes, health insurance, residence, education and many more, in order to detect which addresses hold a higher risk of fraud or misuse of welfare benefits.

SyRi was developed in 2014 after multiple municipalities had been creating their own systems to detect fraud. To enable the sharing of different information items that are relevant for SyRi, the system operates on a legal basis which clearly indicates which kind of data can be captured, stored and shared.

While the core aim for SyRi is to tackle welfare fraud and reduce misuse of public funding, during the development of the system, the Dutch government also mentioned that the administration costs of detecting welfare fraud could be reduced and citizens might be more hesitant to commit fraud if they know that a governmental system is watching them. These goals are related to the more generic purposes of Syri to improve social safety and liveability of neighbourhoods. This is why most implementations of SyRi have been conducted in specific, usually less developed and poorer, territorial areas. The system does not make any decision itself, but provides recommendations for civil servants to conduct further investigations.

Various organisations have opposed the usage of the system. They argue that it causes too many privacy infringements and is discriminatory towards the poor and vulnerable citizens. The lack of transparency on the inner working of the system and the inability of the people affected to get to know their data have been criticized as well. The UN-rapporteur for Human Rights also expressed his concerns on the use of SyRi as it could be a significant threat to human rights.

In addition, the actual benefits of using the system have been disputed as well. While several projects in Dutch municipalities used the recommendations by SyRi, they did not allow to detect new cases of fraud in the end. Some projects revealed significant difficulties in integrating various data sources, which caused the recommendations by the system to become outdated and in fact unusable. In municipalities where the system actually gave recommendations on possible fraudulent behaviour, the success rate was very low. As, the costs of SyRi have been estimated to be over 325.000 euro per year, so that many have been wondering whether the system was worth the privacy and financial costs at all.

Following a court case, the Dutch court decided in early 2020 that the use of SyRi did not comply with Article 8 of the ECHR (European Convention of Human Rights), thus its usage has been cancelled. The judge ruled that the collective, economic welfare interest of preventing fraud weighed insufficiently against the social interest of privacy. Furthermore, the absence of disclosure about the inner working of SyRi makes its usage insufficiently transparent and verifiable.

3.2.7 Unemployed profiling, Poland

Country	Poland
AI typology	Expert and Rule Based Systems, Algorithmic Decision Making
Level of administration	Central/ Municipal
Policy Sector	Economic Affairs
Purpose	Adjudication
Main enablers	Political leadership, Available data on unemployment, drive for modernization
(Expected) Impact	Personalized public services, reduced unemployment, improved efficiency

As early as in 2012, the Polish Ministry of Labour and Social Policy (MLSP) started working on the reform of 340 labour offices (PUP - Powiatowe Urzędy Pracy), charged with analysing the trends and supporting the development of the labour market. The urgency of the reform was underlined by a general perception of PUPs being inefficient, understaffed and unfit to address the challenges posed by the modern labour market.

With that reform in mind - and without significant public spending increases at hand – the MLSP has scoped possible solutions that would ensure more efficient budget allocation. In this light, resorting to an **automated profiling system for unemployment** came across as a modern, cost efficient and individualized method of service delivery.

The process of automated profiling divides unemployed persons in three categories, taking into consideration a number of individual characteristics. Assignment to a given category determines what types of programs a beneficiary is eligible for (e.g. job placement, vocational training, apprenticeship, activation allowance). The system is based on data collected during an initial interview (e.g.. age, gender, disability and duration of unemployment), and a subsequent computer-based test that scores 24 different dimensions. Assignment to one of the three profile groups indicates the needed level of support and resource burden. Importantly, in one case categorisation translates into life-changing, binary decisions: state support or lack thereof.

However, the use of this AI system has received criticism from both within the organisation and outside. Firstly, the underlying working of the AI system is opaque as citizens are not made aware of the score received nor of how this score has been determined. Furthermore, the idea behind the profiling mechanism was to serve solely as an advisory tool, while retaining a human in the loop who would have the final say on the appropriateness of the categorisation.

Surprisingly - as a study found out - less than 1 in 100 decisions made by the algorithm have been questioned by the responsible clerks. Excluding a belief in the outstanding precision of the algorithm, other reasons for not challenging automated decisions include lack of time to consider more details; fear of repercussions from supervisors; and a presumption of objectivity of the process - all in all rendering what was supposed to be an advisory mechanism the ultimate decision-maker.

Many unemployed persons have complained through administrative courts, claiming the categorisation to be unjust. The Supreme Audit Office carried out a thorough control of PUPs, only to conclude about the ineffectiveness of the profiling system and its potential to lead to discrimination. Finally, the Human Rights Commissioner filed a formal complaint to the Constitutional Tribunal over a procedural issue, and the latter ruled that the profiling tool was unconstitutional. As of June 14th 2019, the system has been officially dismantled by the government.

3.2.8 VeriPol, Spain

Country	Spain
AI typology	Cognitive Robotics, Process Automation and Connected and Automated Vehicles
Level of administration	Central / Local
Policy Sector	Public Order & Safety
Purpose	Enforcement
Main enablers	Collaboration with university, corpus of digital reports, integration into existing information system
(Expected) Impact	Higher detection of false reports, higher productivity, reduced submission of fraudulent reports

The filing of fake police reports is quite common in Spain, especially for low level crimes. This practice is regarded as quite troublesome, as it can bring significant consequences for individuals, wasting valuable police resources and being often used in combination with other fraudulent behaviour.

Recently the Spanish national police have adopted the VeriPol **AI system in order to detect false police reports**. The system was designed to be integrated into the existing Spanish National Police information system called SIDENPOL, allowing for easier use and integration into existing work practices. Its development was the result of a collaborative project between the University of Cardiff, the Charles III University of Madrid and the Spanish National Police. The database of police reports was been made available for the researchers of the universities in order to train the AI system on. For this, 1122 reports were used, including 534 true and 588 false reports.

VeriPol exploits a combination of Natural Language Processing and machine learning classification algorithms, capable of estimating the probability of false police reports with significant accuracy. In addition to that, the system also enables insights into the differences between false and true police reports. For example, pilot studies found that false police reports are more likely to include shorter statements, focused on the objects which were stolen and lacking details.

Following the development, the system was tested in pilot situations in both the police department of Malaga and Murcia. These pilots have been regarded as successful because an increase in the number of false reports was detected. Furthermore, an anonymous survey among the staff showed that the VeriPol system was useful, easy to use but should include more functionalities to detect other forms of crime.

Now the system has been rolled out for use by all the departments of the Spanish National Police. The expected impact of the use of the system is to both detect false reports early, leaving more police resources available to focus on other tasks and reports, while at the same time deterring people from filing fake statements in the first place. An additional benefit of the system is to gain more insights into how people lie to police officers as well as to gain more knowledge in detecting true and false police reports.

3.3 Focus on AI and data governance

3.3.1 Exploring AI and data governance dilemmas and traps

As the previous case studies show, it is of prominent importance for successful AI adoption and implementation, to examine the **legal and regulatory aspects** as a complementary focus of the exploratory research to map and analyse the landscape of AI in public services. Having this goal in mind, we have conducted an overview of existing AI-related legal and policy instruments **to understand the role played in AI and data driven transformation** of the European public sector.[33] The aim was to better understand drivers and barriers to AI adoption in public services, and thus set the basis for both the analysis of national AI strategies and the development of the methodology for impact assessment, described respectively in **Section 4** and **Section 5**.

The research underpinning the analysis was structured in three stages: i) the analysis of legal and data governance implications of the use of AI in government; ii) the investigation of complementarities in data and AI governance processes; and iii) the assessment of which AI governance methods best supported trust and therefore strengthened government legitimacy.

As a matter of fact, the rush to understand new socio-economic contexts created by the wide adoption of AI is justified by its far-ranging consequences, spanning almost every walk of life - from labour markets (Frey & Osborne, 2017), through human rights protection (Eubanks, 2018) to healthcare (Jiang et al., 2017). Yet, the public sector's predicament is often a double bind: its obligations to protect citizens from potential algorithmic harms are at odds with the temptation to increase its own efficiency or - in other words - **to govern algorithms, while governing by algorithms**. Whether such dual role is even possible has been a matter of long lasting debate[34].

The main challenge stems from algorithms' intrinsic properties, which make them distinct from other ICT solutions, long embraced by the governments: vast computing power - incompatible with human cognitive capabilities; 'learning' capacity - autonomous knowledge creation happening without proper supervision; profiling ability – of categorizing traits and behaviours; and a nudging - incentivizing compliance – attitude: all these elements create externalities that rule-based programming normally lacks.

Reduced costs of digital information gathering (*price effect*) have led to the creation of unprecedented amounts of data (*quantity effect),* and shifted human activities away from non-digital environments (*substitution effect*), hence rendering data sharing one of the key enablers of modern public services, facilitating efficient and cost-effective service delivery (Martens, 2018). Its benefits include data linking – when two sets of records allow to derive previously unavailable insights; more tailored interventions, especially when data and project ownership is scattered across many agencies; better allocation of public resources; and monitoring of service outcomes.

The upside of sharing data in the research environment has long been appreciated and enacted – including for the purposes of transparency, reproducibility of results, research acceleration and fostering collaboration. At the same time, some diffused concerns linked with data sharing include: the risk of data loss; statistical disclosure; revealing the identity of an individual by the unique or rare combination of characteristics within a dataset; and the potentially negative impacts of secondary usage of personal data, which the owner would prefer to remain private in a given context (Involve UK, 2017).

Therefore, **a dilemma naturally emerges between securing citizens' privacy and maximizing the efficiency of service delivery**. As a rule of thumb, it should be borne in mind that citizens tend to be more likely to accept the necessity of data sharing, if there is a public benefit (however defined) clearly perceived. However, there is ample evidence that users find it difficult to turn their privacy preferences into meaningful decisions, sacrificing long-term privacy for immediate gains (Coll, 2015).

Furthermore, citizens' perception towards data sharing is only one of the issues to consider while using AI in the public sector. Relying on automated methods follows an all too familiar pattern: stakeholders initially consider decision making aids trustworthy, then after observing that errors happen they distrust even the most reliable applications. In brief, a too early adoption of faulty applications puts the trust in the system at risk.[35]

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[33] This exploratory study was conducted by Maciej Kuziemski, Research Fellow at The Berkman Klein Center for Internet and Society at Harvard University under the direct supervision of Gianluca Misuraca.

[34] See for example Lodge, M., Mennicken, A., (2017). *The importance of regulation of and by algorithm,* in: Yeung, K. (2017). *Algorithmic regulation: a critical interrogation*, Regulation & Governance

[35] As already highlighted in Dzindolet, M., et. al., (2003). *The role of trust in automation reliance,* International Journal of Human-Computer Studies

Similarly, public sector's reliance on voluntary best practices and self-regulation fares well, as long as no misdemeanour is found on the side of data processors - as exemplified by the public outrage and calls for regulation of Internet platforms that have ignored self-imposed standards, even after the introduction of the EU General Data Protection Regulation (GDPR) which has forced companies processing data to conform and introduce new handling and security practices.

Along the same vein, a recent study pointed to the ***abstraction traps* specific to machine learning** - or how algorithms fail to properly account for or understand the interactions between technical systems and social worlds (Selbst et al., 2019).

These include: a) *The framing trap* - failure to model the entire system over which a social criterion, such as fairness, will be enforced; b) *The portability trap* - failure to understand how re-purposing algorithmic solutions designed for one social context may be misleading, inaccurate, or otherwise do harm when applied to a different context; c) *The formalism trap* - failure to account for the full meaning of social concepts such as fairness, which can be procedural, contextual, and contestable, and cannot be resolved through mathematical formalisms; d) *The ripple effect trap* - failure to understand how the insertion of technology into an existing social system changes the behaviours and embedded values of the pre-existing system; and e) *The solutionism trap* - failure to recognize the possibility that the best solution to a problem may not involve technology.

3.3.2 Data governance regimes and regulatory tools for AI

The development of AI is driven by the merging of enormous amounts of data with powerful machine learning algorithms. However, it is impossible to talk about an emerging AI landscape, without looking at **existing data governance regimes and practices**. In fact, existing data protection and AI governance landscapes seemingly have a lot in common. Landmark achievements in the field of data protection – such as GDPR – would not be possible without years and years of negotiation, established fora, robust civil society advocacy, infrastructure and enforcement mechanisms. It would be only logical for AI governance – that is rule-making around algorithms that process data – to be established in accord, and as an extension of the legacy and infrastructure of data protection and competition regulation.

To the contrary, what seems to be happening, is an effort driven by the narrative of exceptionalism, whereby AI (however defined) is a phenomenon that is immune to existing governance structures, policies and laws. A gold rush to become a rule-maker in the field of AI governance has seen governments, international organisations, and corporations publish dozens of (similar) frameworks, strategies, and guidelines[36]. These documents reflect a longing after effective global coordination and rule-based order, yet – for the most part – omit or override existing governance mechanisms and institutions, as if they were completely mismatched for 'the age of AI'.

There have been recurrent warnings against the creation of such regulatory silos that would favour technocratic frameworks over a comprehensive view of the effects of data on the economy, society and environment. Many of these warnings could be applicable to the current setup of AI governance in fact.

Further, it would make an enormous difference to **think of AI governance as an extension of data protection and competition regulations**, acting hand in hand to reduce harms and secure human dignity. Such effort – instead of happening in a vacuum – would help update major existing regulations (i.e. GDPR) to make they work where they do not: by addressing massive imbalances in power, advancing data portability and privacy by design or securing EU wide, public digital infrastructure.

With the current turn of attention towards AI, it is useful to assess existing and emerging regulatory scenarios and tools that will gain traction in the future. Existing portfolios of regulatory measures include, but are not limited to: national strategies, antitrust and consumer protection measures, ethical guidelines, impact assessments, data protection enforcement, bans and standards and Intellectual Property (IP) protection rules.

At the same time, as the pressures to deploy automated decision making systems in the public sector intensify, it would be important to examine how machine learning and bureaucracy have both '*become generalizable modes of rational ordering based on abstraction and deriving authority from claims to neutrality and objectivity*'.[37]

[36] For an overview of the comparability of existing governance frameworks, see Fjeld, J et. al., Principled Artificial Intelligence: Mapping Consensus in Ethical and Rights-Based Approaches to Principles for AI. Berkman Klein Center Research Publication No. 2020-1. 2020

[37] As presented at the Data Justice Lab in 2019 on AI Realism and structural alternatives

With that purpose in mind, one should consider how existing data governance regimes and national regulatory practices can be *transforming* and not just *intensifying* existing power asymmetries. Nation states around the world are adopting bespoke strategies concerning the development of AI. These strategies prove to be a successful framework to direct public sector's attention, mobilize resources, and mandate horizontal coordination. At the same time, their wide-ranging scope and form, as well as often solely advisory nature, hampers meaningful comparison. Going forward, for national strategies to be successful, it would be necessary to develop common standards for goal formulation, execution and measurement.

One could argue that the strongest AI policy instruments can be found within the competition law and consumer protection legislation. Great concentration of data has translated into huge market power, which in turn has fuelled cases of market domination, unfair competition and infringement of consumer protection measures.

Recent reports by German and French antitrust authorities have concluded, in fact, that **existing competition laws are sufficient to tackle the challenges posed by unique market features related to AI**, such as pricing algorithms (Bundeskartellamt & Autorité de la concurrence, 2019). It is therefore no longer a question of the enforcers having the right tools to intervene, but rather whether their intervention can be prompt enough to prevent irreparable harms.

Furthermore, **there are instances when emerging technologies could also empower citizens**: a new wave of consumer-empowering AI such as automating the reading and legal assessment of online consumer contracts and privacy policies is making strides to counter market dominance and enforce compliance. This could assist in evaluating unfair contractual terms and GDPR infringements, using machine learning and grammar-based approaches.

By far the most diffused regulatory response, both within the private and public sectors, is the introduction of **voluntary ethical codes and guidelines to steer the development and use of AI**. The review by Field and others of almost 50 of such ethical frameworks developed globally shows that they cluster across eight main themes (privacy, accountability, safety and security, transparency and explainability, fairness and non-discrimination, human control of technology, professional responsibility and promotion of human values). However, these frameworks tend to give little attention to structural and fundamental issues such as power, democratic oversight, climate or health catastrophes, as the current COVID-19 pandemic has clearly demonstrated.

3.3.3 The need for a new paradigm on impact assessment of AI and data governance

Common perceptions of AI governance are heavily influenced by a prevalent narrative that sustains AI as a pervasive, inevitable, almost nature-like force that will change every walk of life. Proponents of such framing – which, not surprisingly, includes companies whose value offering is around AI-related products – direct our attention to implementation modes, and away from **questioning the foundations of our relationship with emerging technologies**.

This focus on 'how', and away from 'why', questions narrows the scope of reflection to 'fixing' or 'solving' the problems emerging with AI implementation, such as bias and unfairness. The proposition usually reads as follows: once we remove human bias from datasets used to train algorithms and encode fairness as an objective, we will be able to use computation widely to achieve better decision-making outcomes.

This narrow framing obscures the causes of AI problems, turning their solutions into mere technicalities. Reality goes differently: for instance, ensuring computational fairness can be counterproductive when the underrepresentation of one ethnic group in a dataset translates into increased targeting of that group. Above all, the inherent problem with centring attention on bias and unfairness is the underlying assumption that making human decisions more 'machine supported' is a value per se, and that the only question is 'how' and not 'why'.

With the **rise of the automated decision-making systems within the public sector and beyond it**, there have been proposals to extend the scope of existing impact assessments to cover the likely consequences of their usage. One of the seminal reports that initiated the policy debate around these issues, called for so called *algorithmic impact assessments (AIAs)* to become a part of public sector's procurement procedure. The proposed process was envisaged to mirror existing ones, used to assess e.g. environmental or privacy related impacts.

Some of the potential benefits of rolling out AIAs would include: better communication with the general public; increase of in-house expertise of public agencies; higher levels of accountability of automated decision-making systems and a meaningful way for the public to question them.

Another type of AI-related impact assessment was introduced under GDPR's art. 35, the so-called DPIAs - Data Protection Impact Assessments. These are conducted by data processors involved in activities that are likely to result in high risk to individuals' rights and freedoms, are focused on individual and societal harms, and provide the opportunity to assess not only pure compliance risks, but also broader effects on individual rights and freedoms, including the potential for significant social or economic disadvantage.

Scholars have established that DPIAs could be considered examples of AIAs, and analysed their shortcomings, including that the DPIA process leaves limited room for accountability and involvement of the general public (Kaminski & Malgieri, 2019). All in all, it is concluded that should sufficient levels of transparency around DPIAs results be kept, they could form a basis for a multi-layered explanation process.

With the start of the new decade, it is becoming clear that the AI policymaking landscape needs to move beyond the platitudes of voluntary ethical frameworks, towards more granular, context-specific instruments legitimized by the democratic processes. This implies in our opinion, **the need to move from the 'how' to the 'why' of AI governance**. Whereas the former focuses on improving existing systems, the latter poses fundamental questions about power balance and governance systems[38].

In the future, policymakers should thus abandon the narrative of exceptionalism and start learning lessons from other instances of quantification, perhaps considering ethical codes applicable across the board: from edit scores, through data prediction models (Saltelli, 2020). In addition, more detailed reflections might be ignited on the semantic interoperability of AI – to resolve framing issues that have annoyingly kept the value conflicts of all proposed solutions under the radar. In so doing, the discussions around technological impacts would move away from the circle of newly minted AI ethicists, towards the most affected targets - end users and citizens, the 'low-level experts' (Veale, 2020).

In this context, regardless of the regulatory approaches deployed by specific countries and at international level, it would be useful to consider the consequences of AI deployment through the four distinct lenses: design, institutions, timing and monitoring (Bennett Moses, 2016). More specifically:

- **Design** could imply to compare, since the early stages, technology specificity vs neutrality (limits of predictive capacity, interpretability, ease of application and enforcement), '*treating technology as the object … in the formulation of rules or regulatory regimes';*
- **Institutions** should be considered at the different possible levels of regulation, considering that the slower the institution regulating (eg. higher level) the more technology neutral it should be to allow for changes;
- **Timing** would refer to the so-called Collingridge dilemma (An information problem: impacts cannot be easily predicted until the technology is extensively developed and widely used. A power problem: control or change is difficult when the technology has become entrenched);
- And finally **Monitoring** might imply multiple dimensions: e.g. technology horizon scanning, impact assessment, iteration/agility, citizen participation etc.

While it is out of the scope of this report to enter into much detail at present, these lenses will return useful when discussing about the analysis of the public sector focus on AI national strategies, as well as in the conceptualisation of the methodology for impact assessment that will be outlined as part of the next phase of this research, and introduced respectively in **Section 4** and **Section 5** that follow.

[38] See for example Pasquale, F., The Second Wave of Algorithmic Accountability, Law and Political Economy. 2019

4 National Strategies: focus on AI for the public sector

4.1 Scope and approach

One of the main goals of the AI Watch is to monitor and analyse the implementation of AI national strategies developed by Member States in line with the Coordinated Action Plan.[39] The aim is to gather information on all EU Member States' national initiatives on AI, with the purpose of having a complete overview of national plans, measures and strategies related to AI. A first report on 'National strategies on Artificial Intelligence: a European perspective in 2019' has been published and provided input to the data collection and analysis of national strategies of the OECD AI Policy Observatory launched in February 2020.[40] The analysis conducted in 2019 as part of the AI Watch presents information on **EU Member States' national AI strategies** in a structured and comprehensive way, with the aim to develop a common AI Policy Framework that can be used for the comparison of the strategies, so to identify areas for strengthening synergies and collaboration.[41]

As we have anticipated, the European Commission has been regarding AI as a technology of strategic importance for the future of the European Digital Economy, and it has been actively stimulating the development and diffusion of these new technologies through funding and strategies. In this perspective, the proposal advanced by the European Commission for a Digital Europe Programme (DEP) aimed to dedicate a consistent part of the financial resources to AI development, showing the urgency of investments in the field.

As a matter of fact AI has been heralded as the key technology which will drive the next industrial revolution. To this end, an important aspect of the proposal for the Digital Europe Programme is the **crucial role that the public sector should play to make sure that AI is fully implemented in EU Member States**. To this end the DEP calls for ensuring that the public sector and areas of public interests, such as health and care, education, transport, and the cultural and creative sectors, can deploy and access state of-the-art digital technologies. Moreover, it suggest to promote offering public administrations access to testing and piloting of digital technologies, including their cross-border use, for which it is also requested to provide more interoperable public services across the EU and at EU level. In addition, the DEP propose to build up and strengthen the network of European Digital Innovation Hubs, to help both companies and public administrations, benefit from digital opportunities, aiming to have a Hub in every region and giving a particular attention to local administrations and especially cities, as it is at the local level that most AI applications in public services are indeed emerging.

The **potential of AI for the public sector** has been very high on the political agenda of EU Member States already since the Ministerial Tallinn Declaration on eGovernment adopted in 2017 and further reinforced at both the Digital and eGovernment High Level Conference organised under the Austrian Presidency of the EU Council in September 2018 and the Digital Government Conference: Next steps for a human-centric digital government, organised by the Finnish Presidency of the EU Council in October 2019, where the emerging debate on AI has been framed within the context of the policy priorities of the Tallinn Declaration and in particular the need to ensure enabling drivers required to nurture a data ecosystem fertile for AI to be grounded and effective.

In this perspective, to complement the mapping conducted on AI in public services (see **Sections 2 and 3** of this report) and supplement the analysis of the National AI strategies made as part of the AI Watch activities recalled above, we have carried out a review of the Member States strategies focusing on the activities dedicated to enhance use of AI for the public sector and to improve public services delivery.

At the end of May 2020 the following countries have published an official AI national strategy: Czech Republic, Cyprus, Denmark, Estonia, France, Finland, Germany, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Sweden, and the United Kingdom (part of the EU still in 2019), as well as Norway and Switzerland who also signed the EU Declaration on AI and are associated to the Coordinated Action Plan.

In addition to the 16 countries that have dedicated official strategies on AI by the end of February, 5 countries were in the final drafting phase and many others have developed various policy documents that includes references to AI.

[39] See https://ec.europa.eu/knowledge4policy/ai-watch/national-strategies-artificial-intelligence_en

[40] See https://ec.europa.eu/knowledge4policy/ai-watch/oecdai_en

[41] In this sense, the analysis of national strategies conducted by AI Watch follows a similar approach as that used in the AI strategies, presenting policy initiatives from a holistic perspective. To highlight the numerous economic and policy outlooks from which the transformative nature of AI can be explored, it presents policy initiatives across various policy areas, including human capital (i.e. educational development), from the lab to the market (i.e. research and development, innovation, business and public sector development), networking (i.e. collaboration and dissemination), regulation (i.e. ethical guidelines, legislation and standardisation) and infrastructure (i.e. data and telecommunication infrastructure). This analysis will be updated and released on an annual basis and the collaboraton with the OECD on collecting and analysing national strategies on AI in the EU Member States will be further strenghtened.

However, this review takes into consideration only the official strategies published by the end of February 2020 and available in English[42] as indicated in the table below.[43] [44]

TABLE 12 OVERVIEW OF NATIONAL AI STRATEGIES ANALYSED

#	Country	Published Date
1	Czech Republic	May 2019
2	Denmark	March 2019
3	Estonia	May 2019
4	Finland	June 2019[45]
5	France	March 2018
6	Germany	November 2018
7	Lithuania	April 2019
8	Luxembourg	May 2019
9	Malta	October 2019
10	The Netherlands	October 2019
11	Portugal	April 2019
12	Sweden	May 2018
13	United Kingdom	April 2018[46]

The aim of this Section in fact is not to provide a detailed analysis of the AI National strategies, rather to gain a better understanding of the main elements of each country's strategy relevant to set the ground for a deeper assessment of the specific initiatives regarding the use of AI in the public sector. This preliminary overview serves also to provide insights for **peer learning** through comparison of the different actions Member States are taking with regards to promoting the use of AI within the government and in public services.

While there has been great investments and interest in AI, the application of AI technologies within the government has not been gaining as much attention as applications in the private sector. Within this perspective, **the role of the government in AI is often seen merely as that of a regulator or as a facilitator**. The regulatory role of governments in AI falls on providing guidance or legal and regulatory frameworks to minimize the potential risks of AI while enabling the maximum opportunities from its application. In the facilitator's role, governments are frequently argued to be a source of funding (or other support) to stimulate the development and adoption of AI. Governments are often asked to improve the availability of their data to private businesses as to assist in the development of AI.

Actual usage of AI within the government in order to improve public services, policymaking and internal operations are frequently left out of scope or do not gain the same amount of interest and related investment. Therefore, this review is not about AI governance, rather regards the **actions governments are currently taking to stimulate or facilitate the development and use of AI in their public administrations**. Governance frameworks, such as ethical guidance or regulatory reform, are included only as they could be seen as an instrument to assist organisations to use AI (in a responsible way), but they are not the main focus of the overview as the uptake and use of AI does not solely rely on having ethical frameworks of course.

[42] In this respect it should be noted that not all strategies are (fully) translated to English at this moment which limits comparisons in case some elements are left out in the English versions. In our analysis a further check and deeper investigation has been however done for documents available in various EU languages mastered by the research team, including Danish, Dutch, French, Italian and Spanish.
[43] Differently from the analysis conducted as part of task 5 of the AI Watch, which includes information on all 28 EU member states, we considered only the AI Strategies that were officially published by the central government. Moreover, for countries with multiple AI Strategy documents, only the latest and most recent version have been consulted. Other documents published by non-governmental actors – no matter how influential in their respective country – are not considered official documents and thus not included in this report. Similarly, despite many countries have included AI-related actions in broader digitalisation strategies, we have not considered them in this review as these initiatives could be scattered among various policy documents. It is therefore possible that some Member States do have policy initiatives dedicated to stimulating AI in the public sector, but not specifically mentioned in their AI Strategy.
[44] Although **Latvia** published the official strategy in February 2020, the official translation to English was not available at the moment of preparing this report. Therefore, it has not been taken into consideration. It should however be noticed that from looking at the version machine translated and discussing with Government representatives it has an important focus on public sector and public services.
[45] The analysis considers the latest AI Strategy of Finland, containing insights from the 2017 AI Strategy and relevant action plans.
[46] We considered the latest official AI Strategy of the UK, although other documents on AI in the public sector not covered in this analysis.

4.2 A framework of analysis for AI strategies in the public sector

With the aim to shed some light on the depth and scope of the AI strategies of Member States, this policy review is complementary to the monitoring and analysis conducted as part of the AI Watch described above, for it provides a description of the main activities addressing the use of AI in the public sector.

In this respect, despite the fact that not all the 13 strategies analysed had a specific chapter dedicated to the application of AI in the public sector, the review looked at what countries are currently proposing and/or implementing to increase the uptake of AI within their administrations. The analysis contained in this report in fact does not intend to evaluate the validity of the instruments proposed, but rather to compare the efforts and plans of different countries and to serve as an instrument for knowledge exchange and peer-learning.

For this purpose, a basic framework of analysis has been designed and may be further integrated into the holistic approach developed for the analysis of AI Strategies of Member states, to which we already provided input and some inspiration. While of course there may be other, more general, relevant actions where the government might be directly or indirectly involved when it comes to AI, in this study we have limited our analysis to the text of the strategic documents.

While each strategy has different priorities relevant to each country's situation and context, a number of policy initiatives have been identified that seem to be occurring in several Member States and have been classified according to the following **'policy themes and actions'**:

a. Stimulating awareness and potential of AI

These initiatives focus on stimulating awareness among civil servants on AI in order to share their understanding and to provide opportunities to detect in which areas AI could be valuable for their work. While a number of different awareness activities are mentioned in the various strategies, three main ones are recurrent: holding **awareness campaigns** for civil servants or public sector workers on AI; organizing **regular meetings** between civil servants either in institutions or in specialized innovation hubs or by participating in **policy events** organised by European institutions or other relevant parties.

b. Improving data management for AI

These initiatives aim to improve the quality, availability and accessibility of public sector data in order to develop and implement AI. Some of these policy actions focus on improving the **data quality** of public sector data; both for internal as well as external use. Common actions that are part of this scheme are establishing **data management programmes**, organizing training to improve **data literacy** or changing the **technical infrastructure** to improve data governance and quality across the public sector. Another set of policy initiatives focus on improving **data access** to public sector data.

While some of these initiatives aim to improve the availability and quality of public sector data for private sector use, some strategies similarly highlight that other public sector organisations would be able to use these datasets, fostering inter-organisational data transfers. Initiatives such as stimulating **open data** or improving the open data websites for developing AI are frequently listed. **Plans to improve access by public institutions to private sector data** are also considered. Many private organisations hold data that is potentially highly valuable for public sector AI, but proper frameworks or arrangements are required to share this data in a responsible way with public institutions.

c. Building internal capacity on AI

Every technology offers very limited value if people do not have the intention or the abilities to use it at its full potential. For AI, this is no different. Therefore, some strategies focus on enhancing the **internal capacity** in public administrations with regard to AI-related skills. Public institutions need to have civil servants with the right capacities and skills to develop and/or use AI in their operations. Therefore some of the policy initiatives include having **AI training for all public officials** to make sure there is general knowledge of what AI is and could do in their respective tasks. These training activities will assist in building the know-how to detect where AI could be used, to build trust in AI innovations and to understand how current AI would be best combined in their work, assisting in the adoption of AI applications. While some training is of general nature, other policy actions focus on **specialized AI training** for technical personnel. These specialist training programmes are aimed at working with large datasets and focus on developing AI for public sector use. Lastly, some strategies also focus on creating **new positions or institutions** such as Chief Data Officers or specialized AI teams to stimulate AI development within the public sector.

d. Learning by doing

Since AI is still a new set of technologies, there is still a limited understanding of the way it is developed and applied, especially in public sector contexts. Therefore, a variety of countries have mentioned some **AI flagship projects** which will be used to learn from AI implementations and its effects. Based on the experiences of these initiatives, knowledge could be shared among institutions and revisions of the AI strategies made in the future. Understandably, some countries mention a large variety of different projects and others only a couple, but the general argumentation is that these pilot projects will serve as a benchmark for future AI initiatives. In some countries, **regulatory sandboxes** are being established to provide an experimental setting or safe area to test AI applications before they are deployed on a larger scale.

e. Developing ethical and legal AI frameworks

As there are many ethical concerns with the development and use of AI, and this is of particular relevance when it comes to public services, many strategies are exploring the ethical considerations of using AI. Some strategies mention the intention to **develop an ethical framework** to act as a guidance for all public sector AI usages. Such a framework document could assist in establishing trust – among both civil servants and citizens – to ensure that the AI used in government is of high quality and in line with ethical values. Other initiatives aim to conduct legal reforms in order to facilitate AI development and use as, sometimes, it is mentioned that barriers for AI development are the limitations in data sharing between public institutions or with private companies. Therefore, some countries are exploring how to review the **regulatory frameworks to facilitate data sharing** with public or private actors to develop AI. Some of these reforms will be sector-specific, such as in the healthcare sector, while some strategies mention the possibility to explore general **AI laws** which – among other goals – aim to clarify the accountability and transparency issues related to the use of AI in public services.

f. Allocating funding and procurement

This set of policy actions has the goal to stimulate the development and uptake of AI by providing adequate funding and mechanisms for adopting technological innovation in the public sector. Often, in fact, innovation in the public sector is hindered due to lack of appropriate funding schemes. Therefore, some strategies highlight the need to establish **special funding programmes** to provide financial resources for AI experiments and projects in the public sector. While the amount of funding of these countries varies, they do allow the initiation of some AI initiatives. Another set of policy actions focus on stimulating the private sector in providing AI solutions for the public sector. By **stimulating AI or GovTech startups** to develop AI tailored for the public sector, more creative AI solutions might be made available. As part of enabling public-private partnerships in developing appropriate AI solutions for public sector use, some strategies mention also the need for **revisions to existing public procurement regulation** in order to provide more accessible ways to contract with the public sector. It has been mentioned in various strategies that the development of AI requires a more interactive approach which should be reflected with new procurement processes.

Based on this framework of analysis, **Table 13** below provides an overview of the policy actions proposed in each theme, and of which countries mention them in their strategies. To this end, each strategy has been benchmarked to check if it lists one or more of the themes identified. This comparison only highlights the concrete policy actions or statements to do certain actions made in the strategies. Some countries in fact do mention challenges related to public sector adoption of AI, but do not provide any explicit action to tackle them and are therefore not represented in the overview.

Clearly, as with any comparison, sacrifices in nuances have had to be made to allow an easy review. In addition, the comparison does not take into consideration neither the depth nor the amount of resources that countries plan to invest in the different activities. Furthermore, as the analysis is mostly interpretative, some parts of the strategies might have been overlooked or even misunderstood, influencing the findings of this preliminary review. The aim of this study is in fact to provide a **contextual framework for the analysis of the current state of the art of AI use in public services in the EU** and could be used for **knowledge transfer among Member States**. It should thus be considered as an instrument to foster future analysis, rather to provide a conclusive statement on the actions that Member States are taking. Likewise, it can serve as a **call for action for Member States to devote more resources into promoting the use of AI within the public sector**, rather than mainly stimulating private sector adoption.

TABLE 13 COMPARATIVE ANALYSIS OF NATIONAL AI STRATEGIES FOCUS ON PUBLIC SECTOR

Policy theme	Policy actions	CZ	DK	DE	EE	FI	FR	LIT	LU	MA	NL	PT	SW	UK	Total
Stimulating awareness and knowledge sharing	Awareness campaigns on AI		X		X		X	X	X	X	X	X		X	**9**
	Hosting regular AI meetings	X			X						X				**3**
	Participation in EU events				X				X		X		X		**4**
Improving data management for AI	Improving Data quality	X	X	X	X			X	X			X	X	X	**9**
	Improving Data accessibility	X	X	X	X	X		X	X			X	X	X	**10**
	Access to private sector data													X	**1**
Building internal capacity	General AI training		X		X		X	X		X	X	X	X		**8**
	Specialist AI Training		X		X					X	X	X	X		**6**
	New positions or institutions				X	X		X			X	X		X	**6**
Learning by doing	AI pilot projects	X	X		X	X	X		X	X	X	X	X		**10**
	Regulatory Sandboxes for AI				X	X		X					X		**4**
Ethical and legal framework	Development ethical framework		X			X	X	X			X	X	X	X	**8**
	Reform of data sharing laws	X			X									X	**3**
	General AI Law				X										**1**
Funding and procurement	Funding for AI projects		X		X				X					X	**4**
	Stimulation of GovTech Startups	X						X				X		X	**4**
	Revising procurement processes	X			X	X				X	X				**5**

From the description of the strategies it emerges that not all countries have highlighted the same depth and scope of initiatives to stimulate the adoption of AI within the public sector, despite the declared interest or stated importance. In particular, as it can be seen in the overview, there are considerable differences in what actions Member States are taking to ensure the uptake of AI in the public sector.

Nevertheless, there are several policy actions which are mentioned more often in the countries' strategies. More specifically, the actions that are the most present are those aimed to **improve the data used for AI in the public sector**. Almost all strategies mention improving data accessibility of public sector data to improve and enhance AI uptake. In addition, improving the data quality of the public sector data is also frequently mentioned by the strategies, showing that many governments realise the importance of having a strong data infrastructure within the public sector as data is the lifeblood for any AI-applications.

Many strategies also mention exploring the hosting of **awareness campaigns** to highlight the importance and possibilities of AI in the public sector. Frequently, these awareness campaigns are based on the successes of AI pilot projects conducted by the Member States. Many governments mention existing projects or planned AI pilots which will enable learning by doing and to illustrate success stories across the government. Often, the strategies mention establishing **training programmes for civil servants on AI** in order to equip them with the required skills to either develop, procure or use AI technologies in their professions is mentioned.

Furthermore, many strategies underline plans to implement an **ethical or regulatory framework** to provide guidance for the deployment of AI in the public sector. These guidelines are argued to be a way to ensure the ethical use of AI and to minimize possible negative effects of AI within their societies. While the development of these frameworks is often mentioned, only one country aims to implement a general AI law to assist AI uptake in the public sector, if this is deemed necessary.

4.3 Overview of EU national strategies focus on AI for the public sector

Following the overview and comparison presented above, this sub-section describes the main relevant activities of each AI Strategy analysed. In doing so, a brief introduction into the aim of the strategy is given, followed by the goals and actions that each country is planning to take with regards to the uptake of AI in the public sector.

4.3.1 Czech Republic

The AI Strategy of the Czech Republic (or Czechia) contains a variety of actions to stimulate the use of AI within the public sector. Within the strategy, the public sector has been given a variety of roles in order to stimulate the development and use of AI. The public administration has been regarded as coordinator, co-coordinator and co-operator, depending on different activities. The government is seen as contributing to enabling the potential of AI by making data available, improving the digital infrastructure and introducing modern public services. Most of the strategy is aimed at developing the enabling environment for the Czech economy to make maximum use of AI by stimulating businesses, data standards, ethical and regulatory frameworks and research.

The document also highlights that the Czech government aims to create conditions for the development and application of AI in key public services, such as health and transport. The government acknowledges the potential of AI to improve a variety of governmental services and allows the public administration to be more productive with a better quality of services. It names several activities to stimulate these objectives, such as:

- Public administrations should be involved in AI policy development, particularly in R&D or knowledge transfer, including in digital innovation hubs. The government is exploring methods such as hackathons to create opportunities for the private sector to discuss possible new applications of AI in the public sector.
- By 2021, the Czech Government plans to identify specific legislative barriers to the research, development and use of AI in each sector
- There are also plans to develop a binding public administration data availability plan for the use of AI by 2021. Within this plan, special attention will be given to data standards. In addition, a programme for the collection and protection of high-quality health care data for the use in AI will be implemented by 2021.
- Furthermore, by 2021, the Czech government aims to have a start-up support programme to assist the establishment of businesses working on AI applications in the public sector. Especially AI for public services or those in areas of the national interest and specialization in the country will be valued.
- By 2021, there should be a number of AI pilot projects within the public administration and health care. By 2027, there should be ground-breaking AI projects within the public sector which enable simplifying the life for citizens and businesses, streamlining activities and increasing the added value of public services. There are plans to use AI in a variety of healthcare-related services, such as the administration of medical products and devices, reimbursement processes, reporting of interventions, predictions of costs, and the processing of data, as part of the National eHealth Strategy. Other plans include the use of AI in social services in order to facilitate citizens to stay at home, even when fragile conditions arise, as long as possible.
- The Czech Government will also promote the use of high-performance computing by the public sector.

4.3.2 Denmark

The Danish National AI Strategy has, among its key objectives, that the public sector should use AI in order to offer world-class services to citizens. There is a clear general understanding that a public sector using AI could improve public services to be more aligned to the needs of citizens. As a result, the Danish government has three overarching goals in the strategy with regards to public sector AI:

1. Being one of the leading countries in Europe in using data and AI to improve and target public services;
2. Having a public sector which uses in a systematic way a framework and methods to support the responsible use of AI. This in return ensures that the investment in AI is utilised as well as possible;
3. Public authorities should have a good framework to utilise data to develop AI solutions.

The strategy mentions that several public institutions in Denmark have already used AI technologies in various ways such as in application forms, customer service calls or invoicing. Experiences from the healthcare sector show that AI can indeed enable faster and better treatments. In addition to the national AI Strategy, the Danish

government launched the World-Class Digital Services programme as part of its public sector reform programme. This strategy aims to increase the quality of digital public services of which AI will be a part of.

As the Danish public sector is one of the most digitised in the world with access to a well-developed digital infrastructure, high-quality public sector data and a population with good IT skills, the strategy argues that the Danish government is in a good starting point for AI adoption and mainstream use in public services too.

More specifically, the Danish government is planning to create a responsible ethical and legal framework for the use of AI, for both the private and the public sector. It argues that the public sector will gain confidence when it will be working with these frameworks.

Other actions the Danish government is taking is in improving the data quality and quantity for usage by public and private actors for AI. To stimulate a variety of AI applications, there will be a common resource to develop language-based AI and better access to non-personal public sector data. The government expects that by making these resources available, both private and public actors will be able to develop higher-quality AI solutions utilizing already high-quality public data.

The Danish government is also aware that technology does not provide any value on its own, but only adds value in the interaction with people. This requires strong IT competencies in all layers of society, including the public sector. However, the government acknowledges that there is a lack of expertise and experience within the government on AI. Therefore, one of the ambitions of the government is to enhance digital competences in the central government. An internal academy for central government will be established in order to provide generalist training courses. In addition, the government will hold dialogues with universities working on AI in order to develop IT specialist courses for civil servants.

In order to promote awareness of the potential of AI and promote investments in the public sector, the Danish government will launch a number to initiatives to assist in the development, testing and use of AI by improving access to capital, consultancy services and experience.

In terms of funding, the government aims to allocate around 27 million euros to test and deploy new technologies in municipalities and regions. The National Centre for Public Sector Innovation will also support the deployment and use of AI across the public sector by disseminating experience from research and projects.

The strategy lists a number of current AI pilots in the public sector, some of which are labelled Signature Projects. These Signature Projects are supposed to improve the experience in AI solutions and to contribute to larger scaling of AI in all of the country. There are three main policy areas where Signature Projects are being launched: healthcare, social and employment services, and cross-authority case processing. These projects will be selected in collaboration with municipalities and regions and will be receiving funding to test the use of AI.

The following pilots and signature projects are mentioned in the strategy:

- Chatbot by the Ministry of Education
- Early diagnosis of cancer at Odense University Hospital
- Optimisation of the drinking water system in the city of Aarhus
- X-Ray Inspections to detect food quality by Innovation Fund Denmark
- Signature Project AI to assist general practitioners in decision support or diagnostics.
- Signature Project AI to shorten unemployment periods by making it easier for case officers to target employment efforts to individual citizens
- Signature Project AI to improve quality of citizen service centres, automate inquiries and prepare inquiries for processing such as the application for a building project.

4.3.3 Germany

The Federal Government of Germany has adopted its AI Strategy in November 2018. The main goal of the strategy is to promote the usage of AI in all parts of society in order to build up Germany's competitiveness. In order to stimulate AI adoption in Germany, the government is investing half a billion euros in AI policies.

Within the strategy, it is mentioned that AI offers a lot of potentials for the public sector and public administration's operations. However, this is also seen as a necessity as the expectations of citizens demand a response from public authorities to make interactions easier, faster and of higher quality as they are expected

in the private sector. As a result, the strategy has a specific section focusing on using AI for state and administrative tasks, although limited scope and depth.

The strategy mentions that the use of AI offers the possibility for administrations to provide information and services more targeted, tailored and accessible to citizens. However, the use of AI in the public sector will also mean that new requirements and rules should be put in place. Both the opportunities and the threats of the new technology should be explored. The strategy mentions that appropriate emergency response and protection mechanisms will be developed in order to counter AI-based attacks (especially in the military context).

In order to promote the usage of AI within the public administrations, the opening of public sector data is highly regarded and it is suggested to make government data open by default, unless serious restrictions in terms of data protection exist. This option will be explored in the evaluation of the Open Data Act. Another possibility to improve the provision of open government data is to establish an open data platform for the Federal Government. This provision of data online would enable different public organisations to use them for AI in their organisations. In order to increase this availability and quality of the data provided by the public sector, additional funding for data management across public authorities at the federal level will be provided.

4.3.4 Estonia

In May 2019, an expert group - the AI Taskforce - led by the Ministry of Economic Affairs and Communications and the Estonian Government Office have presented various proposals on how to advance the take-up of AI in Estonia. The current National Strategy is based on these proposals and aims to act as a plan to implement the Taskforce's suggestions. Consequently, the national strategy is a sum of different actions aimed to improve the uptake and adoption of AI in both the public and the private sector. The progress of the implementation of the actual plan will be monitored by a steering group from the Ministry of Economic Affairs which will present an annual overview of the progresses.

The current strategy indicates that the Estonian government will invest at least 10 million euros in 2019-2021 for the execution of the AI Strategy. Among the list of proposed actions, there is a specific section devoted to advancing the uptake of AI within the public sector, in addition to advancing AI uptake in research and development and in the private sector.

Overall, there are 30 proposed actions and existing measures directly addressing AI within the public sector, with several agencies responsible for them. However, while the strategy only sums up the action plans, further details or explanation on these actions are not included in the document.

Nevertheless, the Estonian Government has a variety of actions to promote AI and to identify ideas for potential use cases within governmental agencies. For the senior management of different government agencies, there will be training courses organised by the Government Office. For managers and specialists, there will be courses to highlight the value of data science and AI. In order to assist civil servants in the procurement of AI, training sessions will be made available and good practices shared.

There are plans to create a set of guidelines for the procurement of AI within the public sector as well as possibilities for joint procurement between public authorities, so that resources and development for AI can be shared. In addition, there is also an online course being developed and success stories of current projects will be published to raise public awareness of AI.

Other actions involve the launch of regular meetings between the public sector AI network and other institutions to share experiences and discuss ongoing activities. Various possibilities are being explored to disseminate knowledge and to exchange current experiences between different governmental networks.

The Estonian strategy also includes several actions to improve the technical infrastructure and data quality of the public sector to develop and use AI. One of the actions foreseen is the promotion of the availability of open data on the Government portal. Moreover, it is being considered to develop a new IT infrastructure for all public agencies which makes it possible to process data more cost-effectively, faster, and on a larger scale.

Additionally, there is the intent to order and make available as many reusable AI components as possible that could be used by other institutions based on their own needs, without having to start from scratch. In order to assist agencies in creating trustworthy data catalogues and metadata, data governance will be developed with data stewards in agencies and there will be a development of data management tools. Workshops on data governance will be conducted and the semantic interoperability framework will also be upgraded in order to improve the quality of data and meet the needs for AI development.

A variety of funding mechanisms will be made available to finance AI projects within the government. There will be funding available for both research on implementing AI-based decision-making in Estonian public administrations and for pilot projects for AI. The planned funding is aimed to be both flexible and sufficient to start projects which might have higher failure rates in order to learn from the experiences.

Furthermore, there is a review planned for the evaluation criteria of IT developments in order to plan them as ongoing system developments and not as one-off projects. Any new IT projects to be funded should meet the requirement to be AI eligible, meaning that the information system should create data in such a way that it can be applied for future AI projects.

Other actions proposed are related to the participation in European programmes related to AI policy development, such as being actively involved in the monitoring of the EU coordinated AI action plan and the AI High-Level Expert Group, as well as the establishment of a Chief Data Officer in all the public agencies, and the development of the concept of interoperable public sector AI (*BürokrattAI*), a shared AI interface for citizens when they interact with public services.

Finally, the creation of a technological sandbox to test and develop public sector AI applications in a safe environment is planned and if there were legal changes to be made to stimulate the uptake of AI, there should be a review of the current legal framework, before considering the development of a specific AI Law.

4.3.5 Finland

The Finnish government was one of the first European countries to release a dedicated AI Strategy. Based on the proposal advanced in May 2017, the strategy document has been published building on the experiences gained between 2017 and 2019 and lays the ground for the future. The aim of the AI Strategy is to prepare Finland for the age of AI by making it competitive, able to attract talent, and with an informed and educated citizenry. In the coming years, the Action Plan has a number of key measures which should be implemented. A monitoring group with representatives from both the private and the public sector will be tasked to assess whether the expected results are being achieved.

In the Finnish perspective, AI-powered public services are crucial in the further development of the country's economy and welfare. Efficient and effective public services strengthen the competitiveness of the economy, both by improving the ease of doing business and reducing administrative costs, but also by enabling a well-functioning citizenry, and by potentially luring talents from across the world.

One of the main themes of the Finnish AI Programme is to make sure that the public sector is able to use all the opportunities provided by AI and to deliver quality public services efficiently. As a result, the strategy encompasses many initiatives and plans to ensure AI technology is implemented effectively in the public sector.

A special group of the Finnish government is tasked with the government's digitalisation objectives and ICT development, including AI (*DigiNYT*). More concretely, one of the key actions of the AI strategy is focusing on building the world's best public services, acknowledging that AI technologies are merely a tool for implementing new and better public services, but that in the end, user acceptance for these new services is the key to success.

This key action is based on early findings of Finland's *AuroraAI* experiment. *AuroraAI* is an AI programme laying the foundations to transform the Finnish society towards an AI-society in a human-centred and ethically sustainable manner. The Finnish government argues that the world's best public administration enables a society where people are able to learn to understand their own wellbeing and where public services are tailored to citizens in a timely, secure and ethical manner. The wellbeing of citizens, companies and society should be the starting point of such an endeavour. Any reform of public services, the strategy mentions, should follow a life-events approach, where public services are structured around specific common events in citizens' life. This approach was experimented in the *AuroraAI* programme conducted between 2018 and 2019. One of the lessons learned from the experiment is the need for organisational silos to be opened up within the government and that human-centred operating principles should serve as a starting point for all future governmental services. However, it is also mentioned that the capability of employees to work with AI must be enhanced.

The *AuroraAI* programme also enabled the creation of a platform that various organisations – including those from the private sector – are able to join to provide their services for specific life events. It is expected that public services based on *AuroraAI* could potentially eliminate the need for citizens to go through different service points, enable better public services, create opportunities for citizens to take better care of their wellbeing and to facilitate collaboration between different organisations.

While the *AuroraAI* programme will be the leading one for the AI-enabled public sector reforms, high importance is given to the ethical concerns of using AI in public services. Therefore, there are plans for developing an

updated regulatory framework and share ethical design practices, for developing a monitoring system, and for promoting the involvement of citizens during the AI development process. Ethical issues related to AI systems transparency and machine supervision should therefore be tackled.

In addition, there are plans to create a 'sandbox' where AI could be developed and tested with personal data owned by public administrations. These sandboxes are argued to be very useful in building services around life events and development of AI in the public interest. In this respect, there is also a recommendation given to review the current Public Procurement Act in order to enable more effective public-private AI development.

4.3.6 France

France has been the first European country to adopt its AI Strategy, already in March 2018. The French strategy, called 'AI for Humanity', is based on the Villani Report; a document led by the renowned mathematician and politician Cedric Villani and based on large amounts of interviews with experts.

While a specific section on AI in the public sector is lacking, there are a number of actions and plans suggested in the strategy in order to achieve all the benefits AI has to offer for public services. For example, the strategy suggests that an AI component has to be integrated into the Digitization Strategy of the French Government in order to capture the opportunities AI presents for the development of public services.

In addition, the strategy highlights the potential of Artificial Intelligence to enable more inclusive public services. In the report, the difficulties for some citizens to obtain the right amount of information from governmental websites or the presence of friction points in online procedures which create difficulties in providing value of governmental service is emphasised. To tackle these issues, the strategy mentions that public authorities have to rethink the design of their administrative procedures in order to help citizens to benefit of public services. In this process, AI technologies could play a critical role in enabling the required change by absorbing complex administrative procedures or personalizing the user experience online.

Hence, the strategy calls for an open challenge to develop an AI-based platform for the public administration to manage and perform administrative procedures. Such a platform could help users to express their needs and qualify them in administrative terms using AI techniques to provide personalized services. This platform should be designed in such a way to follow and facilitate the user experience. However, if AI technologies are used in administrative procedures, the strategy mentions that citizens should always be aware about whether they are talking to a civil servant or to a virtual assistant; and that they should always be able to request assistance from a human when they encounter errors or problems during the service.

Moreover, the strategy recognizes that the development of AI in the civil service will only be advantageous if the working conditions for civil servants are improved. Any optimization of procedures has to empower civil servants, enabling them to provide human assistance to those who need it. Therefore, there is a strong need to train civil servants in digital tools – including AI systems - and public communication. This training is also needed in order to prevent subjective biases of automated procedures. Public authorities need skills in order to understand and tackle any form of algorithmic discrimination.

The strategy highlights that currently only a very small number of French companies have the innovation capabilities needed for AI development. At the same time, social enterprises and civil society organisations only receive a small amount of the investments in AI which has consequences for AI-based innovation in these fields. In order to improve the amount of AI in the social economy, public authorities should launch programmes to assist specific AI innovation in the social sphere, such as the establishment of an AI-skills and resource hub for actors working in social policy.

A selection of flagship projects using AI in the public sector is presented in the strategy report, including:

- A Chatbot providing easy access to regulations concerning Human Resources Management in the civil service, developed by the Inter-ministerial Centre of Information Technology for Human Resources.
- A Chatbot to provide easier access to the information system Chorus, developed by the Financial Information Systems of the Economic and Finance Department.
- An AI system to detect fraud in value declarations and to identify import trafficking developed by the French customs agency.
- AI systems against financial trafficking are used in the unit fighting against money laundering and the financing of terrorism.

4.3.7 Lithuania

The Lithuanian government has published its AI strategy in 2019 as a continuation of an expert consultation held in 2018. The AI strategy aims to communicate the current and future vision of AI in Lithuania as AI is expected to be one of the main contributors to global economic growth. Given the potential of AI, the strategy outlines a variety of actions to enhance the ethical and trustworthy development of AI in Lithuania in order to minimize any potential risks or harm. The document sets out a variety of strategic recommendations to ensure the utilization of the economic potential of AI systems. Several of these recommendations include actions to be taken for the uptake of AI technologies within the public sector.

In particular, in order to establish ethical and legal core principles for the development and use of AI, the Lithuanian strategy aims to establish an AI ethics committee which is tasked with reviewing the impact of this technology on fundamental rights. Among other tasks, this committee will also foster the development of AI-related skills in the public administration.

Another section in the strategy is dedicated to stimulating the integration of AI systems in economic sectors in which the strategy makes a distinction between the public and the private sector. The strategy mentions that AI promises a unique set of advantages for the public sector as it enables a lift in the wellbeing of citizens. However, the document highlights that among the obstacles for adopting AI in the public sector are the barriers to innovation. Public institutions are slower to adopt new technologies due to a lack of funding or due to their bureaucratic procedures. In order to tackle this challenge, the strategy suggests that the public sector has to adopt a culture of innovation, especially with regards to using AI. This should enable the promotion of AI solutions to be developed and tested.

Other mechanisms to increase the use of AI systems in the public sector include:

- The development of a regulatory sandbox to allow the use and testing of AI in the public sector for a limited time frame. Such a testing environment should enable to try out AI in a live environment and facilitate the definition of which solution should be integrated on a larger scale;
- Public institutions will also be supported in implementing AI systems that assist citizens or improve workflow, but details on how this will be done are not included;
- An AI Advisory Board will be established to assist the government in the decisions on future AI policy;
- New public-private partnerships will be created in order to establish better conditions for the development of AI systems.

As most of the national strategies, Lithuania also underscores that AI requires a significant amount of accessible and high-quality data. The higher the quality of the dataset, the more precise the AI system will be. However, within the government context, it is recognised that frequently data is captured by different administrations and fragmented, limiting accessibility. The public sector, therefore, should create a unified approach to data management which is favourable for the use in AI systems. It is therefore suggested that a data maturity model is to be introduced so that all public institutions could improve their data management.

Improving the data quality standard of public sector data goes hand in hand with the other plan to improve the open data ecosystem of Lithuania. The strategy highlights in fact that a centralized hub for data in the public sector might be established, to improve the accessibility of public data and to enable standards for data literacy.

The strategy also proposes a number of actions to create this AI-friendly data environment, including:

- Creating sandbox environments which help open public sector data for AI and to provide access to public data for individuals and organisations that want to develop AI solutions.
- Establishing dedicated funding for public sector data management plans to promote enforcement of data standards, furthering the environment of AI development and educating institutions on data literacy.
- Promoting and facilitating the collaboration between data scientists and experts to work together with the Lithuanian's data team in order to create the data management model of the government.

4.3.8 Luxembourg

Luxembourg has released its AI strategy in May 2019 as AI is considered a national priority for Luxembourg and it is regarded as a high potential technology with far-reaching potential consequences for Luxembourg, both positive and negative. In this perspective, the strategy aims to make sure that AI is built for people and

ensures that everyone investing, working and living in Luxembourg is able to benefit fully from these new technologies and from the digitalization of the country.

Digitalization is seen as a driver for the productivity of the economy but, the strategy mentions, solely pursuing economic goals is not sufficient. The government, therefore, aims to follow a human-centric approach to change the private, professional and public life of citizens. AI could simplify many citizen-to-government interactions which will result in timesaving, increased transparency, and more customer-oriented services.

The strategy recognises the importance of AI-enabled solutions to contribute to better public services for citizens and has a specific section devoted to AI for the public sector. It is mentioned that Luxembourg has already invested in eGovernment initiatives and has been investing in multilingual solutions to serve as the groundwork for any future AI application in support of public services.

AI thus follows the existing development of administrative simplification currently already ongoing in Luxembourg. It is expected that AI technologies can enhance the accessibility and availability of public services while enabling better, cheaper and faster administrative procedures. This, in turn, should stimulate positive social impacts either directly, through public service delivery, or indirectly, by assisting SMEs as they have less administrative burden from the government.

To ensure that AI-enabled public services can provide benefits to citizens, a number of actions will be taken, such as:

- Developing a comprehensive overview of potential projects based on criteria such as feasibility, necessity and value, to create human-centric AI solutions for citizens;
- Engaging with other EU member states in peer-learning while also considering the exchange of best practices, experiences and data;
- Contributing to the development of AI solutions, in order to build more efficient and personalized public administration services that serve all parts of society;
- Supporting Digital by Default with AI tools that can ease its implementation, reinforce customer-oriented services, and provide tailor-made and integrative products/services to better engage Luxembourg's diverse, multilingual and multicultural society;
- Fostering research and innovation that assess AI systems for the public sector; developing expertise combined with Civic-Tech applications, and disseminating results and questions to the public;
- Studying the creation of a structured public database ecosystem aimed at eliminating technical barriers for AI use cases.

4.3.9 Malta

The Government of Malta has published its AI Strategy in October 2019. The main goal of the strategy is to transform the potential of AI into a major contributor to the economic growth in digital innovation of Malta. By having the national strategy in place, Malta aspires to become the 'Ultimate AI Launchpad', meaning that it aims to become a place where local and foreign companies can develop, prototype, test and scale AI. The conditions in Malta should allow these organisations to springboard from Malta to the world.

The strategy recognizes that AI can play a significant role in the transformation of government and in improving the way public services are delivered and infrastructures are deployed. AI is seen to have the potential to make governments more efficient by improving internal operations and governance processes, thus making better use of taxpayer's money.

As a matter of fact, the strategy highlights that AI can improve almost everything a government does and enables new choices in the way services are delivered. Hence, the Maltese government intends to stimulate AI adoption in the public administration, to create an AI-powered government aligned with the current plans for the digital transformation of the public sector.

This objective to create the AI-powered government is supported by a variety of actions, including:

- Exploring how AI can be deployed in different areas of the public administration. Each ministry's Chief Information Officers will be tasked with this exploration;
- Launching various awareness campaigns for public officials in order to increase understanding of AI, why it is important and why the public sector should adopt this technology. Events will be held for all senior officials in the public sector so to build deeper insights into the AI Strategy;

- Updating existing public service training curricula to include AI-related courses. Public officials who wish to obtain (external) certifications in AI will benefit from financial support. In addition, a training and awareness programme for procurement with AI will be developed for the public administration procurement teams;
- Developing a guidance document with AI use case applications and a checklist as a reference for new AI project proposals;
- Drafting a technical policy statement to assist the adoption of AI for government services;
- Establishing a Technical Committee to review the architecture of solutions which are going to be implemented within the government;
- Changing the public procurement processes in order to support the procurement of emerging technologies such as AI.

The strategy also lists several high-profile AI projects which are expected to have a large and positive impact on the Maltese society. These projects will play a key role in raising the visibility of the benefits that AI can deliver to society and to businesses. The envisaged pilot projects are the following:

- AI for traffic management: a project where it will be explored how AI can be incorporated into the traffic control system(s) and Geographical Information Systems (GIS) of Malta;
- AI in education: a project to develop an AI-powered adaptive learning system to help students achieve better education outcomes and a project to develop a predictive system to identify early school-leavers;
- AI in healthcare: a pilot project to explore the use of AI on the Pharmacy of Your Choice platform;
- AI for customer service: a pilot on the central government information platform to create an AI-driven email assistant for civil servants. At a later stage, a chatbot will be developed to assist citizens in obtaining the information they are seeking;
- AI in tourism: a pilot will incorporate AI into the Digital Tourist Platform to suggest experiences for tourists and to forecast where tourists will go;
- AI for better utilities: a pilot will be undertaken where AI will be used to collect, organise and analyse data to discover patterns of water and energy usage. Another pilot will use AI to develop predictive maintenance and scenarios in utilities management and design of services at local and city level.

4.3.10 The Netherlands

The Dutch government has released its AI Strategy in October 2019. In the document, AI is regarded as a key technology that 'will transform the world', given the many social and economic opportunities of AI technologies which can be applied in many sectors of society.

However, due to the possible risk of a winner-takes-all scenario, the Dutch strategy aims to stimulate the Dutch development and usage of AI in order to avoid becoming too reliant on AI solutions from others. The strategy will be adjusted on a yearly basis and different ministries will be monitoring and evaluating their actions. The Dutch government will work intensively with the Dutch AI-Coalition: a community of businesses, government, academic and knowledge institutions who will work together on tackling the various challenges of AI.

The strategy has a specific section devoted to government use of AI and the role of government is listed throughout the report as crucial. It is mentioned that AI could assist in tackling many of the current social challenges and could improve many processes in government organisations.

To this end, the Dutch strategy mentions that the government should explore in which domains AI could assist public sector goals, but it highlights that it should work with companies using AI to tackle current policy issues. Good collaboration is needed in order to combine expertise and data from various sources.

As the potential of AI is considered to improve governmental operations, the aim of the strategy is to enable the government to implement these solutions. However, the adoption of AI in government needs technical, legal, ethical and organisational expertise and might require a complete rearrangement of existing processes or organisational structures.

The strategy then lists a few actions that the government is proposing to enable this adoption:

- In order to improve the knowledge and capacities of civil servants on AI, digital courses will be provided by the governmental digitalization academy. Additionally, the Dutch government will search for public-private partnerships to reinforce the knowledge inside governmental organisations;
- The Ministry of Internal Affairs together with the Dutch Enterprise Agency (RVO) will develop an implementation toolkit for innovative technologies. Together with the Association of Municipalities, they will host meetings to share experiences of AI used in the public sector;
- Technical experts meetings will be hosted by the Dutch government;
- The Dutch government aims to actively participate in European initiatives on AI for the public sector;
- The government is also aiming to learn from a few experiments and pilots on AI within the Dutch government. A variety of initiated projects are listed in the report.

As the strategy focuses heavily on stimulating the public-private partnerships between the state and the private sector, the Dutch government will also use innovative procurement processes to assist SMEs in developing innovative AI applications for the public sector. As an example, the strategy highlights the use of hackathons in the justice domain to develop AI solutions for concrete policy issues.

A number of policy domains where the Dutch government is exploring the use of AI or will stimulate other actors to use AI in their fields are mentioned and are listed below:

- The use of AI in the field of security and justice. The Dutch government plans to explore how AI could be used in the police forces, the courts of law and in defence. The strategy mentions that AI is already being used in the police and in the Ministry of Defence;
- To stimulate the development of AI in the police, a National Police AI Lab has been established. This Lab is planned to conduct research on AI in the police force and to attract talents to work for the national police;
- The Ministry of Defence plans to conduct research to discover the implications of AI for the defence domain. Based on current experiences and knowledge on AI, the Ministry will develop a specific vision for AI in defence;
- In connection with the legal and ethical challenges in the use of AI, the Ministry of Health will publish a roadmap on AI in healthcare to assist relevant stakeholders in using AI to improve the prevention of diseases, to improve diagnoses, treatments and logistics;
- The Ministry for Agriculture will also explore how to stimulate the use of AI in agriculture together with social actors and the AI Coalition, making investments to further develop the data infrastructure for agriculture.

For all the AI used in governmental organisations, the Dutch government stresses that the algorithms should be human-centric and trustworthy. Hence, the government will stimulate the use of AI Impact Assessment tools, audits or certifications.

Moreover, in all research activities, ethical considerations on the use of AI must be considered and a series of design principles are being developed for specific use on AI systems in the judicial domain.

4.3.11 Portugal

The Portuguese government presented its national AI strategy in April 2019. The document lays out the amplifying effect AI will have on the process of digitisation, recognizing the increasing impact and pace of technology on the lives of people. Hence, the strategy aims to prepare the Portuguese economic, social and cultural landscape on the coming AI Revolution.

The main general objectives of the strategy are to include additional economic growth, establish scientific excellence and to increase human development in an inclusive way. In addition, a clear vision on the impacts of AI is aimed in order strengthen societal robustness. The strategy suggests stimulating ethical-by-design methods to improve society and democracy with AI.

The strategy has a specific section devoted to the modernisation of the Portuguese public administration. In this vein, AI and data science are considered important tools to provide better public services and to adopt evidence-based approaches on public policy design. By using and combining administrative data with other

external data, public policies and decision-making processes could be improved by supporting evidence-informed choices rather than policy based on intuition. Furthermore, using the massive amounts of data currently at disposal of the public administrations, it is possible to change the public service provision from a reactive to an anticipatory approach. The strategy, therefore, aims to contribute to strengthening the scientific and technological competences to deal with large amounts of data within the Portuguese public administration.

At the moment, there are 19 R&D projects funded through the ''Mobilising programme to foster AI in public administration'', with 4 pilot projects between the R&D community and public administrations and 15 additional projects selected from a scientific panel. There are plans to fund more projects in the future.

The strategy lists some specific objectives, including:

- Making administrative data easier to access by academic, public and private actors, while providing a secure and privacy-protecting access;
- Fostering collaboration between public, private and academic organisations concerning the use of AI;
- Promoting new and innovative solutions for the simplification of the public administration.
- Reinforcing public sector skills and capabilities with respect to AI and data science;
- Ensuring the ethical use of AI in public administration, including public sector organisations in the ethics committee for AI.
- In order to meet these objectives, the Portuguese government is planning to:
- Develop a National Data Infrastructure that will act as a centralized repository for administrative data. This infrastructure will be managed by the National Statistics Office;
- Promote AI experiments, new ideas and concepts through the cooperation of academic, private and public sector organisations;
- Develop an ecosystem to increase the number of companies, start-ups and government actors benefitting from collaborative platforms;
- Create a Collaborative Laboratory for AI in the Public Administration and enhance the AI and data science skill qualification programmes within the public sector together with academic institutions.

4.3.12 Sweden

The Swedish Ministry of Enterprise and Innovation released its AI strategy, titled 'The National Approach for AI' in May 2018. The strategy highlights that Sweden aims to be the world leader in harnessing the opportunities presented by the digital transformation. AI is part of this development and is considered to have high potential to contribute with significant benefits in a wide variety of areas by increasing economic growth and contributing to finding solutions to environmental and social challenges. However, Sweden is aware of the need to create the correct enabling conditions to make AI able to strengthen competitiveness and to enhance welfare. In addition, the strategy mentions that AI has a considerable potential to contribute to a more effective and relevant public sector. Hence, the strategy aims to make Sweden a leader in harnessing the opportunities that the use of AI can offer for the public sector.

The objectives and actions of using AI in the public sector are closely linked to the digital transformation goals and the Digital Strategy of the Swedish Government. While the strategy acknowledges the potential of AI in the public sector, there is neither any specific section nor any dedicated action aimed at stimulating AI use in the public sector. Instead, the strategy mentions certain requirements and the wish to take specific actions to achieve them.

One of the conditions to benefit from AI is that a sufficient number of people should have the skills required to develop and use AI. This means that AI knowledge and expertise should be present throughout all of society, including government agencies. This relevant AI knowledge is not only for technical experts, but for all professionals interacting with technology. Hence, the strategy highlights the need for strong collaborations between private, public and academic sectors in AI.

Furthermore, AI can only create value when technology is widely used in the private and public sectors. Therefore, it is in Sweden's interest to stimulate innovative applications and the use in society in various ways. In order to accelerate the introduction of AI, it is mentioned that Sweden needs pilot projects, testbeds and environments for the development of AI in the public sector.

The strategy also recognises that there are ethical risks when AI is applied in the public sector. The use of AI should be transparent and should take into account moral and legal issues. Sweden is planning to take the lead in ethical, safe, secure and sustainable use of AI. The strategy requires the design of an ethical and regulatory framework with principles, norms, standards and rules to balance fundamental needs for privacy, ethics, trust and social protection with access to the data needed for AI. This is deemed important considering that the Swedish public sector already has a high amount of high-quality data that could be useful for the development of AI, but needs risk governance for data management, curation and use.

The strategy acknowledges the need for guidelines and standards to guide private and public stakeholders, since AI standards have the potential to promote technical, semantic, legal and other forms of interoperability between public and private institutions. As Sweden is a relatively small country, the strategy mentions the need to develop partnerships and collaborations on the use of AI with other countries, especially within the EU.

4.3.13 United Kingdom

The United Kingdom has released its 'AI Sector Deal' in May 2019. In this policy paper, AI is presented as one of the Grand Challenges of the UK, and is considered as having the potential to solve complex problems in a fast way, freeing up time, and raising productivity. In order to realise all the social and economic benefits, the UK mentions the need for a strong partnership between business, academia and government.

The strategy is built on five foundations: ideas, people, infrastructure, the business environment, and places. While the strategy focuses on the industrial uptake of AI, there are a number of policy actions mentioned with regards to the public sector. The use of AI in the public sector is seen as a way to better deliver digital public services. A new Government Office for AI, responsible for overseeing the strategy implementation, is planned to be established.

The strategy also highlights the need to have the right digital infrastructure in order to meet AI-related ambitions. This digital infrastructure is highlighted as physical, but also in terms of data infrastructure. This is why the UK government is already making public datasets open. Significant challenges, however, are highlighted in sharing private-sector datasets and the strategy proposes to explore how to enable the sharing of private datasets between private organisations and the public sector. In particular, the UK government is exploring a data sharing framework called Data Trusts to protect sensitive data, facilitate access, and ensure accountability, addressing different barriers to sharing data together with major data holders in the private and public sectors. Moreover, the strategy includes plans to enhance the existing data infrastructure to publish more high-quality public data in an easily findable and reusable format needed for machine learning. Legal certainty will be provided over the sharing and use of data with the Data Protection Bill.

Finally, in order to stimulate the uptake of AI within the public sector, the strategy plans to create a 20 million GovTech Fund to support businesses and to provide government with innovative solutions for public services, while assisting the growth of the UK's GovTech Sector. In addition, the R&D spending across the public and private sector will be increased. The industry is expected to work closely with the government through the AI Council to tackle data ethics questions and the role of AI in the public sector.

4.3.14 Summary of the overview

Summing up, the analysis of AI national strategies reveals a **wide variety of initiatives and techniques that Member States are putting in place or intend to put in place to foster the use of AI in the public sector**, both directly and indirectly.

Using the vocabulary of a classic categorisation of different policy instruments (Bemelmans-Videc et al., 1998) into 'sticks' (i.e., regulatory instruments), 'carrots' (i.e., economic and financial instruments), and 'sermons' (i.e., soft policy instruments, such as training and dissemination programmes), we can observe that, for the time being, the emerging national strategies on AI in the public sector in Europe seem to privilege a 'sermon approach' over sticks and carrots. Soft policy instruments, such as campaigns for awareness, encouragements to improve data quality, and employee training, are in fact prevalent across almost all countries. Regulation and financial resource allocation, such as project funding and procurement process reviews, on the other hand, are instruments that are less uniformly distributed at this stage.

This overview of national approaches to fostering the implementation and use of AI in the public sector is a snapshot of a swiftly developing scenario, which is very likely to transform over time. However, such an attempt to capture the 'spirit of time' of European initiatives for AI in the public sector can serve as a practical first step to systematically assess potential impacts of AI in public services in the European Union.

5 Assessing the impact of AI in public services in the EU

5.1 Theoretical underpinnings of AI use in the public sector

As we know, digitalization is not anymore an emergent phenomenon but the actual shape of everyday life interactions and transactions. Within this context, as we have already emphasised (see **§1.1** and throughout this report), AI has taken the stage in the last three years after a historical presence in academic research, and it is often overlapped with digital innovation, *tout court* (Viscusi et al, forthcoming).[47] Thus, in this report we consider AI as another kind of ICT-enabled innovation, having its own characteristics, yet not independent from the ICT capabilities developed for previous configurations of digital government and governance. In this perspective, for each digital governance configuration there is a type of innovation attitude within the public sector that can be identified for the considered domain of intervention, as described in **Figure 14.**

According to the typology, ICT-enabled innovations can produce changes in governance processes in four ways: Technical/Incremental change; Organisational/Sustained change (both clustered as Type I change); and Transformative/Disruptive change; Transformative/Radical change (both clustered as Type II change) (Misuraca, 2012 and Misuraca & Viscusi, 2015). We have already met and operationalised these four types of innovation potential in **§2.2.4** while analysing the 230 cases in our census of AI initiatives.

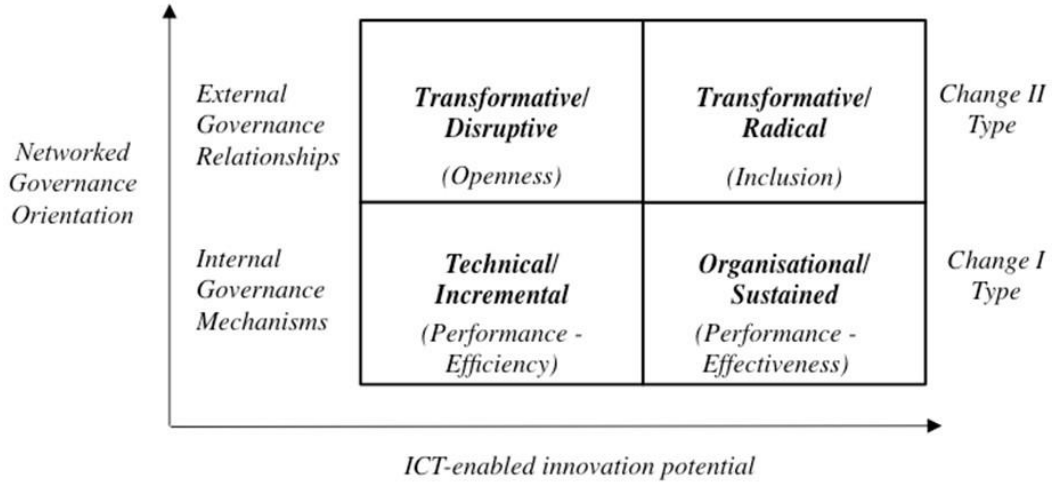

FIGURE 14 TYPOLOGY OF CHANGES FOR EXPLOITING ICT-ENABLED INNOVATION POTENTIAL (MISURACA AND VISCUSI, 2015)

What the figure above tells us is that technical/incremental change (or the automation of existing service and administrative routines and tasks) is probably the first step of an idealistic transition process, focused on the improvement of efficiency of internal governance mechanisms (Change I Type – bottom left box). It is therefore not very surprising that an overwhelming majority of observed cases (127 out of 230) actually stays on this step according to our interpretation.[48]

However, the second step of this transition can go in two possible directions, exemplified by the arrows: either the further reinforcement of Change I Type (bottom right box) with a growing attention to effectiveness rather than merely efficiency in performance, or the jump to Change II Type (top left box) with the immediate result of opening up internal governance mechanisms with a more outward looking approach (e.g. using AI solutions to add a further source of relevant information on what service users think, do, etc.). With all the caveats related to the way our database was created, it is quite significant to note here that 58 cases belong to the bottom right and 42 to the top left cluster.

Finally, the ideal landing point of this transition process is to possibly achieve the top right box where a more pronounced external (networked) orientation of the governance system is coupled with the achievement of concrete results in terms of organisational effectiveness in performing its own duties. In our census, only 3

[47] See also the TRIGGER Project for a 'deep dive' on AI and digital innovation - https://trigger-project.eu/
[48] See the mapping analysis done in **§2.3** above.

initiatives belong to this cluster. Compared with the bottom right box, the resulting innovation is not only sustained at organisational level, but also transformative with respect to the underlying governance model. Compared with the top left box, we are entitled to speak of inclusion rather than merely consideration of contributions coming from the outside of the organisations. In this sense also goes the terminology, with a peculiar use of the term 'disruptive' – as distinct from 'radical' – that is more attuned to the original meaning by Christensen (1997) as elaborated in detail by Misuraca (2012) building on King and Tucci (2002).

A systematic use of AI in fact - starting with low-risk applications in service delivery - could also pave the way for citizen feedback and engagement and enhance the use of emerging digital tools. With increased interaction with AI, and by building upon existing modernization efforts, government delivery of public services could soon mirror the ways citizens interact with technology in their personal lives. Implementation of and use of AI in public services may also become an indicator of how the public sector can leverage other emerging digital tools. As we know however, AI raises questions around privacy, the accelerating pace and adoption of digital tools, and whether humans can keep pace with the rate of automation overtime.

In the paper by Misuraca and Viscusi (2015) the figure is borrowed from, while it certainly is the more intense use of ICTs that supports, facilitates or complements existing efforts to improve governance mechanisms, other 'softer' elements (e.g. cultural or socio-political or knowledge and skills related) come into play to determine the transition from Type I to Type II Change and within the latter, from disruptive to radical transformation of public service, policy and administration. Such elements become essential to consider at the 'meso' level of abstraction – away from the specific government/governance process, in a more reflective attitude towards a strategic decision such as that of moving from one box to another – where the picture is positioned in.

As a consequence of the above discussion, it is worth emphasizing here that the framework assumes as key argument that **ICT-enabled innovation cannot be decoupled from public administration reform** (Misuraca et al., 2011; Misuraca & Viscusi, 2014, 2015), thus encompassing public services and their impact on welfare and citizens satisfaction (Larsson & Grönlund, 2014).

The same line of reasoning can be applied at the meso level to the evolution of the government interests toward the adoption of AI solutions through dedicated innovation initiatives. These would eventually move from simply accompanying or supporting existing systems to actually substituting them. Just to make an example of current chronicle, this would imply leveraging smart cities and digital initiatives to control and contain the spreading of epidemics among the population (Normile, 2020; Strickland, 2020).

In this regard, it is worth noting that innovation and advance in digital systems (e.g., through AI) and networked governance may enable bottom-up welfare state initiatives that may be produced and promoted by non-state actors governmental organisations, and enlarge the scope of most AI-enabled initiatives in the public sector. To the extent that the initiatives mapped in this report are still mainly focused on performance as a value driver and on a type of innovation that is mainly technical and can be associated with incremental changes and/or early adoption phases, this adds a further dimension to the policy efforts of governments and other state institutions.

Indeed, state institutions are often not aligned with the need for knowledge capital change required to fully exploit the effects of digitalization (and AI in particular). As a result, they risk to exclude people without personal means and capabilities, such as, e.g., workers raised within the framework of social protection typical of the industrial production model of the second half of the 20th century, who are facing the challenges of digitalized social services often without adequate skills and digital literacy (Hargittai & Hinnant, 2008; Hargittai et al., 2019; Helsper, 2016).

It is worth noting that the degree of maturity of the systems (both at digital and government levels (Andersen et al., 2012; Pereira & Serrano, 2020) is an input to the framework outlined here and may also enable different networked governance configurations; these latter correspond to various degrees of *openness* or *inclusion* reached by the public sector as well as the participation of the citizens. Consequently, the different digital governance systems have different impacts on the governance configuration of the stakeholders' networks, which may require or enforce innovation to a given context and for certain governance models characteristics.

Moreover, those systems and platforms represent the point where *openness, generativity*, and specific *affordances* (Nambisan et al., 2019) involved in the interactions with citizens make the point of change in the use of ICTs from e-government to 'digital' government. As pointed out by (Loonam et al., 2018) '*these new digital technologies embrace ICT systems such as virtualization, mobility, and analytical systems and are integrated with back-office ICTs*', thus moving from a focus on the management of ICT infrastructure to '*the interface with or fully on the side of customers*' (Matt et al., 2015) or citizens in the case of public administration.

In light of the above considerations, **the need emerges to further advance an interpretative methodological framework** that can model and simulate – on the one hand - the macro and meso elements enacting digital systems and their related networked governance configurations, and provide an instrument that - on the other hand – can capture the possible impacts (constraints/enablers) on knowledge capital and employment status changes of the choices made at macro and meso levels and instantiated in public sector reforms supported by AI initiatives. As a consequence, the different scenarios for AI impact in public services may require or enforce innovation in a given context and to certain governance model characteristics.

Research and policy debates acknowledge great potential to recent advances in AI in combination with the continuous datafication of our societies, enabling the possibility of gathering and processing large volumes of data from social processes. However, in general, AI is regarded as systems that perform human-like cognitive functions, often by making predictions, recommendations and decisions (OECD, 2019). What makes AI different from earlier technological waves is its ability to delegate decision-making authority, rather than to solely provide information (Latzer & Just, 2020). This, combined with its common deployment in the core functions and processes of public administrations. could significantly change how governments choose to govern and serve their population (Engstrom et al., 2020; Mehr, 2017).

Nevertheless, apart from what could seem an attention to public and social values (also related to the complementary flourishing of initiatives on providing ethical guidelines, as we have seen extensively in **Section 4**), AI has been largely considered as a way to improve economic performance, and only recently researchers have started investigating and problematizing the adoption of AI as a way to improve public administration operations and service delivery, as well as considering its general role in public sector transformation (Desouza et al., 2020), and the consequent challenges for governance (Sun & Medaglia, 2019).

In this perspective, the use of AI has led many to emphasize its potential transformative effect on society by disrupting the labour market (Lewis et al., 2018) causing challenges in accountability (Vogl et al., 2019), amplifying risks in privacy through large scale data collection (Power, 2016) and increasing inequalities in our societies through biased decision-making algorithms (Pasquale, 2015). Others highlight that despite these risks, AI could yield large benefits to society by improving efficiency, productivity, decision-making and creating more valuable and meaningful jobs (Gasser & Almeida, 2017; Vinuesa et al., 2020).

In the public sector, AI technologies have been argued to be highly impactful, as they are seen as great tools to tackle resource scarcity, create new ways of engaging with citizens, automate processes, personalize public service delivery, improve internal management, fight corruption and generally improve the quality of decisions in policy making (OECD, 2019; Mehr, 2017; Wirtz 2019). In the healthcare sector in particular, there are high expectations for AI, as the recent pandemic crisis is showing, with a race towards finding the AI-enabled solution to manage the response to the COVID-19 emergency. Indeed, AI could assist in healthcare research and development, providing faster and more accurate diagnoses, supporting predictions of diseases and treatments, as well as the diffusion of healthcare expertise where medical capacity might be scarce (Jiang et al., 2017).

Nevertheless, there is **limited conclusive evidence on the real impacts of AI in public services**, and many claims of AI effects are solely based on technical assessments of the algorithms in controlled environments that do not represent the real world. For example, a recent review of AI in breast cancer highlighted that the claims of AI solutions are often inflated and not as accurate in real life as vendors claim (Sadoughi et al., 2018).

Despite existing challenges in assessing the true abilities of AI – as it is likely that the accuracy of AI solutions will somewhat increase in the coming years – a more fundamental challenge lies in the difficulties of adopting and using AI solutions within the public sector, as anticipated in **Section 2**, and in line with consolidated literature on the implementation of (innovative) technologies in public administration, well established within the eGovernment research field (Gil-Garcia et al., 2014). Literature on digital transformation – both in the private and the public sector – demonstrate instead that **achieving successful ICT-enabled transformation, whether it includes AI or other technologies, is more a social, organisational and political challenge**, rather than a technological one (Hinings et al., 2018; Vial, 2019).

As illustrated by Wirtz et al., 2019 in a recent literature review, four major dimensions are limiting the use of AI in the public sector: technology, laws, ethics and social factors. In comparison with the private sector – where businesses have deployed initiatives to change their infrastructure, governance, and business models to create and exploit value from their digital assets – the public sector is still tied up to a consideration of technology as something separated from public sector reform and policy making. Accordingly, the focus is still preeminent on what can be considered the **eGovernment rhetoric legacy**, namely that the provision of ICT-enabled services mainly involves the translation of administrative procedures in digital format.

Taking these issues into consideration, especially in the research area of eGovernment (Dwivedi et al., 2019) quite a few scholars have commonly engaged in identifying key themes in the state of the art literature in order to outline research agendas emphasizing both challenges and opportunities of AI. In particular, Sun & Medaglia, 2019 have pointed out those related to decision-making in the public sector '*where environmental variables are constantly changing, and pre-programming cannot account for all possible cases*' (p. 370), thus further questioning the way policy makers frame and legitimise AI-supported solutions.

To illustrate the dynamics emerging from the changing nature of the public sector in the digital age, we can refer to the recent work of (Andersen et al., 2020). In this conceptual article the authors argue that, contrasting the political ambitions on the next generation of government, the uptake of technology can lead to **digital sclerosis**, characterized by stiffening of the governmental processes, failure to respond to changes in demand, and decreasing innovation feedback from workers. In this regard, they outline three early warnings of digital sclerosis: decreased bargaining and discretion power of governmental workers, enhanced agility and ability at shifting, extended proximities, and the so-called *panopticonization*. To respond proactively and take preventive care initiatives, policy makers and systems developers need to be sensitized about the digital sclerosis, prepare the technology, and design intelligent augmentations in a flexible and agile approach, as depicted in **Figure 15**.

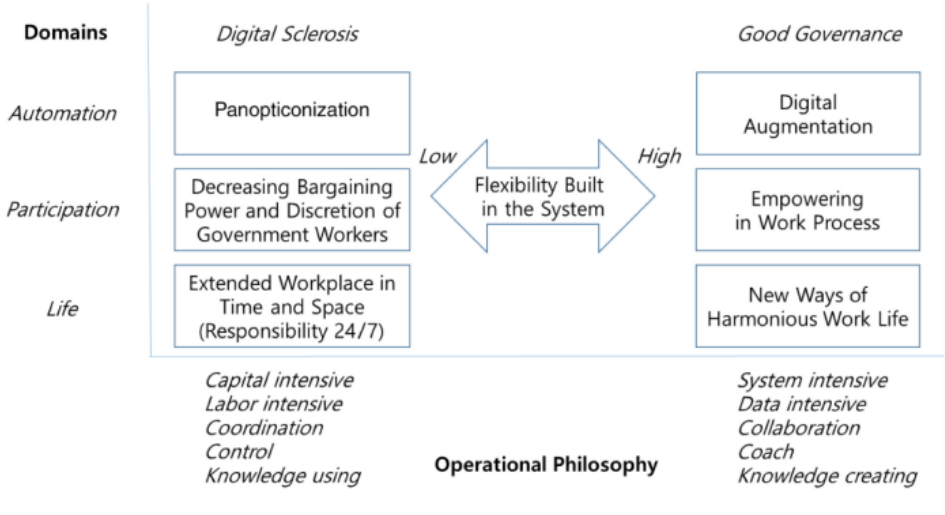

FIGURE 15 DIGITAL SCLEROSIS VS GOOD GOVERNANCE (ANDERSEN ET AL., 2020)

As a guiding principle for the entire stream of research on AI in public services, and to be particularly considered in the elaboration of the proposal for developing a methodology for impact assessment, we consider the need to integrate a **public value perspective** by looking at the 'value drivers' informing current initiatives and strategies of AI use in public services. As anticipated, this will be further elaborated building on the body of research that has questioned the different types of values in eGovernment initiatives (e.g. Bannister & Connolly, 2014) and the general adoption of ICTs for the public sector innovation (e.g Misuraca & Viscusi, 2015).

The values at play in the public sector adoption of ICTs have been a subject of research and practical interest for the scholars in the field of public sector management and eGovernment, far before the current hype on AI (e.g. Bozeman, 2007; or Cordella and Bonina, 2012). Although most of the debate has been polarized around the concept of public value, some authors have focused on identifying frameworks for understanding the specific impact of ICTs on public sector values and on its reforms, where an emphasis has been often put on the difference between public value and new public management perspectives.

This debate has been further moved to the realm of AI, by (Toll et al., 2019) who have used the 'ideals' making up 'value positions' toward the eGovernment initiatives, identified as professionalism, efficiency, service, and engagement by (Rose et al., 2015), to analyse the values exhibited in the AI policy documents in Sweden. In this respect, an important element to consider, especially for assessment of value drivers and AI, is what Bozenam identifies as 'citizen's public values' and the need for further research on 'the degree of consensus required to consider a value as a public value' (Bozeman, 2007, p6).[49]

[49] Notwithstanding the vast number of contributions on values, as highlighted by Viscusi et al, (forthcoming), it is worth noting that not only an 'identification problem' still exists but, especially for AI, principles and values have been often overlapped or used interchangeably in the state of-the-art literature as well as in the current landscape of AI strategies and ethical guidelines proliferation.

5.2 Towards a methodological framework to assess AI impacts in public services

As anticipated in **§1.2**, the AI Watch is devoted to providing an overview and analysis of the use and impact of AI in public services by assessing the most relevant examples available in the state of the art. It also has among its objectives to develop a methodology to identify risks and opportunities, drivers, and barriers of the use AI in public service provision.

Taking the issues discussed in **§5.1** into account, should eventually help governments in better creating and capturing value from AI applications and in understanding how public sector organisations adapt to changes in complex environments as the ones introduced by AI to improve public services delivery.

In fact, most research studies and policy documents dealing with potential benefits and known challenges are not backed by empirical findings showing evidence of uptake of AI applications in the public sector, especially in the specific context of service operations and related ecosystems. Literature and practice in the field also show that even when AI technologies are adopted by governmental institutions, it is still unclear what changes are effectively introduced into the organisational structures and administrative processes, a clear requirement for any innovation to create value in the public sector.

Early findings of our state of the art analysis show that **identifying the key dimensions of the use of AI in public services is crucial** to ultimately set the ground for building tools for Member States to help assessing the suitability and impact of their approach, and allow for better goal-setting and benchmarking.

Therefore, in this sub-section we define the basic elements of a generic framework to assess different drivers and barriers to AI implementation in government, in order to understand the potential impacts of its usage.

The exploratory research conducted so far confirms that many factors influencing public sector transformation also play a role in the adoption of AI and the realisation of organisational change in government and governance. However, for the special case of AI more attention is required to the issues of data quality, data maintenance, data sharing and to the general maturity of digital economy and society (van Noordt & Misuraca, forthcoming.)

To further advance in the direction of **understanding the positive and negative consequences of AI take-up on public administration and service delivery**, a broader modelling effort is being conducted in parallel to this work, to develop a comprehensive approach to prioritize the focus areas in analysing the use and added value of AI-enabled innovation.[50] The expected result of this ongoing research is to develop a sound proposal of a suitable and robust methodology to assess potential social and economic impacts of the use of AI to support public services, with an analysis of the opportunities, threats, key enablers and barriers for implementation emerging from its application to a selected number of case studies.

While it is out of the scope of this document to enter into the details of the proposed modelling exercise, which will be further elaborated in the next phase of the research, we anticipate here some of the foundations on which it is being thought and that will be proposed for further consultation and peer-learning debate.

The first substantive task that is being carried out includes the **definition of the data gathering requirements for further mapping initiatives in EU Member States** and identify case studies for in-depth analysis of the social economic impact of AI in public services (achieved or expected).

A first category of requirements can be derived from the **shared European values embodied in public services**. A good starting point can be Article 2 of the Treaty on the European Union, which defines the values on which the Union is founded and are common to the Member States as *'a society in which pluralism, non-discrimination, tolerance, justice, solidarity and equality between women and men prevail'*[51]

An additional set of shared European values (rights and freedoms) is defined by the Charter of Fundamental Rights of the European Union[52] and only apply in cases where Member States implement EU regulation directly or transpose it into national legislation. Some rights and freedoms, such as the right to data protection and to a transparent administration, are particularly relevant for our framework.

Opinion surveys[53] conducted among citizens of the EU indicate differences in the way in which they recognize and identify with these values. The differences are not only between the Member States, but also within each

[50] This part of the research is being conducted by JRC with the support of **TNO - The Netherlands Institute for Applied Scientific Research** as part of the study for Scientific support to the development of a methodology to assess social and economic impacts of the use of Artificial Intelligence to support public service, funded by under the ELISE Action of the ISA[2] Programme managed by JRC for DIGIT.
[51] https://eur-lex.europa.eu/resource.html?uri=cellar:2bf140bf-a3f8-4ab2-b506-fd71826e6da6.0023.02/DOC_1&format=PDF
[52] https://www.europarl.europa.eu/charter/pdf/text_en.pdf
[53] https://ec.europa.eu/commfrontoffice/publicopinion/archives/eb/eb77/eb77_value_en.pdf

country, between different demographic categories, including age, education, income, social position. These differences would have to be taken into account in the actual implementation of specific AI applications in public services.

A second important category of requirements and corresponding indicators reflect **values and norms of public administration**. Traditionally focusing on principles of good public administration, in recent years they have come to reflect the increasing technological (digital) character of the delivery of public services as well as the increased privatization of traditionally public tasks. These two developments in particular demand additional standards for good governance (e.g. of citizens' personal data and public or shared resources including open data, computing infrastructures, algorithms, etc).

In defining the requirements corresponding to good public administration, further inspiration can be drawn from existing sets of principles, such as the Principles of Public Administration developed by OECD-SIGMA in close co-operation with the European Commission[54]. They help (aspiring or acceding) Member States in evaluating the functioning of their public administrations through providing detailed requirements for a number of core areas. In addition, they outline a methodological framework for the Principles of Public Administration which provides measures of each principle, focusing on implementation.

As previously mentioned, for EU regulation transposed or directly adopted into national legislation the right to good administration is enshrined in the Charter of Fundamental Rights of the EU[55] where, in particular, the requirements outlined in Article 41 are highly relevant for algorithmic applications.

A third category of requirements and indicators reflects the **political priorities and ambitions, national and international, with regard to the use of AI in the provision of public services**. They may be expressed in international documents, such as the EU White paper on AI or the OECD AI principles referred to above, in national AI strategies and other relevant policy documents. However, as we have seen in **Section 4**, not all Member States have finalized their national AI strategies and fewer still have explicitly defined strategies or guidelines to address the specific needs of uses of AI in the delivery of public services. However, most of the documents examined make explicit references to their expectations relating to AI applications in public services.

Building on the analysis provided in **Section 4**, we can argue that despite a shared European ambition with regard to AI in general and AI applications in the public services in particular, the various policy documents reveal differences between Member States. Although the requirements in general are similar, the priority given to individual requirements differs. One assumption is that the differences in priorities stem from differences in readiness, in terms of available digital assets, skills, funding, or other factors. This would suggest that customized ways to assess the social and economic impact would have to apply, which will require 'deep dives' at country level or in specific cases in policy domains.

Finally, an important category deserving attention is that of the **negative requirements for AI in the public sector**, defined as a precaution, in response to perceived potential risks; or to a negative impact with its unexpected consequences. This category of requirements is linked closely with anticipated or already known undesired outcomes and impacts of AI applications for the delivery of public services. These requirements define what applications should not do, and can vary from general to specific. A few examples may include the requirement to eliminate bias in data used to train algorithms; the need of forbidding discrimination in algorithmic decision-making or of setting upper limits for error rates, false positives/negatives, or standard deviations of algorithms. This is already being considered in some Member States approaches, such as the French legislative initiative to limit or forbid[56] the use of legaltech to analyse and predict the judicial ruling and behaviour of judges and jury, or emerging law cases such as SyRi - System for Risk Indication, in The Netherlands (already discussed in **Section 3)**; or the case regarding the use of facial recognition in a school in Sweden. In addition, there are also preventive administrative measures, such as the decision of the Belgian police regulator to forbid piloting the use of face recognition technology at the Zaventem airport[57] ; or the negative advice by the French data protection regulator regarding two pilots using facial recognition technology in French schools[58]; or the cease and desist letter issued by the French data protection regulator to the French Ministry of the Interior regarding the use of Automatic number plate recognition (ANPR) systems [59]

[54] http://www.sigmaweb.org/publications/principles-public-administration.htm

[55] https://www.europarl.europa.eu/charter/pdf/text_en.pdf

[56] The French Justice Reform Act, Article 33, https://www.legifrance.gouv.fr/affichTexteArticle.do;jsessionid=98B09D0394DAE57F1618DC21F30405F6.tplgfr34s_1?idArticle=JORFARTI000038261761&categorieLien=id&cidTexte=JORFTEXT000038261631&dateTexte=

[57] https://www.vrt.be/vrtnws/nl/2019/09/20/politie-mag-geen-automatische-gezichtsherkenning-gebruiken-op-de

[58] https://www.cnil.fr/fr/experimentation-de-la-reconnaissance-faciale-dans-deux-lycees-la-cnil-precise-sa-position

[59] https://www.cnil.fr/fr/radars-troncons-mise-en-demeure-du-ministere-de-linterieur

In our initial framework it is thus proposed to consider the multiple elements of AI in public services that can be grouped into macro-areas labelled as: Digital Infrastructure, Organisational Resources, Digital Government Development and Digital Society Development, as described in **Figure 16** below.

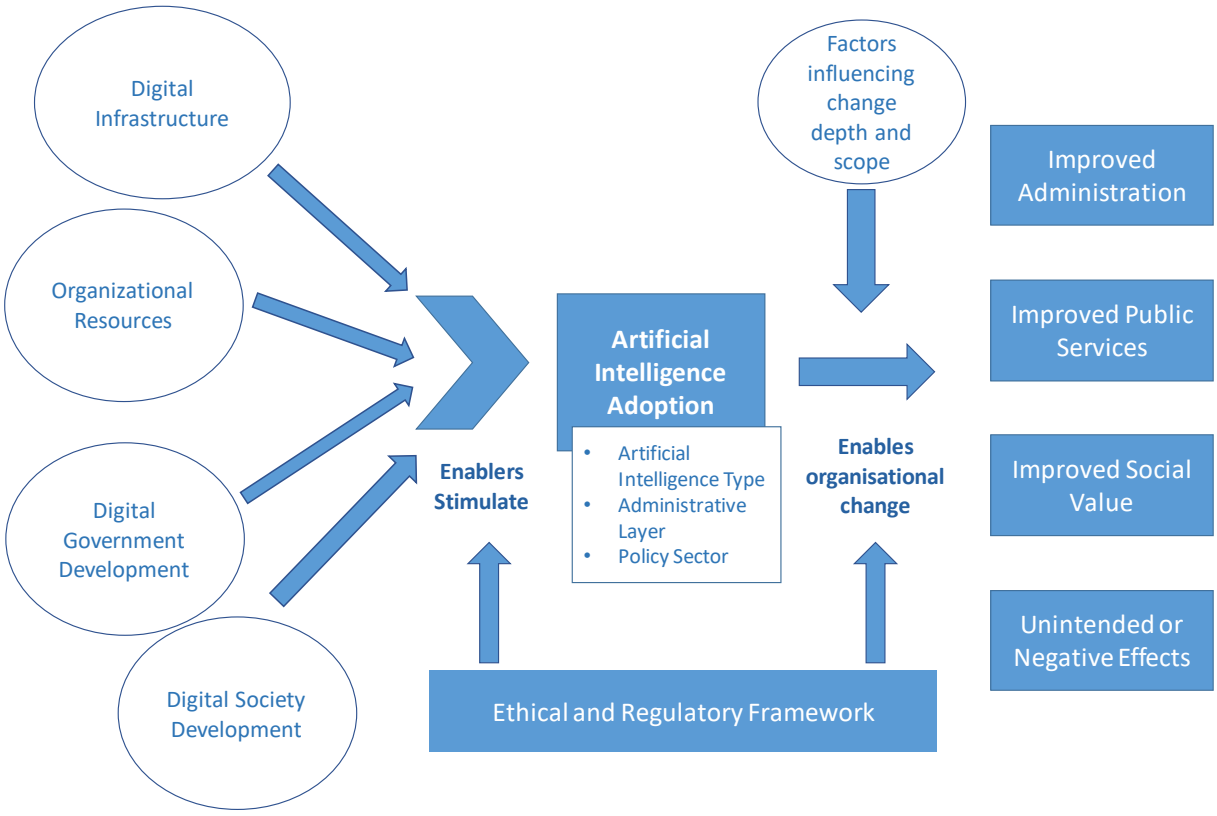

FIGURE 16 CONCEPTUAL FRAMEWORK FOR AI IMPACT IN PUBLIC SERVICES

In light of the above and in line with the perspective advanced, our research will thus reflect on the technological, legal, economic and social implications derived specifically from the use of AI as well as on the barriers that may prevent the full exploitation of the AI potential in the public sector. To this end, the approach proposed aims to empirically assess the impact of AI on public services, taking into consideration key dimensions relevant in evaluating the impact of AI in public services, as well as its potential, unintentional or unexpected, effects.

5.3 Proposed approach for modelling and assessing impact of AI in public services

The development of the methodology proposal takes into consideration some of the most advanced insights of the theory of public sector innovation to explain the adoption and implementation of new technological developments in the public sector. This will enable the identification and empirical validation and monitoring of opportunities, threats, key enablers and barriers for implementation of AI in public services in European countries.

Developing and extending the proposed conceptual framework, an operational toolkit can ultimately be delivered to support *ex ante* and *ex post* analysis and monitoring of the effects of introducing AI in public sector organisations. Also, a system of common indicators can be defined, which will be further operationalised into a **proposal for modelling impact assessment of AI in public services**.

To achieve this specific aim, the research is structured into 3 sub-tasks as part of the activity of scientific support that TNO is conducting for JRC, as indicated in the **Figure 17** below that shows the overall approach for proposed for developing the methodology for impact assessment.

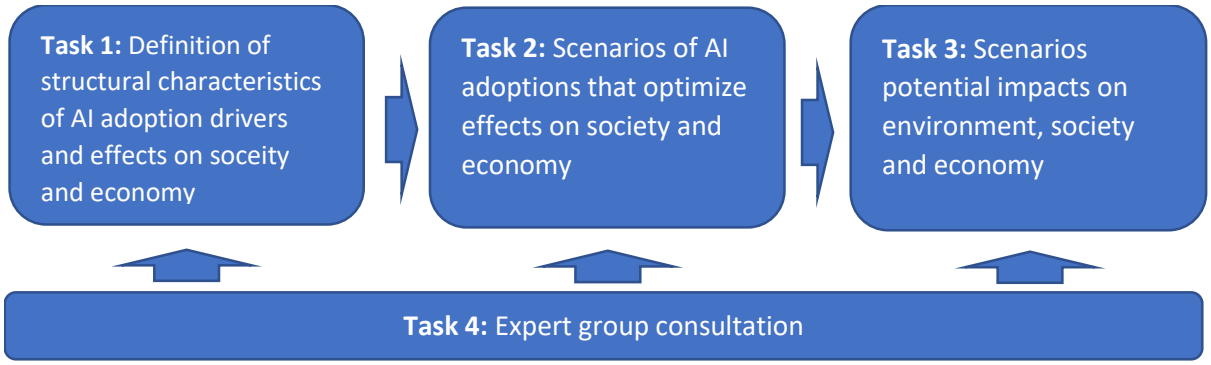

FIGURE 17 OVERVIEW OF THE METHODOLOGICAL APPROACH PROPOSED

5.3.1 Structural features driving AI adoption in public sector and services

The first step of this part of the research is to identify opportunities, threats, key enablers and barriers for implementation of AI in public services, based on further review of literature and analysis of practices emerged from the mapping. In parallel the research will produce a first estimation of the likely effects on the public services (for example social impacts such as better and more tailored services to citizens and economic impacts such as productivity, employment and growth).

In line with the theoretical orientations briefly described in **§5.1**, the proposed approach starts from a simple premise: that all policy interventions are about modelling human behaviour - to be changed or maintain unchanged compared to a given initial state relating to a specific issue, context, time and target population. **Any impact assessment approach is thus context- and time-specific**.

Recent efforts to create and apply more realistic models of impact assessment put the behaviour of actors and their interactions in the system at the centre of their analysis to understand the emergent properties of technology diffusion and their effects in a group and society (Rai & Robinson, 2015; Schlüter et al., 2017).

In this perspective, **we suggest to examine the impacts of AI in public services as the public value perceived by the actors engaged in service provision** (government agencies, private actors) and those receiving the service (citizens). These actors - government, businesses and citizens - are the primary agents that will perceive the public value generated by the implementation of AI in the provision of public services.[60]

In general, public value is considered the variable to optimise in the provision of public services. According to Moore (1995) public value is understood as *the collective expectations with regard to public services provision*. In defining expected outcomes in terms of public values we will use the taxonomy of perceived social value of ICT applications in public services provision proposed recently by (Twizeyimana & Andersson, 2019). This taxonomy is merged and operated within the model presented below.

The transformative capacity of innovations enabled by new digital technologies is contingent on their adoption across a given sector. In turn, adoption and implementation of AI in the public sector depends on at least:

- the extent to which the adoption of AI in the delivery of public services is regarded by the government, the civil society and the private sector as generating social and economic benefits;
- the extent to which citizens, the policy and regulatory environments, and the private sector support the uptake of AI in the delivery of public services;
- the level of resources available for the adoption of AI in the public sector (i.e. aggregated demand, financial resources, knowledge and skills);
- the ability of administrative and infrastructural legacy systems to accommodate the substitution of current means of delivering public services for new, AI-enabled ones.

[60] In the conceptualization of the embeddedness of artificial intelligence in the provision of services the citizen or business can be expected to have little insights as to the role of AI in the provision of services (i.e., its effects in the provision of services of given AI algorithm).

There is a growing body of literature into factors affecting the adoption and implementation of ICTs in public services and eGovernment, in particular using the basic behavioural model and approach proposed here. So far most analyses are limited in their scope, but they allow for testing the impact of individual factors on the adoption of ICT applications in service provision without further extending it to assess its outcomes and impact.

In our approach we thus propose **to develop a behavioural and structural model to organise and aggregate the different factors affecting the adoption and implementation of AI in public administration**, building on past research on ICT implementation at corporate and governmental levels and on the impact assessment features of the perceived social value of ICT applications in public services model originally proposed by Twizeyimana and Andersson, (2019).

This new model is being applied and tested as a meta theory based on insights from literature. It is deemed able to measure relationships between variables and correlates. Previous editions of the structural part of the model have demonstrated that different drivers to adopt and implement new technologies can be grouped in few categories, thus enabling the creation of composite indexes. For instance, data on adoption influencers can be aggregated in institutional capacities, contextual factors, expected vs. measured (or perceived) outcomes, and change pressures resulting from benchmarking/benchlearning activities.

In the following phase of the research we then aim **to populate the model building on the information generated by empirical analysis**. The actual drivers and barriers to AI implementation via (and not independently from) the public body's or agency's digital transformation can be derived from in-depth case studies and additional ones can be collected via a questionnaire. A second set of variables consists of aggregations of outcomes, pressures and resources. Together, they can provide a means to measure the propensity or willingness to adopt AI in the public sector, as well as the implementation and its outcomes.

An outline of the conceptual scheme that will be used to inform data gathering (through questionnaires and interviews) and populate the model for its testing and validation is illustrated in **Figure 18** below, outlining the key forward and feedback loops of external and internal drivers and barriers to adopt and implement AI in the delivery of public services and the renewal of policy making processes and procedures.

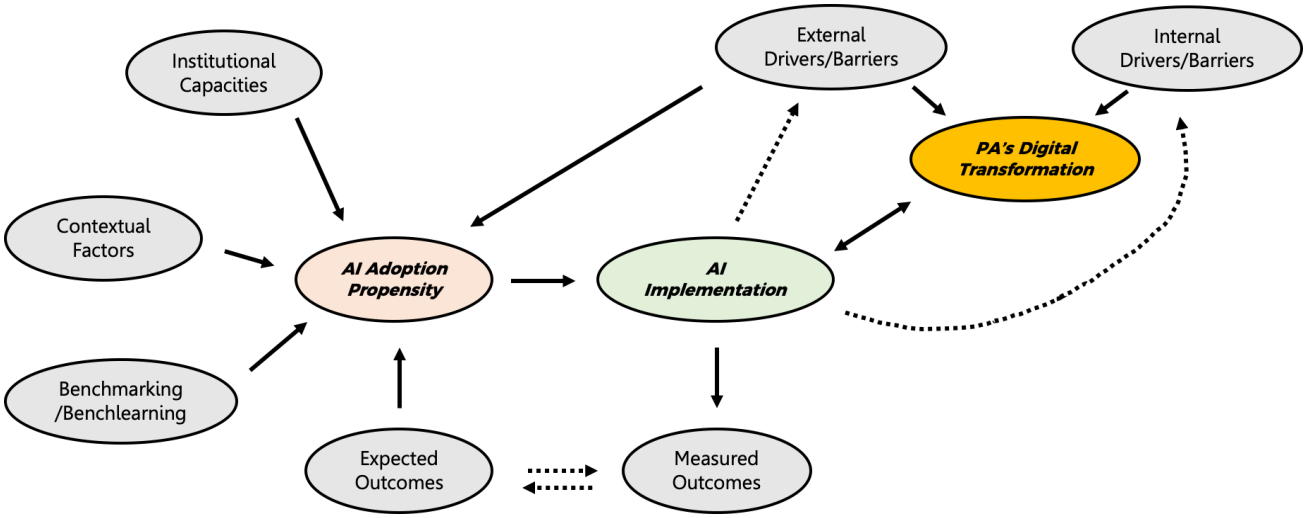

FIGURE 18 STRUCTURAL FACTORS AFFECTING ADOPTION OF AI IN PUBLIC SERVICES

Populating and validating the model will then involve the following steps:

1. Public sector representatives will be asked about their past and current experiences in adopting AI for service provision better policy making, the underlying motivating factors, and the willingness to further implement it in the future. This data gathering exercise will give an indication of the level of adoption and propensity to adopt AI, thus linking propensity to adopt to actual implementation across a sample of relevant cases.
2. As a separate, but not disjoint feedback, managers will be asked to narrow the focus on implementation, to reconstruct the key internal and external drivers and barriers playing a role in public administration's digital transformation.

3. The interplay between AI adoption propensity and AI implementation will be used to assess impacts via the configuration and testing of an outcome based structural model. This novel approach is intended to address the limitations of currently used models that rely heavily on experts' estimations on number of adoption events or levels of investment by adoption units (e.g. in the case of government agencies procuring AI systems to support the delivery of public services).

Quantitative data will be collected through a questionnaire. This data gathering exercise is necessary to:

- demonstrate and validate the structural model;
- assess and rank the factors affecting the adoption of AI in public services for the cases analysed;
- assess and rank the internal and external drivers and barriers to digital transformation;
- generate indicators/parameters that can be used in scenario exercises (e.g. simulating the potential socio-economic impact of the adoption of AI applications in the public sector).

4. To assess the process and the statistical validity of the data gathering instrument before its use, a validation exercise of at least 30 answered questionnaires will be carried out, in order to:

    - provide descriptive statistics of measured outcomes, factors influencing adoption, drivers and barriers to implementation in the cases analysed;
    - allow the testing of correlations between outcomes, other influencing factors, drivers and barriers, propensity to adopt and ultimately implementation of AI in the public sectors.

5. The identification of a control panel of interviewees NOT involved in AI, but only in ICT implementation will be also considered.

6. The contribution of an existing Input-Output (I-O) model to the structural analysis, impact estimation and simulation scenarios will be leveraged during the development of the research, if deemed appropriate.

5.3.2 Developing scenarios of AI adoption and modelling potential impact

The decision to adopt a particular AI application in the public sector at the national and European levels is not a linear process. The impact of technology in other sectors also affects the decision of individual organisations or policymakers to adopt or support the deployment of AI.

In this activity, **scenarios of adoption based on the structural model presented above will be created**. It is worth noticing that traditionally impact assessments are undertaken to gauge if a given policy intervention is likely to achieve the goals of an intervention program (*ex-ante*). Results of the ex-ante assessment are used to steer or redesign the intervention program scope and scale as well as its instruments and governance. Similar efforts are conducted in ongoing or finished intervention programs to assess if their aims were achieved or the scope and scale of the effects. The most frequently used framework to organise the assessment is the well-known intervention logic model (to achieve certain outcomes) or the so-called Theory of Change (inputs, activities, outcomes). These basic frameworks despite their limitations have been widely used and came under criticisms for their simplicity in the face of complex intervention programs where the counterfactual of effects and the leverages to achieve desired outcomes are not trivial (Mayne, 2017; Moore & Evans, 2017).

The shortcomings of the basic model of impact assessment has led to the development of a myriad of complementary approaches (Branch et al., 2019). In general, the approaches and models for impact assessment attempt to account for the paths between intervention and actual outcomes and effects in society in the face of complexity of wicked problems. The challenge of assessing the effect of AI applications in the provision of public services resides on understanding the effects at the individual level (individuals, organisations) and to scale them up to collective effects. Approaches like cost-benefit analysis, general equilibrium modelling, and social return on investment present limitations as they do not look into individual preconditions for preferences and agency of actors, for example (Dhondt et al., 2016). This is in agreement with premises of recent research into evaluation and impact assessment of ICT-enabled Social Innovation (Misuraca et al., 2018). Some of the most frequent approaches that have seen attempts to generate frameworks applicable to different areas of policy analysis and impact assessment include also Diffusion analyses and System analysis approaches, such as: Actor network theory; System dynamics and Agent based simulations and modelling. A review of the tenets of these approaches to impact assessment can be followed in recent reports and literature on social impact assessment and evaluation (Misuraca et al., 2017). However, these methodologies also present a number of shortcomings that need to be considered and that we propose to overcome in our approach.

The modelling of technology diffusion is generally done based on data such as volume/value of sales, volume/value/type of services provided, levels of investment for a specific technology in a given period of time and geographic scope. When such data is available, it is possible to estimate rates of diffusion and economic

effects (Rogers, 2010). In this case, however, for the diffusion of AI in the provision of public services, we need to estimate the potential future effects of an emerging technology. Therefore, the likely effects on existing processes and products are uncertain and must be estimated by the stated preferences of businesses and citizens.

In general, **system analysis approaches put emphasis on the need to look into the systemic character of any realm of human activity**. Here there is no consensus on the limits and boundary conditions of the system. In general, the boundaries are set to a large extent *ad-hoc*. For example, public service delivery involves many agents but, in principle, they are divided in providers (i.e. the government) and recipients of the service (i.e. citizens and businesses). The stylised form and data availability of such models and tools have limited their wide application in policy-making practice. While looking into the system as a whole, they normally build on assumptions of experts concerning expected preferences, beliefs and values of the actors that they intend to represent in the simulation exercises of behaviours and likely outcomes.

One of the major challenges in scenario development is the **reliability and validity of the parameters used as initial conditions of the variables of interest**. This is valid for systems dynamics (Forrester & Senge, 1980), actor network, agent based modelling as well as in general equilibrium modelling for macro-economic forecasts (Di Bartolomeo & Saltari, 2016). When there are no data available (e.g. time series data) to calibrate the parameters of a model, generally the approach followed is to have a number of experts that agree on the size and direction of the likely effects (i.e. achieving concurrent validation). An additional step to ensure the reliability of the parameters to be used in the scenario modelling is to strive for structural validation. This means that the relationship between variables is confirmed by means of statistical analysis indicating the strength and direction of the relationship between the variables of interest. Often this step is not achieved.

One additional hurdle concerns the **aggregation of disparate sources of influence on the variables of interest** (drivers of adoption, adoption levels, social impact, employment and jobs) into a coherent set of relations that can be reliably tested. In this area, most available theories for modelling does not fare well. For this reason, **we adopt here an intermediate behavioural structural model** with a double purpose.

First, it enables to translate preferences, opinions expressed by experts, consumers and policymakers concerning the likely effects of AI applications diffusion into numerical composites amenable to statistical testing.

Second, the intermediate structural model guides the structure of the further coupling to assess meso and macro modelling. In this regard, it is proposed as an initial attempt, to follow the approach developed recently in the literature of innovation studies concerning the use of structural decision-making models related to innovation activity (Montalvo, 2006; Wehn & Montalvo, 2018).

As already mentioned above, the suggested basic behavioural model used has been already applied to the testing of structure of adoption of ICTs in government in the provision of public services (Ozen et al., 2018; Ozkan & Kanat, 2011; Rana et al., 2013). However, it will require validation of the scenarios proposed to optimise the societal effects of AI adoption. To do this, (remote or face-to-face) workshops with experts and stakeholders' representatives will be organised. The workshops will be based on a **group model building dynamic** so to contrast and discuss the strategy scenarios generated by the research team and to validate a final scenario that optimises strategic levers and strategic outcomes in terms of expected social and economic impact.

Finally, an **estimation of the impact will be conducted based on the selected scenario that optimises the target variables selected**. This will facilitate the creation of a roadmap for further implementation of AI in the public sector, for which a detailed approach and tools for implementation will be further refined in collaboration with a group of experts and in consultation with representatives of Member States and relevant stakeholders, as well as various services of the Commission and other international institutions as appropriate.

5.3.3 Methodology validation and stakeholders engagement

A crucial aspect to consider for developing a methodological approach that would combine scientific rigour with practical application potential and policy relevance relies on the modalities of engagement with relevant networks of experts and stakeholders, as well as on the access to strategic partners, including Member States at both policy and technical level. For this purpose, the research includes two levels of validation of the methodology. First an **extended pool of experts will be consulted** including a dedicated group of external expert assigned to accompany the methodology development; and other external experts. In addition to this, Member States representatives of the 'eGovernment Action Plan Steering Board'' and other stakeholders

representatives will be engaged in **peer-learning workshops** organised alongside the research activities to present, discuss and validate findings and validate methodological approaches and choices.[61]

Other opportunities to engage with experts and stakeholders, either during official or informal consultation events, or online and in dedicated experts workshops, will be defined in details and in collaboration with DG CONNECT and Member States. Cross-fertilisation with other Tasks of the AI Watch – and in particular the task devoted to the Analysis of AI Strategies - will also be critical to develop a common approach and exchange early results, while strengthening the analysis and recommendations.

Finally, instrumental to the development of the proposed methodology as reservoir of data for the empirical assessment of the model and to validate the scenarios and modelling assumptions, at least 10 **in-depth qualitative case studies will be conducted** at country level, or with specific policy domain or administrative level focus (e.g. city or regional level) or to address specific thematic areas (e.g. AI procurement), so as to apply the methodology proposed to assess potential impacts and added value of the use of AI in public services.

As illustrated by the early findings of the landscaping analysis, the scope, goals and practices of public sector use of AI is much diverse: relying on an automated decision system to grant protection to asylum seekers is a task with a different order of magnitude than increasing use of digital public services through predictive analytics. Thus, it is practical to gear the thinking towards high-potential impact applications that may have consequences of particular relevance for the populations they target.

The case selection will be done in line with the public value approach proposed and will follow the model developed by (Faulkner & Kaufman, 2018) for assessing candidate cases and making the final selection. This model is based on an extensive review of the literature on public value, from which the authors distilled four components for measuring public value, common to and applicable across different categories of organisations, public and private, acting separately or cooperating in joint initiatives. This would be particularly relevant to AI application for the delivery of public services, given that they are likely to be the product of collaborations between different government agencies (e.g. in data sharing partnerships) as well as between public and private actors (e.g. making use of shared cloud resources).

The four components of the model and their corresponding definitions are provided **Figure 19:**

Framework for measuring public value
1. Outcome achievement = the extent to which a public body is improving publicly-valued outcomes across a wide-variety of areas. e.g. human health,; access to knowledge, benefits to economic activity and employment, social capital and cohesion, and environmental outcomes, improvements in social outcomes.
2. Trust and legitimacy = the extent to which an organisation and its activities are trusted and perceived to be legitimate by the public and by key stakeholders. This dimension includes the extent to which the public trust the particular, trust the programs or services delivered by institution, and perceive an institution to be delivering services transparently and fairly.
3. Service delivery quality = the extent to which services are experienced as being delivered in high-quality manner that is considerate of users' needs. It is expected to be maximized when individuals who interact with the service are satisfied, and when they perceive the services to be responsive to their needs, accessible, convenient, and incorporate sufficient citizen engagement.
4. Efficiency = the extent to which an organisation is achieving maximal benefits with minimal resources. It is expected to be high when the benefits provided by an organisation are perceived to outweigh the costs of that organisation, when 'unnecessary' bureaucracy is avoided, and when an organisation is perceived to offer 'value for money'.
Source: Faulkner, N., & Kaufman, S. (2018). Avoiding theoretical stagnation: a systematic review and framework for measuring public value

FIGURE 19 FRAMEWORK FOR MEASURING PUBLIC VALUE

The case study analysis and application of the approach to concrete experiences in Member States, will permit thus to validate - and revise as it may be required - the proposed methodology, while drawing up recommendations on the way forward to roll out AI based systems and solutions in public services.

[61] In this respect, the collaboration between JRC and DIGIT should be further exploited, considering the special role in co-leading two actions of the ISA[2] Programme (i.e. ELISE and IPS), so to build on synergies to coordinate activities and ensure complementarities.

6 Conclusions

6.1 Coming back from a first venture into the unknown

The interest on the use of AI within European governments to support redesigning internal processes and policy-making mechanisms, as well as to improve public service delivery and engagement with citizens is growing. This is demonstrated by the emerging body of literature and the nascent applications in the public sector, a number of which have been included in our mapping and analysis.

Governments across the EU Member and Associated States are exploring the potential of AI use to help reorganise the internal management of public administration at all levels. Indeed, when used in a responsible way, the combination of new, large data sources with advanced machine learning algorithms can radically improve the operating methods of the public sector, thus paving the way to pro-active public service delivery models and relieving resource constrained organisations from mundane and repetitive tasks.

However, **there seems to be an imbalance between the transformative potential and the effective adoption and use of AI solutions in governmental organisations**, **and there is little evidence of the social and economic impacts achieved so far**. For this purpose, departing from a review of existing literature on public sector innovation and digital government, followed by a landscaping exercise - which allowed us to gather and map a first inventory of 230 AI use cases and do an analysis of existing national AI strategies in all European countries - this report has the ambition to contribute to unveiling the complexities, paradoxes and pitfalls in the implementation of this 'new' wave of technologies, for the improvement of policy design and evaluation and of the delivery of public services to businesses and citizens.

Clearly, **developing a baseline study for any topic is challenging to say the least, as you embark into a journey in an unchartered territory**. In the case of an emerging and ill-defined topic such as AI in the public sector, the challenge is increased as you are boarding in a 'venture into the unknown', with no established parameters. This does not only means to develop a measurement framework for new phenomena but also define the emerging topic under investigation, which takes on many shapes and forms, in a bottom up fashion, dictated more from the way it takes contingent characteristics than the need to identify precise benchmarks against which to be assessed.

Overall, **from the landscaping exercise conducted it emerges that many European countries are experimenting with a variety of AI technologies**. The analysis of the initiatives included in our sample shows the diversity of AI typologies and purposes, as well as the policy areas in which these are implemented, providing a rich – though preliminary - overview of the use of AI in public services in the EU.

Although the data gathered so far do not provide a full picture of the current landscape - as challenges in data collection and coverage remain - **this inventory is encompassing enough to be regarded as a first and unique *reservoir* of knowledge**, from which to extract indications, emerging trends, and illustrative examples of current AI usage, rather than a conclusive overview of the state of the art. In fact, the analysis of findings will also serve as a possible baseline for further analyses than those proposed in this report, as it is becoming clear that over the coming years, many more organisations from the public sector will be willing and able to use AI, by either developing their own solutions or sharing successful ones from other European administrations.

In this perspective, on the basis of the results of the mapping of cases, as well as the analysis of national AI strategies focused on public sector, **the proposals advanced in this study lay the methodological foundations of a framework for impact assessment** that can support future road-mapping of AI in public services throughout the EU.

But there is more. First, the longitudinal analysis of some case studies of AI-enabled government services and policies from different countries of Europe has clearly demonstrated how grounded the concerns are about an (un)ethical use of AI – as witnessed by most of the recent policy documents at national and supranational levels – with respect to such issues as privacy and personal data protection, transparency, fairness in operation, and other constitutive elements of public action. **There are high expectations from the use of AI in government – but it is clear from our current exploration that positive impact is far from straightforward and should not be taken for granted.**

At the very bottom, **it is of utmost importance not to overlook the ethical and sometimes, the political risks associated with the new direction of change**. A related implication affects the power relations between the state and the citizens, which can be certainly improved by enabling the latter to criticise the

recommendations of the AI systems used for public services, although in some of the narratives provided, the ruling of a Court or the raise of a negative opinion pushed by the media was needed to realise that, at the very end, the real benefits of those innovations were not justifying the implementation costs, let alone the reputational aspects.

A lesson learned is thus to bear in mind that while small-scale pilot studies or experiments might be successful and the promises in case of broader adoption encouraging, setting aside dedicated resources and **providing significant efforts to ensure larger scale usage of AI technologies inside the government machinery may not be enough to accomplish the ultimate goal of sustainable take-up**. Where the term sustainable, more than ever, does not only refer to monetary convenience, efficiency or even effectiveness of public action, but points at the resulting (re)shaping of the government's regulator and facilitator role in our societies.

Undoubtedly **this report fills in a gap in action oriented research into the development and implementation of AI technologies in government and public services**, an area that has not yet received the same attention and funding as in the case of private sector and/or for business development. Truth to be told, without adoption and active implementation of AI, there will be no positive impact from this technology. However, and to a greater extent than the familiar e-Government and digital innovations, a comparable level of attention must be devoted to the 'soft' aspects of government transformation than the development and take-up of AI systems and solutions.

6.2 Key findings from landscaping AI use in public services in the EU

The analysis of AI use cases in this report is based on a collection of 230 different AI initiatives over across Europe (all the EU Member States, including UK that at the time of the data gathering in 2019 was still part of the EU as well as Norway and Switzerland). While all Member States appear herein, this is clearly not a statistically significant overview as there has been no random selection and some countries are more represented than others in terms of cases of AI use identified. A majority of the AI use cases in the current inventory in fact originate from the Netherlands, Portugal, Denmark and Estonia.

In addition, **most of the evidence gathered is drawn from the national level of government**, and most cases named regional actually originate in federal countries. Only a quarter of the all initiatives collected take place at the local level, **which is likely not to be very representative of the real situation, as local authorities and especially cities are unanimously regarded as leading actors in experimenting with AI technologies to cope with the various challenges materialising at urban and sub-regional levels**. While two working hypotheses have been formulated during the making of the mapping – one that there should be an optimal size of population served by AI-enabled systems and the other that countries ranked comparatively higher in Digital Government and Digital Economy indexes would be overrepresented in the inventory – the truth is that at the moment it is too early to draw any conclusions.

As a matter of fact, the public sector is multifaceted, composed of many domains, institutions and units that in a relatively autonomous or independent way design, adopt and apply technology solutions in general and AI-based specifically for a variety of different purposes. **Depending on the domain, type of institution or level of government there is first of all the need of better understanding whether an application found in practice is in reality AI-based**. In fact, it remains challenging to define and operationalize what is to be considered AI and which technologies, applications, or algorithms are to be included, in particular when it comes to public services and/or policies. In the inception of our empirical research, a broad definition of AI was adopted, so as to allow the gathering of information on what the involved public administration regarded as AI.

While this approach lends to criticism in terms of structuring power of a reality that is stable enough to be structured, for the reasons already expressed it seems well justified by the nature of the underlying phenomenon – still fluctuating in terms of technological definition and evolution across time and space. In this respect, **our proposed taxonomy has the advantage of focusing both on the typology of AI solutions being used, but also the purpose for which they were deployed**.

With all the above caveats, **two are the typologies of AI which are most frequently appearing in government: one related to Chatbots or Digital Assistants, and the other focused on providing some sort of intelligent, data based predictions and simulation, through the recognition and visualisation of patterns in (big) socioeconomic data**. These two AI typologies are found in 51 and 36 of the gathered cases respectively. The other two most frequent clusters, both holding 29 items, are the use of Expert and Rule Based systems, facilitating Algorithmic Decision Making and of Computer vision in order to recognise persons, objects or other items in digital imagery.

Most of these AI systems, 87 out of 230, **are used in the provision of general public services or in communication and engagement activities**. These occur in a large variety of typologies such as having Chatbots to communicate with citizens, analysing data to make public services more tailored to beneficiaries or public policy making more accessible through e.g. automatic transcription of political hearings. Other evident purposes of AI use are e.g. to assist in the enforcement of existing regulation, such as prioritizing targets likely to break up the law, or improving the internal management and maintenance of operations or even providing insights for research and analysis of existing policy or to generated new policy, with the headcount being respectively 47, 45 and 39 out of the 230 cases in our mapping sample.

On the contrary, our research found the least represented AI applications in the granting of rights and benefits, possibly since governments are reluctant in delegating this authority to AI systems in full, and the generated controversies have in fact been part of the description of some longitudinal stories.

An important finding to underline is the fact that **more than a half of the AI solutions currently in use** (127 out of 230) **seem to bring only incremental or technical changes to the government body or agency adopting them**. Among these, various Chatbots are included, which may well assist in the acquisition of information by citizens, but frequently do not seem to change the nature of the public service delivery model of the implementing organisation – although some applications declare quite ambitious aims, such as facilitating G2C transactions or becoming a one-stop-shop of government contacts by connecting multiple actors and information systems together. This is an encouraging trend, as **disruptive and radical or transformative changes induced by the adoption of AI are far less common** based on our assessment.

In addition, it is worth stressing again that the **disruptive innovations often come under scrutiny or criticism, as citizens may not always appreciate the pro-active service delivery style of their governments**, for instance due to privacy or transparency concerns. A long term study, therefore, would be required to document if some of the most disruptive trials have survived or suffered from later dismantling, halted or reversed by new policies or regulations, leading to restrict the amount of transformative cases of AI in government.

In this sense, it is also important to note that **most of the current AI is being used to achieve performance related goals**, such as doing governmental tasks quicker, faster, or more efficiently, with 68% (157 out of 230) of the initiatives having this 'value driver' orientation. Only 21% (49 out of 230) pursue instead inclusion driven goals, e.g. to make public services more accessible to the citizens who have challenges in using the traditional versions of their delivery models or to those who do not feel at ease with an all too large amount of digital information to be consumed. Only in a mere 10% of the inventories AI initiatives (24 out of 230), the goal of improving the openness of government actually comes to the forefront.

To complement the findings from the AI use cases, a survey was held among the European Member States in order to gain unique insights with regard to their use of AI and their policy initiatives to facilitate or boost that usage. This survey was completed by 18 countries, with answers often coordinated by a group of experts to ensure valid responses. Following the results of the survey, **67% of the countries indicate to have set aside some funding to stimulate development and adoption of AI in government**, although the amount of funding varies considerably.

On the other hand, **more than half of the respondents indicated that their government does not have any specific training programme on AI available for civil servants**. A good number of countries (13) did instead establish departments, units or dedicated teams tasked with working on or stimulating the uptake of AI in the public sector, researching the effects of AI or preparing new AI-specific regulations.

The findings further illustrate the **high importance of ethical and human-centric AI**, while the need for a dedicated AI law seems to be limited, as none of the governments have implemented such a law or shown interest in doing it early. Instead, **many countries aim to revise existing laws if this is seen as necessary to cope with the challenges AI brings with it.**

A few Member States have illustrated their **plans to explore innovative public procurement to stimulate the development and adoption of AI**. These guidelines or principles are considered crucial for the management of AI procurement projects, as they both equip civil servants with relevant expertise to tackle common challenges in AI procurement such as ethical concerns, while at the same time allowing innovative GovTech startups and SMEs to offer their innovative AI solutions to government organisations. It is therefore well advised to continue exploring in the near future how existing procurement processes can or need be adjusted to stimulate the use of emerging technologies, such as but not limited to AI, in the public sector.

The survey results are globally confirmed by specific analyses conducted on the current data and AI governance landscape, where we have found that many of the existing policy discourses aim to portray AI as an exception, immune from existing governance frameworks and legislation. Instead, **governments should see the governance of AI as an extension of existing regulatory tools**, such as for privacy and data protection, competition law, consumer protection, ethical compliance etc.. These guidelines are often adequate to limit the unintended and unwanted consequences of AI deployment. However, challenges seems to remain in the speed and capability to enforce - rather than on the intrinsic performance of - regulatory instruments coping with the major risks of AI.

In line with the overall scope of the AI Watch, this report has carried on a specific review of the AI national strategies published by the Member States, to assess the focus of the documents on public sector. In this regard, identifying common policy themes and instruments, the review showed that **most countries are taking several actions to stimulate the use of AI in their public sector**. These include actions to increase the uptake of AI in public administration or aimed at improving the awareness and knowledge of the possibilities of AI in public services; and initiatives to improve the quality, quantity and accessibility of data to enable the development of AI. In addition, a variety of actions are planned to enhance the internal capacity of public institutions to develop and deploy AI nationwide.

However, as AI is still a new technology (or better said a combination of) and limited experience with it is shared, not to mention reuse potential, **many strategies include a requirement for experimental AI projects to learn by doing and sharing experiences**. Despite the potential of AI, there are in fact also concerns about using AI in government. Therefore, actions taken by governments include the development of a legal framework to assist civil servants in using AI in an ethical and human-centric way. Lastly, some strategies mention special funding programmes to provide financial resources to start AI projects in government or to assist in using AI start-ups developing GovTech solutions for the public sector.

Exactly to address the **need of better understanding the positive and negative consequences of AI use in public services**, our research has reflected on the lack of evidence on impacts of AI in the public sector. Despite the large amount of publications and policy discussions, most impact assessment studies conducted on AI focus solely on technical assessment of those solutions, which takes place in optimal and controlled environments. Assessing the impact of AI technologies in a real-world setting, considering the challenges of adoption and implementation of such innovations, and the need to ensure integration of these systems in the existing digital infrastructures and organisational processes, is likely to depict a very different picture.

Findings from some of the illustrative case studies described in this report already suggest that there is a strong risk of civil servants not trusting the work of their AI 'colleagues', meaning that they double-check all the machine work, possibly harming productivity rather than enhancing it. Other potential paradoxes include enhanced detection of social problems because of AI, but then not having adequate resources – or political approval - to act upon these problems, leading to wonder what in the end the transformative impact of the technology is about.

Taking into consideration the complexity of innovation adoption in the public sector, our research proposes an original methodological framework for impact assessment, building on previous work on assessing the effects of digital government transformation. In this approach, the contextual and individual factors that are crucial for the impact assessment of AI applications are defined, allowing for a comparison between the *ex-ante* and the *ex-post* policy situation resulting from the introduction of AI. Implementing this approach takes particular care in analysing the organisational changes emerging as a result of the adoption of the AI system, as well as the broader social and economic impact generated by the use of AI to improve governance and public services delivery, according to a public value perspective.

6.3 Policy implications and future research

This report provides a preliminary **overview of the use of AI in public services in the EU**. At the same time it has outlined a methodology proposal for assessing social and economic impacts of AI in this field. Its ambitious goals and the achievements reported about place this endeavor within the evolving action research stream on (digital) technology for public policy, characterized by the increasing importance given to AI for the public sector, and the **recognition of the role of the government as a crucial player in the design of the regulatory frameworks and tools for the governance '*with* and *of*' AI**.

The mapping exercise designed and conducted as a 'baseline study' allowed us to develop *ad hoc* typologies and a framework of analysis, to better understand the public value generated by the use of AI in public services.

But clearly **this is only the starting point of a learning journey, which requires an iterative approach, involving relevant stakeholders and work with all Member States representatives**, preferably at different administrative levels. In particular, further '*deep dives*' at country level through case studies and thematic analyses are needed to test and validate the assessment framework, while gathering insights and recommendations for further extending it.

Only through such an iterative approach it will be possible to redefine some of the concepts and elements by now considered as provisional and subject to change, as well as incorporate them into the proposed method for modelling impacts. This will serve also to monitor and review the policy actions related to AI in the public sector that are outlined in the national strategies, complementing the research part of AI Watch dedicated to this activity. As this report highlights, **there are still various open issues in the field which limit our understanding of the full potential of AI in the public sector**.

Our analysis also shows that **the level of AI adoption and use across the European countries is heterogeneous**: both in terms of the number of use cases identified, and of the different technologies regarded as AI and their purposes and functionalities. As illustrated by the early findings of the landscaping analysis, in fact, the scope, goals and practices of public sector use of AI is much diverse: just to make an example, an automated decision system to grant protection to asylum seekers is a task of a far higher delicacy and complexity than increasing the use of digital public services through predictive analytics. Thus it seems more practical to gear future thinking towards high-potential impact applications that may have consequences of particular relevance for the populations they target.

Current ambitions with regards to AI are however plagued by various challenges in the adoption and use of these technologies within the public sector. Whereas AI development and adoption is a cornerstone of the new Digital Strategy to shape the future of Europe, and it is regarded by EU Member States as a key technology for driving economic growth in the next decades, there are differences between the Member States with regard to the wide range of actions mentioned in the national documents, and the extent in which they may develop specific 'policy instruments'.

In this regard, using the vocabulary of a classic categorisation of different policy instruments (Bemelmans-Videc et al., 1998) distinguishing between 'sticks' (i.e., regulatory instruments), 'carrots' (i.e., economic and financial instruments), and 'sermons' (i.e., soft policy instruments, such as training and dissemination programmes), we can observe that, for the time being, the emerging national strategies on AI in the public sector in Europe seem to privilege a 'sermon based approach'. **Soft policy instruments, such as campaigns for awareness, encouragements to improve data quality, and training, are in fact prevalent across almost all countries**. Regulation and financial resource allocation, such as project funding and procurement process reviews, on the other hand, are instruments that are less uniformly distributed at this stage.

However, apart from further analysing the strategic actions undertaken by Member States to stimulate the development and adoption of AI within their own administrations, **there is also a need to take a closer look at successful cases of AI implementation and learn from their experiences**. By researching on these cases, best practices can be better understood and shared among the EU, which helps further scaling out of AI solutions. Elaboration of what works and what does not work – using a comprehensive impact assessment framework – is crucial to move the debate on AI forward on what AI is actually providing positive contributions to public service delivery and which may instead be threatening the quality of services.

This effort resonates well with the work being conducted by the High Level Expert Group on AI (AI HLEG)[62], which developed as part of its mandate the Policy and investment recommendations for trustworthy Artificial Intelligence. This document is the second deliverable of the AI HLEG and follows the publication of the group's first deliverable, Ethics Guidelines for Trustworthy AI, published on 8 April 2019, and

The document in fact recognises the important role of Europe's Public Sector to act as a catalyst of sustainable growth and innovation, stating that '*Europe has a strong public sector that can play a significant role when it comes to the uptake and scaling of Trustworthy AI and establishing a Single Market for Trustworthy AI*'. Moreover, it underlines that '*Public services are critical to the relationship between the state and citizens, groups and individuals and that **AI has the potential to play a significant role in improving the quality and efficiency of public services***'.

[62] https://ec.europa.eu/digital-single-market/en/high-level-expert-group-artificial-intelligence

This statement is further declined into a set of recommendations, which are structured around the following four areas of intervention:

1) Provide human-centric AI-based services for individuals;

2) Approach the Government as a Platform, catalysing AI development in Europe;

3) Make strategic use of public procurement to fund innovation and ensure trustworthy AI; and

4) Safeguard fundamental rights in AI-based public services and protect societal infrastructures.

The evidence gathered in our research at European and global level is perfectly in line with these recommendations. First and foremost, the human-centric aspect needs a twin declination – like two sides of the same coin – both inside and outside the 'black box' of the specific service being digitally transformed, thanks to the contribution of the AI. This is directly related with the fourth recommendation of the AI HLEG, however to be interpreted more as a caveat against all-too-enthusiastic interpretations of preliminary AI trial results than as a barrier to be raised against further innovation and experimentation in the domain at hand.

Approaching the (EU and MS) government(s) as a single platform has in our opinion the potential of being the real game changer, also in comparison with United States and China. In fact, the signs are relatively good of the intention to consider the AI policy strategy as a single EU-wide initiative, although tempered by the usual differentiators at national level in the various EU countries. The joint endorsement of very important statements of principle, however, can only be considered as a first step in the direction of a common approach to benefit and cost sharing across institutions and levels of government, grounded on a reuse logic and huge investments in capacity building of prospective inside users of these innovation.

In fact, the risk is pretty high that as partly happened in conventional e-Government until nowadays, the pace of technological innovations with limited or no outreach grows too fast compared with the rate of transformation in existing service or policy practices, or creation of new services and policies, which is supposed to be the ultimate goal of ICTs and now AI take-up in the public sector. If we add the complexity of designing, testing and implementing AI successfully in real cases and the relative closeness of many initiatives in our mapping, dictated by similar government needs and purposes despite their belonging to different public administration contexts, **the importance of a coordinated action to promote AI innovation in Europe, based on reuse, interoperability and sharing of implemented solutions**, can only become more evident.

This leads us to the third recommendation, related to **the use of innovative public procurement to stimulate and speed up AI adoption**, a specific activity that is likely to further extend the appropriateness and cost effectiveness of AI take-up in government, meeting the expectations of increasingly proactive service providers and policy designers to the changing global landscape, made more complicated by the Covid-19 crisis.

Future research activities should therefore go more in-depth to increase our understanding of the conditions for these recommendations to be enforced and supported by coherent policy actions. This will require gaining more information about the scope, depth, amount of resources and effects of such actions. For example, while many strategies highlight the need to enhance the AI skills within the public sector, it would be useful to compare how many trainings are given, to whom, how many are attending and whether after the training, uptake and use of AI in the public sector has increased.

This should include the **development of a dynamic database, based on a modular approach to data collection**, including not only the Member States' strategies that will be published in the coming months, but also a broader spectrum of policy documents relevant to AI in the public sector, that are not necessarily part of the official AI Strategies or can even constitute best practice examples from other non-EU contexts to take proper inspiration from.

While our first Survey Questionnaire has been designed to further complement the exploratory analysis and the inventory of the situation in each EU Member State, additional modules should be developed to gather data through surveys, focus groups and other statistical techniques, so as to have **a more in depth mapping of AI use in public service, and identify trends, gaps, and different scenarios in service provision as well as in governance of AI**, at both national and sub-national level, including through linking with the **AI4CITIES**[63] and the **'Living-in-EU'**[64] initiatives coordinated by DG CONNECT, and the future Smart Cities and Communities initiatives that may be funded under the forthcoming Digital Europe Programme.

[63] https://ai4cities.eu
[64] https://www.living-in.eu

Finally, this activity should also **consider alternative policy scenarios**, including the absence of specific legal and regulatory instruments, leaving 'ethical principles' and 'responsible practices' as merely voluntary; a moderate legal framework, encouraging or requiring technical adjustments that do not conflict significantly with profits; or a restrictive regulatory systems, curbing or banning deployment of the technology.[65]

In support of such analyses of contextual conditions and to better assess the current use level of AI in policy processes and public service delivery, **a set of highly impactful cases involving the use of AI should be conducted at EU and global level**. This work would thoroughly analyse AI implications from different angles (e.g. technical, semantic, organisational, legal, and economic) and policy perspectives. These analyses are to be conducted with a twofold objective: on the one side, to further expand the knowledge base for the mapping; and on the other side, to define drivers and barriers to implementation, thus contributing to develop the impact assessment framework and the roadmap with recommendations and guidelines on use of AI in public services.

In this regard, **interoperability issues and the role of location information and data intelligence in the roll-out of AI in public administration should also be considered**, in order to provide recommendations for action research and draw possible implications for policy, with specific regard to the assessment of broader innovative public services. In parallel to this, and following the presentation of the initial methodology proposal to assess potential impacts and added value of the use of AI in public services at the 1st Peer Learning Workshop with Member States on 11-12 February 2020, in-depth qualitative case studies should be conducted to test and further refine the proposed approach. This will include collecting data according to specific indicators, making sure that the socio-economic context is appropriately taken into account.

The case study analysis and application of the approach to concrete experiences in Member States, will permit to validate - and revise as it may be required - the proposed methodology, while drawing up recommendations on the way forward to roll out AI based systems and solutions in public services. For this purpose, **the outline of the proposal for developing a methodological approach for assessing the use and impact of AI in public services in the EU will be further advance and reviewed** with stakeholders through *ad-hoc* consultation activities and peer-learning workshops with experts and Member States representatives.

In the same vein, based on the results of the analysis conducted to landscape the use of AI in public services across the EU Member and Associated States, and the application of the proposed methodological approach to the case studies, the research will further analyse strengths and weaknesses in **addressing questions of AI governance in different contexts, and draw recommendations on how to best coordinate the efforts of policy-makers and regulators within the data/algorithm sphere**. To this end, the findings will provide directions on concrete actions for further development of AI based systems and solutions in government.

The insights gained from the review of cases will be then further elaborated in order to design a proposal of **framework for the use of AI in public services, defining guidelines and a generic implementation roadmap**, based on best practices and the results of the analysis of the re-use potential of AI based systems and solutions, identifying also opportunities for collaboration among relevant stakeholders from various sectors.

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