

Artificial Intelligence in Government Taking Stock and Moving Forward

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Artificial Intelligence in government: Taking stock and moving forward

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Artificial Intelligence in government: Taking stock and moving forward

Abstract

The use of Artificial Intelligence (AI) applications in government is receiving increasing attention from global research and practice communities. This article, introducing a Special Issue on Artificial Intelligence in Government published in the Social Science Computer Review, presents an overview of the main policy initiatives across the world in relation to AI in government, and discusses the state of the art of existing research. Based on an analysis of current trends in research and practice, we highlight four areas to be focused on in future research on AI in government: governance of AI, trustworthy AI, impact assessment methodologies, and data governance.

Keywords: Artificial Intelligence; government; public sector

1. Introduction

Despite the recent boom of references to Artificial Intelligence (AI) in the media, in the corporate sector, and in public discourse, the notion of AI is not new. The term was coined in the 1950s in an academic context to indicate an emerging research field studying 1) the ability of machines to carry out tasks by displaying intelligent, human-like behaviour; and 2) the ability of machines to behave as intelligent agents by perceiving the environment and taking actions to achieve some goals (Russell & Norvig, 2016; Tzafestas, 2016).

The often highlighted value creation potential of AI applications includes the ability to augment labour and increase productivity, to more effectively allocate resources, and to foster innovation. AI instances include techniques such as supervised and unsupervised machine learning (Smola & Vishwanathan, 2008), artificial neural networks (Priddy & Keller, 2005), case-based reasoning (Kolodner, 1992); natural language processing (Chowdhury, 2003), multi-agent systems (Wooldridge, 2009); and machine reasoning (Bottou, 2014). AI applications include cyber-physical systems (Radanliev et al., 2020), such as robotics and Internet-of-Things (IoT) applications, image and facial recognition, speech recognition, virtual assistants, and autonomous machines and vehicles.

AI represents an ideal technology for use in the public sector context, where environmental settings are constantly changing, and pre-programming cannot account for all possible cases (Dwivedi et al., 2019; Sun and Medaglia, 2019). AI differs from traditional automation technologies because it does not make decisions on pre-programmed if-then logic, in which the same input instructions produce the exact same results. Instead, AI features autonomy in function and learning, an assumption of appropriate and available data, and the incorporation of physical and virtual spaces (Ahn & Chen, 2020). However, if the assumptions are not met, AI might not be the best option for automation and decision making.

Opportunities coming from the innovative disruptive power of AI in the public sector are primarily found in three areas: 1) improving the internal efficiency of public administration; 2) improving public administration decision-making; 3) improving citizen-government interaction, including the provision of better and more inclusive services, and the enhancement of citizen participation in the activities of the public sector (Samoili et al., 2020)

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3 (Samoili et al., 2020). As a potentially disruptive socio-technical phenomenon, AI is relevant
4 to the full range of government's roles: as a regulator and as a catalyst for research and
5 development (governance *of* AI); and as a user (governance *with* AI, or AI in government).
6 Such potential could be realized if governments foster an environment characterized by a
7 skilled workforce, an appropriate regulatory framework, resources that can be promptly
8 mobilized, and incentives to innovate. Risks of AI, on the other hand, include for example,
9 widening societal divides, infringing citizens' privacy rights, and clouding the accountability of
10 public decision-makers. Such risks require thoughtful strategies and regulation in order to be
11 avoided or mitigated.
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15 Consideration of the governance of AI is currently the subject of policy debates across the
16 world, but it cannot be considered completely novel when compared to previous waves of
17 technology, for which innovation incentives, implications and regulation had to be similarly
18 balanced. As AI-related policy initiatives and research on AI in government accumulate, this
19 article aims to map key trends in policy and research and identify directions for future
20 research. This article accompanies a Special Issue on Artificial Intelligence in Government
21 edited by the authors for the Social Science Computer Review, building on a call for cutting
22 edge studies on this topic area from different social science perspectives, including Public
23 Administration, Information Systems, Sociology, Information Science, and Management.
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27 The rest of this article is structured as follows. In Section 2 we provide an overview of the
28 main policy initiatives concerning AI in government in Europe, the United States, and China,
29 and map the state of the art of research on AI in government drawing on a review of existing
30 research. In Section 3 we present the six studies included in the Special Issue and map
31 them against the state of the art of existing research. Finally, in the concluding section we
32 summarize our points and propose a set of key questions for future research on AI in
33 government.
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36 37 **2. AI in Government: policy and research**

38 39 *2.1 Policies across the world*

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42 Governments across the world are providing increasing attention to the potential of AI. This
43 potential is seen not only in relation to economic growth, since national AI strategies also
44 focus on common themes such as trust and ethics, security and enhancing the talent
45 pipeline (Berryhill et al., 2019). Increasing attention has also started to be devoted to the role
46 of AI in achieving the Sustainable Development Goals (SDG) of the United Nations' Agenda
47 2030 (Medaglia et al., 2021; Vinuesa et al., 2020). It is not surprising that different countries
48 and different areas of the world are starting to develop approaches to AI in government that
49 have diverse features. These features, some argue, are indicators of different value drivers
50 (Viscusi, Rusu, et al., 2020) and governance orientations (Viscusi, Collins, et al., 2020).
51 For instance, Europe has been expressing the will to position itself in the global landscape
52 with AI strategies that rely more heavily on enterprise and government data. This positioning
53 has been attributed to its relative lag, within global competition, in competitiveness in the
54 consumer data space (Groth & Straube, 2021). The European Commission reviewed its
55 "Coordinated Plan on the Development and Use of Artificial Intelligence Made in Europe"
56 (European Commission, 2021) to foster cooperation between all European Union Member
57 States, plus Norway and Switzerland. The plan focuses on four key areas: increasing
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3 investment, making more data available, fostering talent, and ensuring trust, and highlights
4 the public sector as a “trailblazer for using AI” (European Commission, 2021, p. 46). Within
5 the AI strategy at the EU level, the public sector is also a focus in the “European Strategy for
6 Data” (European Commission, 2020a), where it is stated that “Public policy can increase
7 demand for data-enabled offerings, both by increasing the public sector’s own ability to
8 employ data for decision-making and public services and by updating regulation and sectoral
9 policies to reflect the opportunities provided by data and ensure that they do not maintain
10 disincentives for productive data use” (European Commission, 2020a, p. 5).
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14 The European Commission devotes a specific section in a recently published white paper on
15 AI to promote the adoption of AI by the public sector, considering it “essential that public
16 administrations, hospitals, utility and transport services, financial supervisors, and other
17 areas of public interest rapidly begin to deploy products and services that rely on AI in their
18 activities” (European Commission, 2020b, p. 8). The framework provided by the European
19 Commission provides for a deployment of AI in the public sector that is aimed at developing
20 *human-centric AI*. More specifically, healthcare, rural administrations and the support of
21 public procurement of and with AI are considered priority areas for consideration.
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25 Among European countries, Finland was the first to present its own AI strategy, in 2017. As
26 of April 2021, nineteen European countries have dedicated official strategies to AI. Despite
27 the growing focus of these countries on the potential of AI in the public sector, the reality is
28 that government is often seen merely as a regulator or as a facilitator of AI, that is mostly just
29 providing guidance or legal and regulatory frameworks to minimize the potential risks of AI,
30 while enabling the maximum opportunities from its application. Actual adoption of AI by
31 governments to improve public services, policymaking and internal operations do not gain
32 the same amount of interest and related investment (Misuraca & van Noordt, 2020). A
33 systematic analysis of these national strategy documents (van Noordt et al., 2020) reveals
34 how the majority of policy initiatives put in place by European Union countries belong to the
35 category of “sermons” (Bemelmans-Videc et al., 1998), that is soft instruments, such as
36 communication campaigns, private-public partnerships, and voluntary codes of conduct.
37 Less frequent are “carrots” initiatives, that is the allocation of economic resources and
38 economic incentives, such as direct cash transfers, tax incentives, competitive research
39 funding schemes, etc; or regulatory instruments (“sticks”), including binding laws and
40 regulations, the establishment of Intellectual Property Rights, competition regulation, or
41 ethical regulations.
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47 The European approach to AI is often mentioned in the context of the “global AI race” that
48 also involves the United States and China (Craglia et al., 2018). Comparisons between
49 these three entities involve levels of investments, research, training, and education.
50 Successful deployment of AI is seen as key to efforts to dominate an arena characterised by
51 strong network effects (Makridakis, 2017).
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54 While the U.S. has by far the highest private sector investment in AI (McKinsey, 2020), the
55 take up of AI in the U.S. public sector is less clear cut, partly due to the fact that much less
56 research and official information is available about the current and planned use of AI in
57 public administration (Cath et al., 2018; Craglia et al., 2018).
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59 The U.S. Federal Government has been putting forward initiatives to develop trustworthy AI
60 for government services, aligned with constitutional values. Several Federal agencies have

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3 already been using AI for various purposes, including processing grant applications,
4 compliance checking, and predictive maintenance. A recent mapping of the use of AI
5 technologies showed 142 uses of AI in relevant federal administrations (Engstrom et al.,
6 2020). A noteworthy challenge facing the federal government, vis-à-vis the booming of AI in
7 the business sector, is the lack of available talent in the public workforce. U.S. federal
8 agencies are often forced to find ways to leverage expertise from the private sector to
9 develop strategies to adopt AI, including new approaches to hire and train existing workers
10 with new skills to innovate with AI technologies (The White House Office of Science and
11 Technology Policy & Policy, 2020).
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15 As in Europe, sub-national levels of government in the U.S. seem to lag behind the federal
16 government. A survey conducted among IT executives of 45 state agencies showed that
17 only 1% have adopted AI across their state, and that most of the state of AI adoption is
18 merely in a proof-of-concept phase (Center for Digital Government et al., 2019). From a
19 citizen perspective, U.S. agencies face a lack of confidence by citizenry in governmental
20 organisations to successfully manage the development and use of AI technologies. Rush in
21 development and opaque management are cited by citizens as potential causes of mistrust
22 in government AI (Zhang & Dafoe, 2019).
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26 The deployment of government AI initiatives in the People's Republic of China is often
27 referred to as the most relevant counterpart of those in Europe and the United States. The
28 setting up of AI-powered surveillance systems, in general, and examples like the social
29 credit system, in particular (Creemers, 2018), are frequently cited as dystopian initiatives
30 curbing citizens' rights and endangering global power balances. However, the prevalence of
31 such fears, while not unfounded, often hinders a proper understanding of the complexity of
32 the reality of government AI initiatives in China.
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36 The "New Generation Artificial Intelligence Development Plan", released by the Chinese
37 State Council in 2017, was intended to be a unifying document for China's various AI
38 objectives. However, the document presents as more of a wish list than a central command
39 directive, where the lower levels of government are expected to play a vital role in the actual
40 transformation of society through AI (Roberts et al., 2020). While the national strategy
41 focuses on technological enablement, pilots and experimentation are expected from lower
42 levels of government, often following a principle of "experiment first and regulate later"
43 (Elliott, 2020). Sometimes such initiatives go far beyond the national AI policy, sparking
44 relevant domestic controversies. Moreover, the actual delivery of AI-enabled public services
45 appears to be mostly from large technology companies that are favoured by the central
46 government. Applications used in the Chinese public services are not necessarily cutting
47 edge, but their strength lies in the integration of various systems and in the ability to scale up
48 quickly (Elliott, 2020). China's AI policies prioritize the speeding up of technology
49 development, data collection and implementing pilots, while risk management, data privacy
50 and accountability appear to be secondary to these imperatives (Elliott, 2020).
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55 Despite popular conception, China has also been working on the adoption of AI ethical
56 principles and frameworks. In 2019, an expert committee released eight principles to be
57 adhered to in the development of AI (Ministry of Industry and Information Technology of the
58 P.R.C., 2019). Such principles, while partly overlapping with the ones of Europe and the US,
59 do put a stronger emphasis on social responsibility (e.g., "harmony") rather than individual
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rights. Notwithstanding the tensions and contradictions that characterize the Chinese government AI initiatives, citizens in China indicate relatively high support for government applications of AI (Carrasco et al., 2019). At the global level, there is emerging evidence that less developed economies and countries that have higher reported or perceived levels of corruption also tend to be more supportive of AI in government (Carrasco et al., 2019). This could be an indication of the neutrality that people expect from AI.

2.2 State-of-the-art of research

As a new field of policy intervention, the use of AI in government AI is attracting an increasing amount of attention from the research community, raising a range of new research questions. In order to map the body of knowledge on AI in government, we first analyse published literature reviews on AI in the public sector (Section 2.2.1), and then we provide a review of research papers published in the period 2020-2021.

2.2.1. A brief review of literature review papers

In order to have a solid understanding of the state-of-the-art in terms of research on AI in government, this section summarizes the results of our review of existing literature review papers that explore AI in government. Using keywords such as “artificial intelligence” and “public sector” or “government”, we looked for reviews in the last five years and found nine, all of them published between 2019 and 2020. For maximum coverage, we used Scopus and Google Scholar as our main databases and did not limit the search to certain fields or disciplines. Most studies were published in Public Administration, Information Systems, or Digital Government conferences and journals. The literature review papers were selected based on the topic, but also looking for a broad focus on AI in government. Therefore, literature reviews focused on specific subtopics such as AI and smart cities, AI and healthcare, big data and AI, or AI and cross-sectoral collaboration were not included. Overall, we found that existing literature reviews on AI in government highlight different aspects, which could be classified in the following categories (see Table 1): (1) Definition and Attributes; (2) Techniques and Technologies; (3) Uses and Applications; (4) Results, Impacts, and Benefits; (5) Challenges and Determinants; (6) Strategies, Best Practices, and Guidelines; and (7) Ethical Considerations. The next few paragraphs summarize the findings of these review efforts.

Table 1. Categories of Topics Found in Existing Literature Review Papers

	Ahn & Chen (2020)	Desouza et al. (2020)	Reis et al. (2019 a)	Reis et al. (2019 b)	Sharma et al. (2020)	Souza et al. (2019)	Vall e-Cruz et al. (2019)	Wirtz & Müller (2019)	Wirtz et al. (2019)
AI definition and attributes	X		X				X		X
AI techniques and technologies			X			X	X	X	

AI uses and applications	X			X	X	X	X		X
AI results, impacts, and benefits	X		X				X	X	
AI challenges and determinants	X	X					X		X
AI strategies, best practices, and guidelines		X						X	
Ethical considerations about AI						X		X	X

AI definition and attributes. Research efforts are far from producing a universally accepted definition of AI, partly due to the fact that any definition of the term has to include the very elusive notion of intelligence. The paradox of the so-called “AI effect” (McCorduck, 2004) is a case in point: as soon as technological breakthroughs realize some of the capabilities forecasted for AI – such as recognizing human speech, or reading written script – many observers discount these capabilities as not “real” intelligence. As a result, the target of AI is constantly moving, since “Intelligence is whatever machines haven’t done yet”, a claim referred to as “Tesler’s theorem” (Hofstadter, 1999). From the nine literature review papers found, four of them specifically highlight definitions of AI and its main attributes. For example, Wirtz et al. (2019) present a table with six different definitions of AI. Based on those definitions, they propose what they call an integrative definition, which is “AI refers to the capability of a computer system to show humanlike intelligent behavior characterized by certain core competencies, including perception, understanding, action, and learning” (Wirtz et al., 2019, p. 599). Similarly, Ahn and Chen (2020) propose as one of their research questions “What is the meaning and implication of Artificial Intelligence (AI) in public administration?”. In their review paper, they also include several definitions of AI and, although they do not provide their own, they identify three important attributes of AI that should be considered as part of its conceptualization and development over time. These attributes are autonomy in function and learning, an assumption of appropriate and available data, and the incorporation of physical and virtual spaces (Ahn & Chen, 2020). In contrast, Reis et al. (2019a) mostly adopt one definition of AI and devote several paragraphs to clarifying differences and similarities among several related terms, many of which are actually techniques that could be thought of as part of AI. Finally, Valle-Cruz et al. (2019) focus on the concepts related to AI in the public sector, including knowledge, learning, and intelligence. They present seven definitions of AI and for them “AI is the field of computer science that includes a series of techniques to create algorithms and intelligent machines that simulate individual and collective behavior, not only of human beings, but of any kind of living being, automating activities, learning and evolution, as well as improving performance and results obtained with or without the help of human beings” (Valle-Cruz et al., 2019, p. 93). Overall, the literature review papers acknowledge that there is no single definition of AI in government, but there are a few attributes or characteristics that are present in many of the definitions. Russell and Norvig (2016) capture the essence of these definitions with their view that AI could be conceptualized as “systems with the ability to think and learn”.

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4 *AI techniques and technologies.* Four out of nine literature review papers discuss different AI
5 techniques and technologies as found in the literature. For example, Sousa et al. (2019)
6 provide a list of AI techniques, including case-based reasoning (CBR), cognitive mapping
7 (CM), fuzzy logic (FL), machine learning (ML), artificial neural networks (ANN), genetic
8 algorithms (GA), multi-agent systems (MAS), and natural language processing (NLP).
9 However, they do not directly elaborate on any of them and the focus of their review article is
10 on applications. Similarly, Reis et al. (2019a) also present a list of AI techniques, and briefly
11 describe each of them. The techniques included in their review paper are neural networks,
12 deep learning, and machine learning. They also mention some important applications of
13 these techniques such as computer vision, natural language processing, and speech
14 recognition (Reis et al., 2019a). In contrast, as part of the Technology Infrastructure Layer of
15 the AI frameworks they reviewed, Wirtz and Müller (2019) identify many AI techniques,
16 including machine learning, intelligent control, knowledge representation, pattern
17 classification, data lake analytics, cognitive services, and neural networks. They argue that it
18 is very important to consider the actual function needed in order to select a technique or
19 combination of techniques that could help to sense, comprehend or act (Wirtz & Müller,
20 2019). Finally, Valle-Cruz et al. (2019) argue that AI techniques could be based on software,
21 hardware or both: “some software-based techniques are artificial neural networks,
22 evolutionary computation (consisting of genetic algorithms, evolutionary strategies, and
23 genetic programming), fuzzy logic, intelligent systems, multi-agent systems, natural
24 language, expert systems, learning classifier systems, automatic learning, and deep
25 learning” (Valle-Cruz et al., 2019, p. 93). In contrast, they identify robotics, autonomous
26 vehicles, artificial vision, and virtual reality as AI techniques based on hardware. They also
27 provide brief descriptions of some of these techniques.
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34 *AI uses and applications.* From the nine papers identified, six include topics related to the
35 different uses and applications of AI in government. For example, Ahn and Chen (2020)
36 identify nine different uses of AI in government settings. These include smart allocation of
37 public service resources, digital assistance with chatbots, pattern identification and predictive
38 analytics models, automation and “Regu-Tech”, smarter public utilities, smart energy, the
39 Internet of Things (IoT) and robotics sensors, autonomous driving, and sensor-based
40 detection and prevention. They provide examples for each type of use. Similarly, Wirtz and
41 colleagues (2019) also highlight specific AI applications and how they could be used in the
42 public sector. These include AI-based knowledge management (KM) software, AI process
43 automation systems, virtual agents, predictive analytics & data visualization, identity
44 analytics, cognitive robotics and autonomous systems, recommendation systems, intelligent
45 digital assistants (IDA), speech analytics, and cognitive security analytics and threat
46 intelligence. They also provide a list of public sector use cases. In contrast, Sousa et al.
47 (2019) propose a very different approach in which they refer to use as the main function of
48 government, including general public service, public order and safety, defense, economic
49 affairs, environmental protection, housing and community amenities, health, recreation,
50 culture and religion, education, and social protection. In their review, excluding general
51 public service, the functions of government in which there are more papers about AI are (1)
52 economic affairs, (2) environmental protection, and (3) public order and safety. Similarly,
53 Sharma and colleagues (2020) also propose to think about AI applications in terms of
54 different sectors or policy domains. They classified papers found in public healthcare,
55 information, communication and technology (ICT), environmental sustainability,
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3 transportation, government law and policy-making, and economic and financial applications. Valle-Cruz and colleagues (2019) also propose specific policy domains, but the overlap with
4 the previous authors is limited. For them, AI uses in government could be related to public
5 health, climate change, air quality, tax obligations, open government, and politics. They also
6 propose ways to incorporate AI into the policy cycle, from agenda setting to policy
7 evaluation. Finally, Reis and colleagues (2019b) provide a long list of areas in which AI may
8 potentially change government, but highlight that the impact to-date has been mainly on the
9 delivery of government services, sometimes through partnerships with private companies.
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14 *AI results, impacts, and benefits.* Four out of the nine literature review papers highlight the
15 results from AI as either general results or potential impacts, or as benefits from its use in
16 government settings. For example, Ahn and Chen (2020) present what they called AI-
17 augmented bureaucracy and mention that the main outcomes are (1) accurate/detailed
18 understandings of citizens' needs and solutions, customizable service, enhanced simulation
19 and planning capability via Augmented Reality (AR), and predictive governance, which
20 together could be conceptualized as smart government. In contrast, Reis and colleagues
21 (2019a) identify impacts that could be positive or negative, such as job transformation,
22 changes in government decision-making, and citizen quality of life (including health and
23 safety). Taking a more comprehensive view, Valle-Cruz and colleagues (2019) provide both
24 potential benefits, but also some negative consequences. Some of the benefits mentioned
25 are accuracy, efficiency, accountability, trust, cost saving, productivity gains, reduced fraud,
26 better service provision, and improved policy analysis. In contrast, some of the potential
27 negative implications are exclusion of certain actors, increased analysis complexity, new
28 legislative requirements, dehumanization of daily activities, displacement of people by
29 machines in their jobs, and a high dependence on intelligent technologies. Similarly, Wirtz
30 and Müller (2019) also identify both prospective benefits and risks associated with the use of
31 AI in the public sector. Among the benefits are improved information processing, accelerated
32 processing of cases, improved case assignment, workforce substitution, and cutting red
33 tape; some of the risks identified are technology obedience and loss of control, AI dominion,
34 AI paternalism, and violation of privacy.
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41 *AI challenges and determinants.* Four of the nine literature review papers discuss challenges
42 of AI in government and in some cases they talk more generally about determinants. For
43 example, Wirtz et al. (2019) propose a framework with 14 challenges to AI use in
44 government settings. They include a few challenges that have been identified by previous
45 research, such as data quality, privacy, and workforce substitution, but they also propose a
46 way to group them in four categories related to technology implementation, society, ethics,
47 and law and regulations. Focusing on the policy cycle, Valle-Cruz and colleagues (2019)
48 have a very different view and propose specific challenges related to each of the stages of
49 the policy cycle. Some of the challenges they mention are the digital divide, the cumbersome
50 nature of the democratic process, goal displacement, and data obsolescence and
51 homogeneity. In contrast, Desouza et al. (2020) categorize the challenges in design,
52 development, and deployment issues related to cognitive computing systems. Some
53 examples of the challenges they identify are data availability, current asset identification,
54 disclosure of information, inadvertent bias in data and algorithms, lack of trained staff, and
55 availability of tools to audit for bias. Taking a different approach to the topic of challenges,
56 Ahn and Chen (2020) propose a series of questions that reflect some of the challenges
57 related to the use of AI in government. Their main questions are (1) how far are we going to
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3 allow AI to make decisions?, (2) what would be the process of reconciliation when there is a
4 conflict between AI augmented decisions and human-based decisions?, (3) how will AI
5 determine the “good” (or desirable) and the “bad” (undesirable) and, more importantly, for
6 whose sake?, (4) job displacement, (5) AI transparency and accountability, and (6)
7 availability of relevant data.
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10 *AI strategies, best practices, and guidelines.* From the nine literature review papers
11 identified, only two include strategies, best practices, or guidelines to implement and use AI
12 in government. For example, Desouza et al. (2020) present strategies to overcome
13 challenges in the design, development, and deployment of cognitive computing systems.
14 They also divide these strategies according to the public or private sectors. Some examples
15 of strategies in the public sector are: assessing data availability, accessibility, and
16 analyzability; focusing on the risk dimension, engaging outside experts, leveraging inherent
17 government transparency, having an agile acquisition strategy, auditing algorithms to ensure
18 accuracy, and taking advantage of tools. In contrast, Wirtz and Müller (2019) propose the
19 following general guidelines: codifying ethical AI standards and regulations and monitoring
20 their enforcement, setting an AI agenda defining targets, field of application, and a roadmap
21 for employment, establishing limits and boundaries for AI usage and avoiding autonomous
22 decision-making, enhancing computer knowledge and AI-specific skills within the
23 organization, providing insights to data acquisition and processing and creating verifiable AI
24 algorithms, detecting options to automate administrative routine processes by means of AI,
25 and enlarging the working capabilities of staff by AI usage.
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31 *Ethical considerations about AI.* Three out of the nine literature review papers specifically
32 discuss ethical considerations to be considered when using AI in government settings. For
33 example, Sousa et al. (2019) argue that “the policies and ethical implications of AI permeate
34 all layers of the application” (Sousa et al., 2019, p. 6), including AI techniques, AI solutions to
35 support public services, and the actual functions of government. They briefly reference
36 several articles that support the importance of actively avoiding biases and discrimination
37 and creating AI solutions for the good of society. As part of their general recommendations,
38 Wirtz and Müller (2019) mention the importance of ethical AI standards and regulations.
39 They propose the development of “a public AI code of ethics and to check and monitor its
40 implementation by a public AI ethics committee” (Wirtz & Müller, 2019, p. 1087). In their
41 review, Wirtz et al. (2019) provide more details in terms of specific topics related to AI ethics.
42 For example, they mention AI rulemaking for human behavior, which “refers to the
43 consequences for the population resulting from AI-based decision-making and represents
44 one of the greatest ethical challenges associated with AI” (Wirtz et al., 2019, p. 604). They
45 also talk about compatibility of machine versus human value judgment, moral dilemmas, and
46 AI discrimination as other AI topics related to AI in government.
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51 It is important to highlight that, while each of the nine papers touch on a few of the topics
52 identified, they do so in significantly different ways, making it challenging to perform a more
53 systematic comparison. However, they are still a good indication of what has been studied to
54 date about AI in government and what opportunities exist for future research. AI has been
55 studied from very different perspectives and, in general, there is no consensus on the most
56 important aspects to consider. However, it is clear that all eight topic categories identified
57 have been the focus of papers about artificial intelligence in government within the last few
58 years. It is also important to emphasize that there is still a dominant focus on the specific
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3 technologies and techniques, although more research is now highlighting organizational
4 challenges and ethical issues. Only two review papers provide specific guidance or
5 strategies, which could be an indication of the complexity in generating this type of guidance
6 from a general point of view. Finally, we also want to emphasize that there are many
7 potential applications of AI in the public sector, but the specific context of the program or
8 agency must be considered in order to avoid some of the negative unintended
9 consequences, such as biases and exclusion, and also to generate the expected benefits.
10 Each use of AI in the public sector must be considered in context and in terms of both
11 potential positive and negative consequences.
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15 2.2.2. *An evolving focus*

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17 As a complement to the analysis of the selected set of literature reviews provided above, here
18 we draw on a set of recent empirical and conceptual papers to present some additional insight
19 into the evolving literature on AI in the public sector. The goal was to identify a small number of
20 non-literature review papers published in 2020-2021. As above, these papers were selected
21 using keywords such as “artificial intelligence” and “public sector” or “government” and we used
22 Scopus and Google Scholar as our main databases and did not limit the search to certain fields
23 or disciplines. The selected papers highlight what might be considered a logical progression
24 from the generally descriptive consideration of the nature, potential and challenges of AI to
25 papers that systematically and empirically consider specific questions and challenges. For
26 example, few publications in both the gray literature and the academic literature go beyond
27 consideration of the public value potential to specific empirical evidence of value creation nor do
28 they call, in general, attention to specific positive and negative consequences of use in specific
29 contexts. The papers highlighted below collectively foreshadow movement beyond consideration
30 of AI as a technology that is newly relevant to public administrations, to work that rigorously, and
31 in some cases empirically, examines questions about AI use in the public sector, about specific
32 uses of AI in public programs and services and begins to fill gaps in our available frameworks
33 and models to assess, govern and guide uses.
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39 Bullock et al. (2020) and Wirtz et al. (2020) highlight gaps in knowledge about the relationship
40 between AI, discretion, and bureaucratic form in public organizations, with Wirtz et al. (2020)
41 noting that, regardless of new attention to these relationships, few studies are addressing them.
42 Despite the great potential of AI, Wirtz et al. (2020) note that “many challenges and risks are
43 associated with implementing AI in public administration, constituting a darker side of AI” (Wirtz
44 et al., 2020, p. 818). Drawing on insights from predictive policing and anti-fraud and improper
45 payments reduction efforts, Bullock et al. (2020) seek to begin to close this gap by answering
46 specific questions about how use of AI is both changing and changed by the bureaucratic form
47 of public organizations, and what is the consequence of use on discretion. Bullock et al. (2020)
48 put forward a theoretical framework that integrates work on the unique effects of AI on discretion
49 and its relationship to task and organizational context with the theory of system-level
50 bureaucracy. Echoing Bullock et al. (2020), Wirtz et al. (2020) draw attention to the paucity of
51 literature addressing questions focused on how public administrations should respond to
52 challenges associated with AI and on how governments should “use regulation to prevent harm”.
53 In their work, Wirtz et al. (2020) look to regulation theory and former AI regulation approaches
54 as models and put forward an integrated AI governance framework to guide the development
55 and use of relevant regulations.
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3 Van Noordt and Misuraca (2020b) and Makasi et al. (2021) draw attention to the lack of specific
4 frameworks to assess the public value potential of AI as a consequence of specific uses in the
5 public sector. Van Noordt and Misuraca (2020b) present what they identify as a *first discussion*
6 on conceptual frameworks designed to support rigorous assessments of the effects of AI in
7 government. Makasi et al. (2021) also call attention to this gap and the consequent lack of
8 empirical evidence of value creation through the use of AI in public service management and
9 delivery. Van Noordt and Misuraca (2020b) put forward a framework using a public value
10 approach designed “to understand the internal mechanism of the organization, public service
11 quality and broader societal effects” (van Noordt & Misuraca, 2020b, p. 8). Their framework
12 takes into consideration the previous challenges of implementing ICT in government and is
13 designed “to validate and truly assess the impact of Artificial Intelligence in government” (van
14 Noordt & Misuraca, 2020b, p. 9). Makasi et al. (2021) adapt the well-known Information
15 Technology Infrastructure Library (ITIL) service framework and propose guiding principles based
16 on the framework for how to manage Cognitive Computer Systems (CCSs) in the public sector
17 to create public value. Both papers seek to address the lack of frameworks designed to support
18 rigorous assessments of the public value of AI in specific public management and services
19 programs.
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25 Janssen, Brous, et al. (2020) argue that as Big Data Algorithmic Systems (BDAS) are
26 increasingly used to make decisions that are “consequential to individuals, communities and
27 society at large”, for example access to affordable loans, matching of skills and jobs, and
28 mitigating risks of disparities in the treatment of individuals by law enforcement, failures are not
29 to be tolerated. In the interconnected world, they note, where “data is collected by (and about)
30 governments, businesses and citizens, and is processed by different entities using various
31 algorithms, dependencies grow, mistakes accumulate, and accountability is gradually lost in the
32 process” (Janssen, Brous, et al., 2020, p. 2). They argue that good frameworks to guide
33 organizations seeking to employ data governance to gain control over data quality and
34 compliance do not exist. Such frameworks, they contend, are key to the trustworthy decisions
35 through the use of AI that complies with relevant legal and ethical requirements. To begin to fill
36 this gap, Janssen, Brous, et al. (2020) put forward a new framework designed to reduce the risk
37 associated with the use of BDAS and increase accountability. Through its use, governments can
38 “promote stewardship of data, processes and algorithms, the controlled opening of data and
39 algorithms to enable external scrutiny, trusted information sharing within and between
40 organizations, risk-based governance, system-level controls, and data control through shared
41 ownership and self-sovereign identities” (Janssen, Brous, et al., 2020, p. 1).
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47 Providing a specific case example of the argument presented by Janssen, Brous, et al. (2020)
48 that without data governance to ensure quality and compliance with regulated uses, entrusting
49 consequential decisions to AI introduces risk, Vogl (2020) draws attention to the need for
50 research on data governance within specific contexts, such as the use of predictive analytics for
51 the initial screening of cases in child protection services. Such consideration, he argues, calls
52 first for attention to fundamental and well-known system and data problems. Vogl (2020) draws
53 attention to the long-standing and intransigent problem of redundant records in human services
54 systems and the potential consequences of the use of such data in this context. In the context of
55 child protection, using data with redundant records exacerbates the complexity of decision
56 making about program eligibility and service delivery decision making. Without attention to
57 fundamental data and system problems, “valuable information about past abusive or neglectful
58 behavior could be left out of analyses or predictions, or it could associate information about
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3 abusive or neglectful behavior with the wrong individual” (Vogl, 2020, p. 229). Vogl’s (2020)
4 research challenges long standing assumptions that problems with data can be fixed through the
5 use of advanced technologies and techniques.
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8 Liu et al. (2020) and Valle-Cruz et al. (2020) both offer systematic examinations of AI in specific
9 use contexts, focusing respectively on AI and crowdsourcing and AI in public sector budgeting.
10 Both draw attention to the lack of understanding about the public value creation potential of AI in
11 each of these specific use contexts. Liu et al. (2020) focus on the use of AI in crowdsourcing,
12 drawing attention to the limits in our understanding of the connections between these “two types
13 of intelligence and adoption conditions to properly utilize them for the public sector” Liu et al. (Liu
14 et al., 2020, p. 224). Valle-Cruz et al. (2020) call for explorations of artificial intelligence
15 techniques in public budgeting, but urge caution that the value creation might not be found where
16 expected. In fact, they posit, the value might be in “supporting creative ways to analyze and
17 understand the data used for specific government programs and policies” (Valle-Cruz et al.,
18 2020, p. 241) rather than in automated decision making. They call for continuing consideration of
19 AI in the use context of public budgeting highlighting the cost of some uses. They note the time it
20 took to run some of their tests, in some cases, as long as a week, raising questions about the
21 best fit of AI into government decision making processes, particularly given the readiness of
22 many government agencies at the state and local levels to stand-up and sustain the necessary
23 technical infrastructure.
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28 These selected papers illustrate a progression from the generally descriptive work characteristic
29 of the early adoption phase of a new technology to work that examines more specific questions
30 about value assessment, determinants of success and use in context, among others. They
31 illustrate the point that researchers are beginning to systematically examine AI in specific use
32 contexts. Two of the selected papers address specific questions about the relationships
33 between AI and discretion and the utility of regulation theory to efforts to adapt past models of AI
34 regulation for use with future AI technologies. Two speak to the lack of specific frameworks to
35 assess the public value potential of AI. Two speak to the specific role of data. The first
36 addressing the general consequence of a lack of systematic governance of data; the second,
37 addressing the consequences of a lack of data governance, or more specifically, the lack of
38 attention to longstanding and intractable data problems, such as the specific context of child
39 protection. Two final papers highlight the transition to work that examines the practical realities
40 and potential of specific uses of AI in public programs and services, in particular, crowdsourcing
41 and public sector budgeting.
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46 Taken together, these papers contribute to the development of questions about the extent to
47 which previous work on the implementation of emerging technologies in the public sector are
48 relevant with respect to AI, which requires particular adaptations, and in which cases we must
49 start anew.
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51 **3. Contributing perspectives**

52 The papers in this Special Issue provide a mixture of cautious optimism and critical reflection
53 about the potential of AI in the public sector. Some articles explore specific cases in depth, while
54 others engage in big questions, such as the role of trust and discretion. The accepted articles
55 include several of the topics identified in section 2.2.1, particularly AI techniques and
56 technologies, and AI challenges and determinants (see Table 1). They explore these topics
57 either conceptually or in the context of specific national realities. In fact, this Special Issue
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includes articles that examine AI in government settings in a variety of countries, including Belgium, China, Estonia, Sweden, the Netherlands, and the United Kingdom, providing evidence that considerations of AI in the public sector by both researchers and practitioners has become a global phenomenon. Some of the specific topics include the accuracy of different AI algorithms, interorganizational collaboration and AI adoption, trustworthiness in AI, factors that affect AI adoption and performance, the importance of human and technological agency, and adoption of AI in public administrations in the European Union. In terms of methods, the articles included in this special issue represent a diversity in research design and methods, including quasi-experiments, interviews, case studies, literature reviews, statistical analysis, desk research, and documents analysis. Table 2 provides an overview of the articles published in this Special Issue.

Table 2. Summary of the Special Issue articles: issues, countries, topics, and methods

Specific issues/questions	Country	AI Topic Discussed	Method	Authors
<p>How accurate are different types of AI algorithms?</p> <p>To what extent decision makers in government can identify incorrect suggestions made by AI algorithms?</p>	The Netherlands	<p>AI techniques and technologies</p> <p>AI uses and applications</p> <p>AI challenges and determinants</p>	Quasi-experiment	Marijn Janssen, Martijn Hartog, Ricardo Matheus, Aaron Yi Ding, and George Kuk
<p>What challenges do interorganizational collaborations face in adopting AI?</p> <p>What organizational routines do managers use to overcome those challenges?</p>	United Kingdom	<p>AI techniques and technologies</p> <p>AI challenges and determinants</p> <p>AI strategies, best practices, and guidelines</p>	<p>Case study</p> <p>Semi-structured interviews</p>	Averill Campion, Mila Gasco-Hernandez, Slava Jankin Mikhaylov, and Marc Esteve
To what extent traditional decision support tools and AI-based efforts are different and how those differences affect their values and trustworthiness?	N/A	<p>AI definition and attributes</p> <p>AI results, impacts, and benefits</p> <p>AI challenges and determinants</p> <p>AI strategies, best practices, and guidelines</p>	<p>Literature review</p> <p>Conceptual analysis</p>	Teresa M. Harrison and Luis Felipe Luna-Reyes

<p>What are the key factors that influence local governments to adopt chatbots?</p> <p>What are the key factors that affect chatbot performance post adoption?</p>	China	<p>AI techniques and technologies</p> <p>AI challenges and determinants</p>	<p>Quantitative Analysis</p> <p>Regression analysis</p>	<p>Youkui Wang, Nan Zhang, and Xuejiao Zhao</p>
<p>How does human and technological agency influence digital discretion and shape aspirational values in social services?</p>	Sweden	<p>AI uses and applications</p> <p>AI results, impacts, and benefits</p>	<p>Qualitative interpretive case study</p> <p>Interviews</p> <p>Analysis of Documents</p>	<p>Agneta Ranerup and Helle Zinner Henriksen</p>
<p>Which antecedents of public sector innovation enable the adoption of AI in public administrations in the European Union?</p>	<p>Estonia</p> <p>Belgium</p> <p>The Netherlands</p>	<p>AI definition and attributes</p> <p>AI challenges and determinants</p>	<p>Exploratory multiple case study</p> <p>Desk research</p> <p>Interviews</p>	<p>Colin van Noordt and Gianluca Misuraca</p>

In the article entitled “Will Algorithms Blind People? The Effect of Explainable AI and Decision-Makers’ Experience on AI-supported Decision-Making in Government”, Janssen and colleagues (Janssen, Hartog, et al., 2020) draw attention to the increasing use of computational AI algorithms to support decision making by governments. They note that regardless of this trend, AI often remains opaque to decision makers and lacks clear explanation for how decisions were made. Janssen and colleagues used an experimental approach to compare decision making in three situations: humans making decisions (1) without any support of algorithms, (2) supported by business rules, and (3) supported by machine learning. Their experiment shows that algorithms help decision makers to make more correct decisions. However, they found that even experienced persons were not able to identify all mistakes. Their findings imply that algorithms should be adopted with care and that selecting the appropriate algorithms for supporting decisions and training of decision makers are key factors in increasing accountability and transparency. This article shows that understanding the limitations of AI in government is as important as highlighting its potential benefits.

Campion and colleagues, in their article entitled “Overcoming the Challenges of Collaboratively Adopting Artificial Intelligence in the Public Sector” (Campion et al., 2020), use a case study to examine the challenges that interorganizational collaborations face in adopting AI tools and implementing organizational routines to address them. The case study, involving a large research university in England and two different county councils in a multiyear collaborative project around AI, shows that the most important challenges facing such collaborations are a resistance to sharing data due to privacy and security concerns,

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3 insufficient understanding of the required and available data, a lack of alignment between
4 project interests and expectations around data sharing, and a lack of engagement across
5 organizational hierarchy. This article shows that implementing AI in the public sector faces
6 important challenges, particularly related to interorganizational collaboration. Findings are
7 consistent with previous research in proposing that the most important challenges are
8 organizational or managerial in nature, rather than technical.
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11 The article entitled “Cultivating Trustworthy Artificial Intelligence in Digital Government” by
12 Harrison and Luna-Reyes (2020), draws attention to a “growing consensus” about the
13 potential of analytical and cognitive tools of AI to transform government in positive ways, but
14 also notes that “AI challenges traditional government decision-making processes and
15 threatens the democratic values within which they are framed” (Harrison & Luna-Reyes,
16 2020, p. 1). These conditions call for conservative approaches to AI that focus on cultivating
17 and sustaining public trust. The authors use the extended Brunswik lens model as a
18 framework to illustrate the distinctions between policy analysis and decision making as
19 traditionally understood and practiced and how they are evolving in the current AI context.
20 Through their recommendations for practices, processes, and governance structures to
21 provide for trust in AI and for research that support them, the authors seek to provide a
22 balanced view on the potential of AI in government; acknowledging its transformative
23 potential, but also highlighting important challenges that may affect not only decision making
24 processes, but also our democratic values. The results have important practical implications
25 related to how to design processes and structures in government to build trustworthy AI
26 applications.
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32 Wang and colleagues, in their article entitled “Understanding the Determinants in the
33 Different Government AI Adoption Stages: Evidence of Local Government Chatbots in
34 China” (Wang et al., 2020), investigate factors that influence local governments to adopt AI-
35 powered chatbots and factors that influence the performance of chatbots post-adoption.
36 Drawing on a quantitative study of Chinese local authorities, the authors find that vertical
37 administrative pressure, horizontal competition pressure, and environment readiness play
38 different roles in different adoption stages. Although pressure can encourage local
39 governments to implement chatbots, these governments’ readiness determined how well the
40 chatbots perform after their initial adoption. Similar to more traditional technologies,
41 decisions to adopt AI are affected by many factors and the benefits those applications will
42 generate depend on their performance. This article contributes to a more nuanced
43 understanding of some of the determinants of success by showing that the factors that affect
44 adoption decisions are not the same as the factors that have an impact on performance.
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49 In the article entitled “Digital Discretion: Unpacking Human and Technological Agency in
50 Automated Decision Making in Sweden’s Social Services”, Ranerup and Henriksen (2020)
51 present a case study of automated decision making driven by Robotic Process Automation
52 (RPA) in social services in Sweden. The authors find that digitalization in social services has
53 a positive effect on civil servants’ discretionary practices mainly in terms of their ethical,
54 democratic, and professional values. The long-term effects and the influence on fair and
55 uniform decision making also merit future research. In addition, the article finds that a
56 human-technology hybrid actor redefines social assistance practices. Simplifications are
57 needed to unpack the automated decision-making process because of the technological and
58 theoretical complexities. The effect of AI on discretion in the public sector has been
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3 characterized by cautious optimism, while some authors strongly believe that the overall
4 effect will be negative. This article shows that, at least in the short term, AI technologies can
5 have a positive impact on civil servants' discretionary practices. It contributes to a more
6 detailed understanding of the potential consequences of AI in the public sector.
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9 In their article entitled "Exploratory Insights on Artificial Intelligence for Government in
10 Europe" van Noordt and Misuraca (2020a) present findings from three cases of AI adoption
11 in public sector organizations. Their study finds strong similarities between the antecedents
12 identified in previous academic literature and the factors contributing to the use of AI in
13 government. The adoption of AI in government, they note, does not solely rely on having
14 high-quality data, but is facilitated by numerous environmental, organizational, and other
15 factors that are strictly intertwined among each other. To address the specific nature of AI in
16 government and the complexity of its adoption in the public sector, van Noordt and Misuraca
17 propose a framework to provide a comprehensive overview of the key factors contributing to
18 successful adoption of AI systems. Their framework goes beyond what they consider a
19 narrow focus on data, processing power, and algorithm development often highlighted in the
20 mainstream AI literature and policy discourse. This article highlights the intertwined nature of
21 challenges related to data, organizational, and environmental aspects. It also proposes a
22 framework to think about AI adoption success.
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27 **4. Conclusion**

28 Research on AI in government is transitioning towards what promises to be a very important
29 stage. After an initial stage characterized by a focus on mapping the risks and benefits of AI,
30 with relatively little in terms of theorizing and unboxing processes and mechanisms, we are
31 now witnessing a move towards systematic analysis of the benefits and challenges of
32 design, management, adoption and implementation of AI in government. The contributions
33 included in this Special Issue well capture this transition, and open up a series of avenues
34 for future research that will become more essential as AI assumes an increasingly central
35 role in government, including administrative processes, but also citizen service provision,
36 and agency decision-making.
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40 Given the state of the art of both policies and research on AI in government, we highlight a
41 number of areas worthy of increased focus. We are not aiming to be comprehensive with our
42 list, but rather to prompt the research community to pay attention to research worthy issues
43 that are gaining in relevance, and at the same time have not been adequately singled out in
44 existing research agendas.
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- 48 - **Governance of AI.** As a new series of technologies and techniques, AI needs to be
49 understood, and where appropriate, harnessed by government agencies. Making
50 decisions about when to use AI and for which purposes will become an imperative for
51 governments around the world. Many questions about the individual roles or
52 committees needed to make decisions about the use of AI in the public sector,
53 considering the needs of the agency, but also the potential positive and negative
54 consequences on people, and institutions must be answered. Future studies should
55 focus on understanding governance of AI and how to improve it to generate public
56 value. Future research will also need to focus on devising novel governance models
57 to face diverse challenges, by identifying best practices, and updating existing
58 governance models (e.g., adaptive governance) to the unique characteristics of AI.
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Examples of research questions include: what governance models (e.g., for AI talent recruitment, and AI technology procurement) can be devised to meet ethical challenges and at the same time ensure the effectiveness of AI solutions?

- **Trustworthy AI.** The emergence of AI in a public sector context raises key questions about trust in the technology and in the decision-makers who use the results to make or inform decisions. Future research will need to investigate not only impacts of AI on levels of trust, but also to understand mechanisms that build the trustworthiness of AI. New research must address the characteristics of trustworthy AI, namely, transparency, explainability and reliability, and build new understanding of the necessary policy, management and technology innovations required to build trustworthy AI and ideally, as a consequence, contribute to public trust. Research must address technical aspects (e.g., auditability of algorithms) and the socio-technical dimension of AI in government (e.g., algorithms interpretability, transparency towards recipients of AI-powered services, translation of ethical principles to governance frameworks). Examples of research questions include: what are sustainable mechanisms of trust-building in the adoption of AI in government? Which mechanisms are most effective in creating transparency and reliability of AI applications for specific government audiences and clients?
- **Impact assessment methodologies.** While identifying metrics for assessing the impact of digital government initiatives is a well-established focus for digital government research, the use of AI has the potential to render existing approaches inadequate. This is due to the fact AI in government not only carries a wide range of potential unintended consequences, but also because its key characteristics, pervasiveness and self-learning capabilities, might make assessments based on linear models of change ineffective. As AI algorithms carry both high potential and high risks and thus need to be overseen by a public value perspective, future research needs to reflect on how to assess its impacts from a value standpoint. Examples of research questions include: how do we identify positive and negative impact assessment metrics that can capture the deeper impacts of AI in government from a public value point of view? How can we obtain a balanced view of positive and negative impacts of AI from a public value perspective? What are the main differences between AI and previous technologies and how they affect the design and implementation of assessment methodologies?
- **Data governance.** Artificial Intelligence solutions are first and foremost data solutions. The implications are that any AI application is, by definition, only as good as the data that drives it. Refining algorithms and improving the accuracy and reliability of output, systems with learning capabilities need large amounts of high-quality data. Ensuring high-quality data requires sophisticated and effective data management. Barriers to effective data management include a lack of investment in the development and use of formalized data governance, organizational and individual resistance to data sharing, and a lack of appreciation for the implications of bad data. One particular challenge for data governance is the development of policies and procedures for systematically identifying and eliminating bias in data. Examples of research questions in this area will have to include: how does our understanding and practice of data governance need to change when the use of the data is for automated decision making? How do existing data governance models need to be adapted to the use of AI in government agencies with certain characteristics, such as limited infrastructure and lack of staff with the necessary

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3 skills? How can ethical principles about bias be translated into decision frameworks
4 to guide data governance?
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7 Research and policy initiatives focused on AI in government are developing rapidly and
8 acquiring increasing relevance across the world. Given the dynamic nature of this complex
9 phenomenon, it is necessary to take stock of the existing body of knowledge, and monitor
10 the evolving literature to ensure that we move forward in a way that will maximize the
11 benefits and mitigate the risks of AI in a government setting.
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