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# Artificial Intelligence and Public Values: Value Impacts and Governance in the Public Sector

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**Abstract:** While there has been growth in the literature exploring the governance of artificial intelligence (AI) and recognition of the critical importance of guiding public values, the literature lacks a systematic study focusing on public values as well as the governance challenges and solutions to advance these values. This article conducts a systematic literature review of the relationships between the public sector AI and public values to identify the impacts on public values and the governance challenges and solutions. It further explores the perspectives of U.S. government employees on AI governance and public values via a national survey. The results suggest the need for a broad inclusion of diverse public values, the salience of transparency regarding several governance challenges, and the importance of stakeholder participation and collaboration as governance solutions. This article also explores and reports the nuances in these results and their practical implications.

**Keywords:** artificial intelligence systems; public values; governance

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## 1. Introduction

Artificial intelligence (AI) has the potential to offer significant benefits and, at the same time, to pose challenges to our society [1]. The benefits of AI applications in the public sector include gains in the efficiency and effectiveness of AI-enabled rapid processing, abstracting, and reasoning based on a large amount of data [2–4]. Additionally, the government's use of AI can assist in many areas of public service, such as citizen service, by using chatbots and security through the detection of and defense against cyberattacks [5,6]. AI-based decision support systems that are integrated into public service decision making can compensate for human vulnerability in decision making. Humans are susceptible to problematic decision making due to poor emotional states, personal bias, or limited cognitive capacity [7].

At the same time, there are concerns about AI's potential to erode public values. Automation based on algorithms developed using existing data tends to perpetuate historical biases that are embedded in government data [8,9] and to magnify system tendencies for inequality [9–11]. AI can significantly reduce the transparency of data, data analysis, and decision making [12]. Additionally, the use of AI-enabled algorithms for administrative decision making about the production and delivery of public services has the potential to erode the discretion of street-level public service providers [13,14].

Understanding and addressing interconnections between public values and AI is crucial for advancing public values while minimizing negative consequences. The existing literature has identified the impacts of AI on public values that are focused on equity, human autonomy, efficiency, effectiveness, etc., e.g., [3,15,16]. However, the existing literature lacks a more systematic and comprehensive review of the relationships between AI and a broad set of public values, particularly at the level of AI system development.

Governance is central for addressing public value impacts of AI [12,17]. Governance regards government as the primary institution that makes and implements policy and rules [18] with the participation of stakeholders and citizens [19]. Governance is about producing and delivering publicly supported goods and services [18,20] for the purpose

of advancing public values [21,22]. Therefore, public sector AI is an important focus because of the public mission of government in society and the vital role of government in regulating AI use [23]. Progress has been made in understanding potential governance challenges and solutions [12,24] and the use of AI in public governance [25]. Moreover, scholars have argued for the importance of considering public values for algorithmic and AI governance [15,26,27]. However, a significant gap remains in our knowledge about the impacts of AI on public values and the governance challenges and solutions associated with the interaction between AI and public values. Less is known about how government employees perceive the impacts of AI use in government on public values as well as the related governance challenges and solutions.

This article intends to make several contributions to academia. First, the systematic literature review suggests the need for the incorporation of a broader set of public values in AI systems in the public sector as well as the salience of these expanded values. Second, the systematic literature review provides the identification of the key governance challenges and solutions associated with public value creation. Such identification helps inform research and practice. Lastly, the investigation into U.S. government employees' perspectives contributes to insights into the relevance of a broad outlook on public values, the salience of transparency regarding governance challenges, and the solutions involved. Differences in the stakeholders and productive stages for participation introduce opportunities for more targeted governance solutions.

This article first develops a conceptualization of AI and public values and the interactions between them in the public sector. It follows with a systematic literature review to understand the public values that are affected as well as the related governance challenges and solutions. Building on the results of the literature review, this article then explores the perspectives of government employees on governance to address public value impacts. Next, it discusses the features and implications of the literature review and a related survey of government employees. This article concludes with a summary of the main points and suggests avenues for future research.

## 2. Artificial Intelligence Systems and Public Values

### *2.1. Artificial Intelligence as Intelligent Systems*

A broad notion of AI is "any technology that is able to function appropriately with foresight of its environment" [28]. Such technology is "inspired by . . . the ways people use their nervous systems and body to sense, learn, reason, and take actions" [29]. Consequently, AI can be characterized by the ability to perform tasks that, historically, have been performed by humans [30–32]. The capabilities of AI include perceiving, learning, abstracting, and reasoning, as articulated by the Defense Advanced Research Project Agency [5]. A more recent extension of the list adds communication to these capabilities [32].

Machine learning is one of the core capabilities of AI [32]; it allows for learning from data to achieve better performance in areas such as pattern recognition, classification, predictive analytics, and language processing. As a result, machine learning is a way to turn data into knowledge [33]. For administrative government agencies, machine learning is regarded as a core capability that aids in auditing and enforcing regulatory policies on taxation, environmental protection, and safety [34].

Until now, the performance of intelligent work has required human conditions and decision-making capabilities, but AI mostly requires supporting computational technologies. Today's computer systems can perform automation and decision-making functions [35]. Robotic technologies are important for process automation [36] and are the embodiment of AI-enabled computer systems to perform motor functions [32].

To encompass the technologies needed to perform humanlike intelligent tasks, AI is better conceptualized as AI systems. Such a definition allows for the inclusion of data, algorithms, computer systems, and robotics to support the intelligent capabilities of perceiving, learning, reasoning, communicating, and taking actions. The uses of AI's perception capability for the government could involve computer vision to monitor volcanic

activity or surveillance to track potential threats to public safety. Regarding learning, the capability for image classification could help in analyzing cracks on bridges to evaluate transportation safety. For communication, an important AI capability might be interfacing with humans to understand their directions and to communicate actions back to them in an understandable way. For action, AI may be capable of making and executing decisions to implement regulatory policies or perform a rescue mission in a disaster area.

### *2.2. Public Values and Artificial Intelligence Systems in the Public Sector*

This article focuses on the use of AI in the public sector and, consequently, on how this use aligns with specific public values—such as efficiency, effectiveness, accountability, transparency, and equity—that are central to public administration and governance [37,38]. These values guide the purposes of the government and the public institutions and organizations that are involved in public governance and service. Scholars aligned the government's discretionary actions that are augmented by AI with public values [14,39,40].

This article adopts the taxonomy of values for assessing the impact of AI that was developed by Bannister and Connolly for information and communication technology in general [41]. This taxonomy classifies public values by their orientation: duty-oriented, service-oriented, and socially oriented. The duty-oriented values include responsibilities to citizens and elected officials, facilitation of democratic will, proper and efficient use of public funds, the economy, compliance with law, rectitude, integrity, and honesty. The service-oriented values include service to citizens in their various roles, efficiency, effectiveness, responsiveness, transparency, and respect for the individual. The socially oriented values are inclusiveness, justice, fairness, impartiality, equality of treatment and access, due process, protection of citizen security, protection of citizen privacy, protection of citizens from exploitation, accountability, and consultation.

This taxonomy provides a broader perspective that extends beyond the service orientation. Based on an extensive literature review, the efficiency and effectiveness of service have been demonstrated to be the most important public values regarding the use of technology in government [42]. However, such a narrow focus ignores the duty that government has in a democracy and societal concerns about justice, equity, and rights [41,43]. For the use of AI systems in government, efficiency and effectiveness can be achieved by enhancing and automating analytical capabilities [15,44]. As a parallel to information and communication technologies for government in general, a broader consideration of privacy, security, employment, and accountability is important for the use of AI in government [3,12]. The broad societal impacts of AI systems have created the need for ethical considerations beyond service-focused public values. The development of machine ethics and a framework for impact assessment is an effort to assist with the governance of AI systems [45,46].

This article adopts a sociotechnical perspective to understand the interactions between AI systems and public values for good AI governance. Governance involves government, citizens, and stakeholders in the development and implementation of policies and rules for the production and delivery of publicly supported goods and services [18–20]. Good AI governance advances public values via AI use in government. The development and use of AI systems could be understood to be interactions of social and technical components and processes [47], drawing from Latour [48]. From this perspective, the technical components of an AI system include data, algorithms, computer systems, and robotics [8,32,49,50], while the social components include people, organizations, governance rules, and interactions. These elements include both material and social entities such as data, humans, systems, and algorithms. The interactions include the impact of social structures and processes on the adoption and use of technology and vice versa.

The development and use of technologies in the public sector are shaped by organizational and institutional factors [51]. For AI, as an emerging technology, there is a need to ensure public good and establish public values [52,53]. The public values embedded in a government, as embodied in a national AI strategy, are likely to guide the development and implementation of AI. For instance, the U.S. National Artificial Intelligence Research and

Development Strategic Plan (2019 Update) articulated the need for transparency and equity alongside efficiency [54]. This type of national policy framework shapes the development of AI in various government agencies.

At the same time, the adopted technologies can affect organizations and their governance [55]. The use of AI-enabled algorithms for policy implementation is likely to affect equality when socially constructed biases are embedded in the algorithms [9,10,56]. Additionally, human autonomy regarding administrative discretion in government is likely to be affected by the automation offered by AI [39,40]. Likewise, democratic governance is sure to be affected when the extensive use of algorithms allocates disproportionate power to groups with high levels of technical resources and expertise [56,57].

Currently, AI use in the public sector tends to focus on a few functions in the production or delivery of public service, though humans continue to play an important role as the ultimate decision makers or enforcers of rules. These AI functions could be audio or natural language processing that helps automate the understanding of inputs from humans [6]. Predictive analytics is another popular use of AI that helps prioritize resource allocation in the public sector for services such as public safety and the prevention of fraud [2,6]. Humans are still responsible for enforcing public safety rules and determining the subjects of fraud investigations. In the cybersecurity area, AI can fulfill the functions of security analytics and threat intelligence [5,6], while humans exercise judgment on the parameters of threat analysis and responses. Even regarding the use of chatbots for city services, when such chatbots are responsible for identifying relevant information, the actual production and delivery of services still fall on other government systems or personnel.

## 3. Artificial-Intelligence-Affected Public Values and Artificial Intelligence Governance Challenges and Solutions

### *3.1. Systematic Literature Review*

This systematic literature review aims to identify and analyze the impacts of AI on public values as well as the governance challenges of addressing these impacts. This literature review provides a survey of how AI is related to public values. More importantly, it presents an empirical basis for understanding the relationships between AI and public values as well as the governance challenges and solutions. The literature begins with a broad search of AI and governance, to maintain the focus on governance, but remains open to the identification of possible interactions between AI and public values as well as the governance challenges.

The sources for the academic references are the Web of Science and Google Scholar, two popular academic literature databases, and recommendations from subject-area experts. The Web of Science provides coverage of publications in the fields of science, technology, social sciences, arts and humanities. Google Scholar complements the Web of Science with a broader coverage and an interdisciplinary research. As shown in Figure 1, we used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) method to document the process of the systematic literature review. At the first stage, we used three clusters of keywords—"AI and Governance", "AI and Dark Sides", and "AI and Equity and Governance"—and set the time range as "between 2000 and 2022" (to December 2022) to search for articles in the two databases. That process identified 190 articles from the Web of Science and 215 from Google Scholar. Additionally, subject area experts recommended 23 articles regarding AI applications in the public sector. Most of these references were journal articles, but some were book chapters and research reports. Consequently, the acquired references, including 23 from expert recommendations and excluding duplicates and references that are not journal articles, totaled 289 pieces.

Then, the authors developed three criteria to determine the relevance scores for each article: "Does this article mention public values?"; "Does this article define governance challenges?"; "Does this article suggest governance solutions?" Next, we assigned relevance scores to each article on a scale of 1–10 and included articles with a score of 5 or higher. Additionally, only journal articles were included, which reduced the number of relevant

references to 63. Then, we excluded five articles: the full texts for three journal articles could not be accessed, and the other two primarily discussed law and philosophy. Finally, that left 58 references to be analyzed.

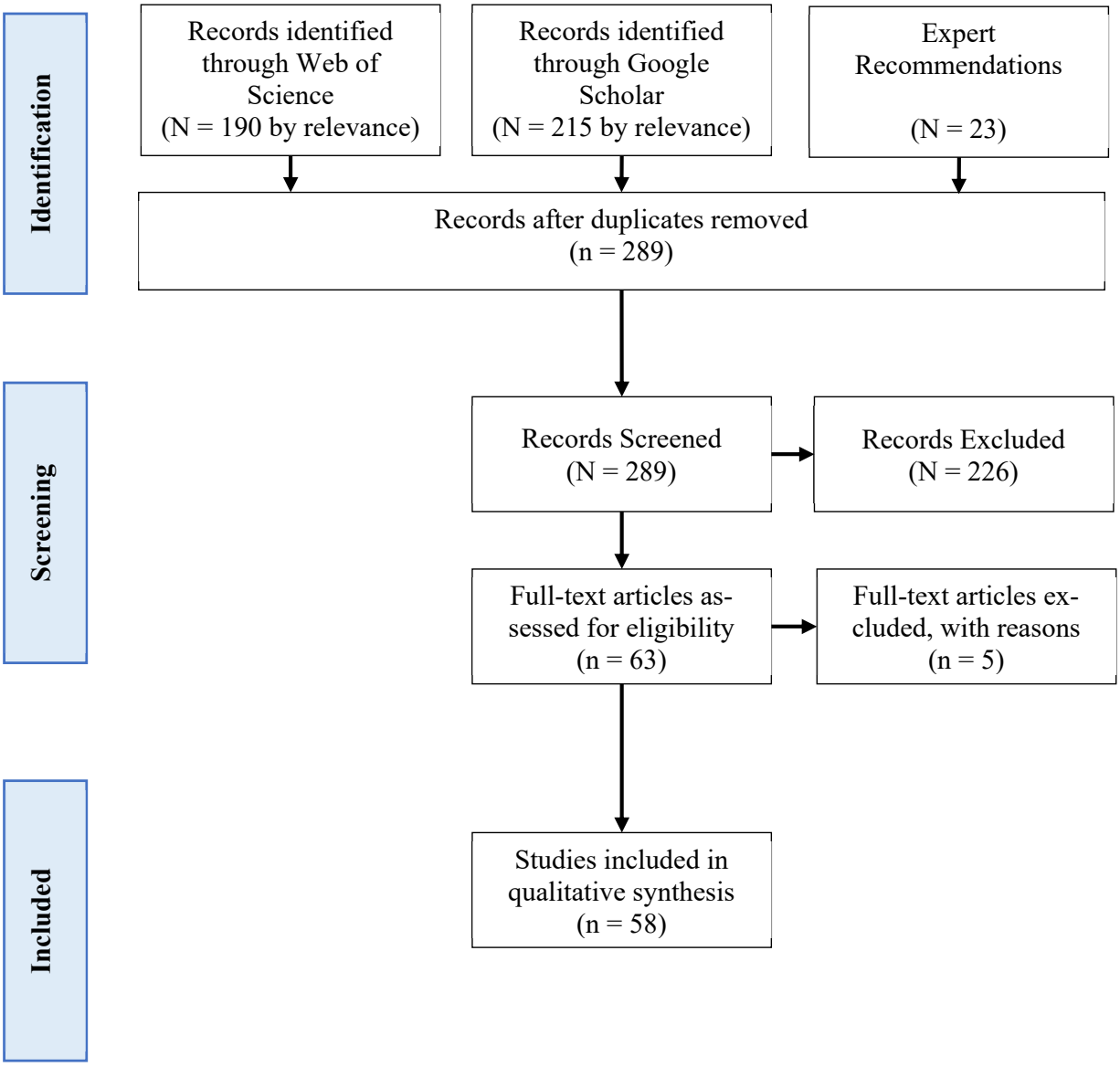


**Figure 1.** Systematic literature review of artificial intelligence and governance: PRISMA.

For public values and AI systems, we used the taxonomy adopted from Bannister and Connolly [41], as discussed in Section 2.1. This taxonomy has three clusters of values: duty orientation, service orientation, and social orientation. We coded a reference into a particular value when it specifically referred to the values that are affected by the use of AI systems. For governance challenges, we conducted theme coding of the 58 references. Three themes emerged: public value challenges; data quality, processing, and outcome challenges; societal governance challenges. The themes emerged from the reviewed references based on a conventional content analysis, which aims to develop themes and codes from the documents and materials, especially when the existing theory and concepts are limited [58]. First, we listed all the mentioned challenges and solutions in the literature. Next, we discussed the findings from the literature review and then agreed on the three primary categories for the challenges and solutions listed above. Finally, we used the three themes to describe the challenges of AI governance as well as the solutions.

### *3.2. Public Values and Artificial Intelligence Systems*

The results of the analysis of the references based on the taxonomy of public values are summarized in Table 1. For duty orientation, there is an emphasis on the duty of AI to comply with laws [1,35] and be responsible to citizens [1,23,59,60]. The application of AI to automate the decision-making process must meet the legal requirement of preventing malicious use of the technology [35]. When government agencies use algorithms and machine learning to deliver public services, they must ensure that AI is responsible for its actions and decisions [12,61]. Further, Larsson [60] indicates that responsibility is a crucial instrument for developing trustworthy AI in public governance in the European context.

**Table 1.** Public values related to artificial intelligence and its governance.

| | **Public Values** |
|---|---|
| Duty Orientation | Responsibility to citizens [1,12,23,35,59–64]<br>Compliance with laws [1,35] |
| Service Orientation | Transparency [1,17,35,50,60,63,65–74]<br>Effectiveness [15,23,39,75]<br>Efficiency [15,39] |
| Social Orientation | Accountability to public [1,12,15,35,49,50,61,63,66,69,71,72,74,76–78]<br>Privacy [3,12,49,50,60,64,74,79–81]<br>Equality of treatment and access [3,12,15,39,49,72,79,82]<br>Fairness [9,17,50,60,61,63,66,74,76]<br>Justice [35,60,64,79]<br>Due process [35]<br>Inclusiveness [23,74]<br>Security [64] |

For service-oriented values, the existing research primarily focuses on transparency, effectiveness, and efficiency. First, most of the references covering service-oriented values emphasize the importance of transparency, as shown in Table 1. Transparency is the basis for citizens to understand and monitor how AI delivers public service and what is provided [68,69]. Second, effectiveness is regarded as one of the criteria for evaluating AI performance in public service [39]. Additionally, effectiveness in governing AI can be achieved by a multilayered governance structure [23] or government regulation [75]. Third, the aim of applying AI in government is to enhance efficiency, such as automating routine tasks to reduce the time spent and costs involved [15,39].

The references analyzed in this literature review address several dimensions for socially oriented values, including accountability, equality, privacy, fairness, justice, due process, and security. This list is ordered by the number of references citing these values, from the greatest to the fewest. Accountability to the public is one of the core values when applying AI in various domains [77]. By enhancing accountability, AI security and quality can be assured [50]. How to ensure the equal treatment of citizens, civil servants, and applicants through AI-enabled services is another focus. Ensuring reliable and affordable access to public services is also discussed in the research [39,49,79]. Fairness in the administrative system, procedural due process, and justice in the judicial branch are crucial to improving the ethical performance of AI [60,79]. Finally, ways to protect personal data, especially sensitive information, are discussed in several of the articles [50,60,64,79,81]. For instance, Wirtz et al. [3] point out that AI systems carrying personal information may be compromised by cyberattacks.

### *3.3. Governance Challenges*

The second focus of the literature review concerns governance challenges, which can be categorized into three themes: public values challenges; data quality, processing, and outcome challenges; societal governance challenges. The extensive list of references for each theme is presented in Table 2. Public values challenges mainly emphasize that the lack of

appropriate governance mechanisms or actions could result in the erosion of public values. The most-cited challenges for AI systems are the lack of appropriate governance mechanisms to foster transparency and accountability (e.g., [50,65,70,73,83]). Governance challenges associated with ensuring equity are also highlighted [3,9,63,73,77,79]. Additionally, privacy and safety concerns pose governance challenges to minimize the negative impact of AI (e.g., [36,79,84]). Linked to the concern about the public sector is a concern about the lack of safeguards against administrative evil and the malicious use of AI systems [1,9,39,77].

**Table 2.** Artificial intelligence governance challenges.

| | **Governance Challenges** |
|---|---|
| Public Value Challenges | Lack of transparency [3,15,36,50,65,68,70,73,83]<br>Lack of accountability [1,12,15,24,36,59,61]<br>Privacy concerns [3,12,36,50,72,79–81]<br>Inequity concerns [3,12,73,77,79]<br>Lack of responsibility [1,3,12,61,64]<br>Safety concerns [3,12,84]<br>Malicious use of AI [1,77]<br>Moral dilemmas [3,12]<br>Social acceptance and trust concerns [3,12]<br>Administrative evil [9,39]<br>Cybersecurity risks [85]<br>Discrimination in recruitment, promotion, and dismissals in organizations [82]<br>Fairness concerns in data processing [76,86]<br>Lack of AI expertise and knowledge [3]<br>Lack of responsiveness [59]<br>Principal–agent problem [87]<br>Sustainability challenges [88]<br>Violation of laws [60] |
| Data Quality, Processing, and Outcome Challenges | Data quality and management [3,17,49,50,71,83,85,89]<br>AI rule-making concerns [3,12]<br>Lost control of AI [12,64]<br>Adverse impacts, difficulty of measuring the performance of AI, and uncertain human behavioral responses to AI-based interventions [85]<br>Financial feasibility [3]<br>Interaction problem with humans [12] |
| Societal Governance Challenges | Replacing human jobs [1,3,12,90,91]<br>Insufficient regulation and "soft laws" [75]<br>Replacing human discretion [39,64]<br>Value judgment concerns [3,12]<br>Authoritarian abuses [17]<br>Cross-sector collaboration hardship [70]<br>Power asymmetry [86]<br>Threatening autonomy [81] |

AI introduces various governance challenges in the areas of data quality, information processing, and outcomes. Data quality and management problems underscore the governance challenges associated with the racial biases and discrimination in the data set [17,49,83,85]. When AI processes biased information, the government obtains biased results that could threaten individual rights. This problem is exacerbated when humans have limited or no control over AI [12,64]. The difficulty in measuring AI performance and outcome quality amplifies the risks [85].

The challenges of AI related to societal governance are substantial, such as collaborative governance problems, displacement of jobs, and threats to human autonomy. The use of AI may affect governmental structure, intergovernmental relationships, and network governance. Coordinating with other agencies, companies, and nonprofit organizations is a significant challenge for public institutions [70]. Conversely, although AI can enhance the efficiency in delivering public services through high-speed operations and rapid automation, humans can lose their jobs, and civil servants may have to sacrifice their discretion [24,39,64].

### *3.4. Governance Solutions*

The systematic literature review suggests three themes for AI governance solutions and their supporting references, as shown in Table 3. First, the references introduce public values solutions as responses to governance challenges. The most-cited tactic is explainable AI for addressing the lack of transparency, emphasizing that the process and outcomes are understandable to and realizable by citizens [59,65,68,86]. Additionally, the research stresses the importance of including more public values in alleviating the negative impacts of AI on public governance [50,60,66,71,72]. Finally, as the system can be embedded with more moral values, ethical AI is regarded as a governance solution [46,77].

**Table 3.** Artificial intelligence governance solutions.

| Governance Solutions | |
|---|---|
| Public Values Solutions | Explainable AI [59,61,65,68,74,86]<br>Inclusion of more public values [50,60,66,71,72,74]<br>Ethical AI [46,61,74,77]<br>Distributed, decentralized, and democratized market [73]<br>Ethical agent [46]<br>Impacts on bureaucratic discretion [39]<br>Privacy by design [35]<br>Trustworthy AI [92,93] |
| Data Quality and Processing sSolutions | Regulation [12,17,35,74,76,78,82,88]<br>Bias assessment [35,74]<br>Data audit [74,81]<br>Data-driven digital government [69]<br>Data-sharing agreement [81]<br>Human audition [61,74,94]<br>Independent quality assurance [35]<br>Oversight committee [74,81]<br>Recognition and removal of bias [83]<br>Understanding of AI [64] |
| Societal Governance Solutions | Collaborative governance [66,70,80,82,95]<br>Multilevel approach [49,85]<br>Artificial discretion analysis [15]<br>Facilitative leadership, alignment of goals and objectives, shared knowledge, socialization, expert insights, and strategies [74,96]<br>Governance coordinating committee [75]<br>Holistic industrywide solution with governmental involvement [23]<br>Integration of workflow and governance [50]<br>Levels of governance [23]<br>Pluralist approach [87]<br>Risk governance [88]<br>Stakeholder participation [74,83]<br>Systems dynamics approaches [85]<br>Task characteristics (complexity and uncertainty) [39] |

With respect to data quality and processing, the most-often-cited governance solutions are the use of regulations and the detection of biases. Governments can regulate behaviors related to data quality and processing through legal approaches [12,17,35,76,78,82,88]. For instance, many European countries have adopted the General Data Protection Regulations to alleviate privacy and human rights threats from AI [76]. Furthermore, including data auditing to eliminate AI biases is another governance solution [35,74,81,94].

Finally, scholars have proposed various societal governance solutions to the potential negative impacts of AI. The most-cited solutions are collaborative governance and the multilevel approach to AI governance. Collaborative governance encourages governments to establish horizontally collaborative relationships. For example, the same levels of government can work together to enact personal data protection regulations or to build

mechanisms that address AI challenges [70,80,82,95]. The multilevel approach suggests that governments use a variety of strategies to alleviate the negative impacts at different levels [49,85].

## 4. Perspectives of Government Employees on Artificial Intelligence Value Impacts and Governance Challenges and Solutions

### *4.1. Artificial Intelligence Governance and Public Values from the Government Employees' Perspective*

This empirical investigation builds on the key themes of public values, governance challenges, and governance solutions, which emerged from the systematic literature review. There are many stakeholders of AI use in government who need to be considered, and their perspectives differ [97]. Among these various perspectives, in this study, we choose to focus on the perspective of public employees because their opinions are crucial for the implementation of AI in government. Additionally, such a perspective is consistent with the original formulation of the taxonomy that is grounded in the perspective of civil servants [41].

To understand the perspective of government employees, we conducted an exploratory national survey of government employees in the U.S. We used Amazon's Mechanical Turk (MTurk) because of its cost-effectiveness and comparability in terms of the data collected via traditional methods [98,99]. The survey was conducted in February 2021 and yielded 566 total responses. The respondents were current employees at the local, state, and federal levels of government in the U.S. The survey included questions that serve as the basis for quality assurance. After removing duplications, nongovernment respondents, and inconsistent answers to the quality assurance questions, we arrived at a final data set of 323 responses. This study draws mostly from the section of the survey that addresses the governance of AI use in government.

### *4.2. Public Value Impacts of Artificial Intelligence Use in Government*

Government employees have opinions about the impacts of AI use in government on public values. The existing literature discusses the concerns of government employees about the implementation of AI [97], but there is a gap in the empirical exploration of how these concerns are translated into the perceived impact of AI use on public values. Information and communication technologies hold the potential for digital transformation [100,101] and the creation of public values [102]. AI is also cited as an emerging technologies that has transformative potential due to the introduction of machine learning capabilities as well as its application to a wide range of public services. Given the current development of AI, a useful approach to understanding the impacts on public values is to explore AI's perceived transformative potential.

The survey questions explored government employees' perception of the extent to which AI technologies would affect public values as aspects of government. The respondents were asked to indicate the extent to which they believe AI technologies will improve decision making, effectiveness, efficiency, and accountability. For each public value, the survey respondents were asked to indicate the extent as "no improvement" (1), "modest" (2), "substantial" (3), or "transformative" (4). The decision-making question aligns with the government's duty-oriented values, as the government is responsible for making satisfactory decisions to serve the public. This type of decision making by the government is manifested by the elected officials and legislators who represent the citizens. Efficiency and effectiveness are frequently cited public service values, as demonstrated in the earlier systematic literature review. Accountability is a society-oriented value that captures the government's role of acting in the public's best interest.

The responses regarding each public value, expressed in percentages, are presented in Table 4. Regarding decision making as a duty-oriented public value, approximately 61% of the respondents indicated that AI has substantial or transformative potential for improving decision making. The majority of the respondents believed in the potential for public value creation via AI use in government decision making. Regarding the service-oriented public

values, 65.3% of respondents noted that the use of AI has substantial or transformative potential to improve government effectiveness, and 77.7% had the same opinion with regard to efficiency. As for the society-oriented public value of accountability, 53.8% of respondents believed there is substantial or transformative improvement in accountability with the use of AI in government.

**Table 4.** Potential impacts of artificial intelligence on public values.

| | No Improvement | Modest | Substantial | Transformative | Substantial and Transformative Combined |
|---|---|---|---|---|---|
| Decision Making | 24 (7.43%) | 102 (31.58%) | 126 (39.01%) | 71 (21.98%) | 60.99% |
| Effectiveness | 12 (3.72%) | 100 (30.96%) | 154 (47.68%) | 57 (17.65%) | 65.3% |
| Efficiency | 9 (2.79%) | 63 (19.75%) | 147 (45.51%) | 104 (32.20%) | 77.7% |
| Accountability | 43 (13.31%) | 106 (32.82%) | 123 (38.08%) | 51 (15.79%) | 53.8% |

Collectively, these results suggest a positive link between AI use in government and its potential for improving public values. These values include the duty-oriented one: the responsibility to citizens via better government decision making; service-oriented ones: efficiency and effectiveness; and the society-oriented one: accountability to the public. Moreover, the results show a favorable assessment of the potential for public value creation, with the majority of respondents indicating that each value has substantial or transformative potential. These results provide empirical evidence on the linkage and potential of AI government use for a positive impact on public values.

The difference in the percentage of respondents believing that AI government use can have substantial or transformative improvement potential for public values has important implications. These government employees see the relatively strong potential for AI's role in improving government efficiency and effectiveness in comparison with decision making and accountability. Such relatively strong potential suggests the relative efficacy of the government's use of AI in affecting service-oriented values than other duty-oriented or society-oriented values. Accountability to the public as a society-oriented value has the lowest percentage of respondents, indicating substantial or transformative improvement potential among all values examined. This suggests that AI use in government has less impact on broader societal values.

### *4.3. Governance Challenges of Artificial Intelligence Use in Government*

Government employees are likely to have some recognition of the potential negative impact of AI on transparency. Government policies and documents regarding the use of AI in government, such as those in the U.S. [54] and in European countries [6], have articulated transparency as a challenge for AI. These documents have likely created some awareness among government employees about the transparency challenge. Moreover, government employees, in their own exposure to AI either through personal use or in conversation with colleagues, have probably found it difficult to understand how and why certain algorithms are developed from machine learning. Consequently, there is likely some awareness among government employees about the negative impact of AI use on transparency.

One important data processing and outcome challenge regarding the use of AI in government is the extent to which AI makes public service decisions [12,103] and how much it could constitute the loss of human control [64]. One of the significant direct impacts of AI use on government employees is the potential loss of their discretionary authority in the face of the automation that accompanies AI. Scholars have cautioned that the removal of discretionary authority from street-level bureaucrats may consolidate that authority in

the hands of information-system-level bureaucrats [40]. Moreover, concerns have been expressed about the potential negative impacts created by unchecked AI automation [103]. Government employees are likely to be concerned about the loss of the discretionary authority on which they have traditionally relied to make personalized and responsive public service decisions. Such concern is also likely to be more prevalent for street-level bureaucrats who interact directly with people and make decisions that can have a significant impact on people's lives.

The public value challenge associated with transparency Is captured by the following survey question: "The development of AI in government is likely to negatively impact transparency due to the technical nature of the algorithm". Respondents could indicate the extent to which they agree with the statement on a scale of 1–7, with 1 corresponding to "strongly disagree" and 7 corresponding to "strongly agree". The survey question addressing whether discretionary power is connected to the governance challenge of data processing and outcomes is "The use of AI in my government agency will take away your discretionary authority". The respondents could select their level of agreement on the same 1–7 scale. The survey question for the societal governance challenge addresses a broader set of societal values: "The goal setting of AI use in government cannot fully consider societal values beyond technical efficiency". Again, the respondents could select their level of agreement on the same 1–7 scale.

Regarding the likely negative impact of AI in government, as shown in Table 5, 68% of the respondents said they are either neutral toward or in agreement with the statement, with scores ranging from 4 to 7. The mean score for the transparency question is 4.32. The single sample *t*-test result indicates that such a mean score is statistically greater than the neutral position (a score of 4) at the 0.01 level of significance. From this, we can infer that government employees do perceive the likelihood that AI in government could have a negative impact on transparency. Such a result lends empirical support for the concern about the potential lack of transparency, as indicated earlier in the systematic literature review.

**Table 5.** Governance challenges.

| | **Development of AI in Government Is Likely to Negatively Impact Transparency Due to the Technical Nature of the Algorithm** | **Use of AI in My Government Agency Will Take Away Your Discretionary Authority** | **Goal Setting of AI Use in Government Cannot Fully Consider Societal Values beyond Technical Efficiency** |
|---|---|---|---|
| 1 (Strongly Disagree) | 22 (6.81%) | 27 (8.36%) | 13 (4.02%) |
| 2 (Disagree) | 40 (12.38%) | 29 (8.98%) | 33 (10.22%) |
| 3 (Slightly Disagree) | 37 (11.46%) | 46 (14.24%) | 54 (16.72%) |
| 4 (Neutral) | 68 (21.05%) | 55 (17.03%) | 70 (21.67%) |
| 5 (Slightly Agree) | 57 (17.65%) | 69 (21.36%) | 64 (19.81%) |
| 6 (Agree) | 67 (20.74%) | 54 (16.72%) | 52 (16.10%) |
| 7 (Strongly Agree) | 32 (9.91%) | 43 (13.31%) | 37 (11.46%) |
| Mean | 4.32 | 4.37 | 4.37 |
| Median | 4 | 5 | 4 |
| Mode | 4 | 5 | 4 |

Regarding the question about the erosion of their discretionary authority, 68% of the respondents said they were either neutral toward or in agreement with the statement (scores of 4–7). The t-test result indicates that such a mean score is statistically greater than the neutral score of 4.0. The results indicate that government employees do perceive that the use of AI in their respective government agencies represents a threat to their

discretionary authority. Such a result provides direct support to the concern about the erosion of discretionary power by bureaucrats as a result of AI use in government [40].

Regarding the inability of goal setting for AI use in government to fully consider societal values, 68% of the respondents were either neutral or in agreement with the statement (scores of 4–7). The mean score for the concern about losing discretionary authority is 4.372. The t-test result indicates that such a mean score is statistically greater than the neutral score of 4.0. We can infer that government employees do perceive that the use of AI in government cannot fully consider a range of societal values.

Such a result provides some of the first evidence regarding the limitations of AI in considering a broad range of societal values, especially from the perspective of government employees. The specific societal concerns and their governance challenges could include job loss [1,3,90], threats to human autonomy [39,64], and the disadvantages of AI making value judgments [12]. Additionally, the extent to which such a recognition regarding AI's limitations is shared by government employees can be a facilitating condition for a dialogue about governance solutions.

### *4.4. Transparency and Participation as Governance Solutions to Artificial Intelligence Use in Government*

The provision of transparency serves as a governance solution to public values. Explainable AI offers a form of transparency that helps humans understand why and how AI makes decisions. Such transparency can be further distinguished between transparency to whom and transparency at what stages of AI development and implementation. For government employees, the targets of transparency can be divided between internal-facing (government managers) and external-facing (the general public). To overcome the lack of transparency of government AI systems, government employees are expected to support making information about the development of the algorithms used in AI systems available to government managers. Government employees are also likely to be in favor of making such information available to the general public to achieve the goal of accountability.

For data quality, processing, and outcome solutions, transparency could focus on data, which are the materials from which the machine learns. Consequently, biases in data tend to be reinforced by the algorithms developed from them [49] and could have negative consequences for the welfare of individuals [104]. Data transparency is also foundational for audit efforts [105]. Government employees are likely to support such data transparency to inform themselves of any inherent bias in the data. With the government's emphasis on being responsible for and accountable to the general public, it is also expected that government employees would support making data transparent to the public.

For societal governance solutions, collaborative governance is suggested by the systematic literature review as one of the main mechanisms [96]. Such collaboration can be among organizations and individuals in the public, private, and nonprofit sectors or among academia, government, and businesses. One of the less-explored dimensions of collaboration is between government and citizens regarding the development and implementation of AI, in which citizen participation is a critical step. Another dimension that lacks comprehensive research is the stages of AI development and implementation. In practice, government organizations have recognized the importance of process orientation for addressing stage-specific concerns [105]. However, scant scholarly research has explored the role of stages in addressing AI-related impacts. This study provides one of the first explorations of the important stage involving the participation of public officials and citizens. Such participation provides an important basis for collaboration.

The public value solution pertaining to transparency for government employees is captured by the survey question "Do you agree that the information on the development of algorithms used in the AI system should be made available to the government managers?" The respondents could indicate the extent to which they agree with the statement on a scale of 1–7, with 1 corresponding to "strongly disagree" and 7 corresponding to "strongly agree". The survey question addressing the transparency of the AI system for the general

public is "Do you agree that the information on the development of algorithms used in the AI system should be made available to the general public?" Again, the respondents could choose their level of agreement with the statement on the same 1–7 scale.

The data quality and processing governance solution pertaining to data transparency for government employees is captured by the survey question "Do you agree that the data the AI system uses should be made available to the government managers?" The question pertinent to data transparency to the general public is "Do you agree that the data the AI system uses should be made available to the general public?" For both questions, the respondents could select a level of agreement on the same 1–7 scale.

The questions about the societal governance solution focus on participation at a specific stage in the AI system life cycle. The life cycle of AI systems can include stages of goal setting, development, use, and impact assessment. Two survey questions explore government employees' views regarding two groups of participants: public officials and the general public. More specifically, government employee respondents could answer the following survey question by indicating which stage is most important for public officials or whether all stages are important: "At which stage of AI development is it most important for public officials to participate? (a) goal setting for AI use in government, (b) development of AI systems, (c) use of AI systems in government decisions, (d) impact assessment of the AI-enabled decisions, (e) all of the above". The second question replaces "public officials" with "the general public" and offers the same answer options to explore the respondents' potentially different sets of expectations for participation by public officials and the general public.

As Table 6 indicates, the results reveal that the majority of respondents (74%) support making information on the development of algorithms available to government managers, but a lesser number (64%) also support sharing the same information with the general public. Based on single-sample t-tests, the mean values of the agreement scores are statistically larger than the neutral position (a score of 4) for both government managers and the general public. Therefore, we can infer that there is support among government employees for making the development of algorithms available as a transparency governance solution to advance transparency as a public value. Moreover, the mean level of agreement (5.285) for sharing information on the algorithms with government managers is higher than the mean level of agreement (4.932) for doing the same with the general public. Such a difference is statistically significant, and it suggests a position favoring more algorithm transparency for government managers than for the public.

**Table 6.** Opinions on transparency governance solutions.

| | Do You Agree That the Information on the Development of Algorithms Used in the AI System Should Be Made Available to Government Managers? | Do You Agree That the Information on the Development of Algorithms Used in the AI System Should Be Made Available to the General Public? | Do You Agree That Information about the Data That the AI System Uses Should Be Made Available to the Government Managers Responsible for the Service? | Do You Agree That Information about the Data That the AI System Uses Should Be Made Available to the General Public? |
|---|---|---|---|---|
| 1 (Strongly Disagree) | 2 (0.62%) | 12 (3.72%) | 4 (1.24%) | 5 (1.55%) |
| 2 (Disagree) | 13 (4.02%) | 23 (7.12%) | 7 (2.17%) | 22 (6.81%) |
| 3 (Slightly Disagree) | 18 (5.57%) | 12 (3.72%) | 10 (3.10%) | 27 (8.36%) |
| 4 (Neutral) | 49 (15.17%) | 68 (21.05%) | 43 (13.31%) | 63 (19.50%) |
| 5 (Slightly Agree) | 86 (26.63%) | 77 (23.84%) | 101 (31.27%) | 70 (21.67%) |
| 6 (Agree) | 86 (26.63%) | 75 (23.22%) | 92 (28.48%) | 71 (21.98%) |
| 7 (Strongly Agree) | 69 (21.36%) | 56 (17.34%) | 66 (20.43%) | 65 (20.12%) |
| Mean | 5.285 | 4.932 | 5.384 | 4.994 |
| Median | 5 | 5 | 5 | 5 |

Providing data transparency is a governance solution that belongs to the category of data quality, processing, and outcomes. The result reveals that a majority of the government employee respondents (80%) support providing information about the data used by the AI system to the government managers who are responsible for the service. Similarly, the result indicates that the majority of respondents (63%) also support sharing the same information with the general public. Based on single-sample t-tests, the mean values of the agreement scores are statistically larger than the neutral position (a score of 4) for both government managers and the general public. We can infer that there is support among government employees for making information about the data used by the AI system available as a solution to the governance challenge of the lack of transparency.

The mean level of agreement (5.285) for sharing information about the development of algorithms with government managers is higher than the mean level of agreement (4.932) for doing the same with the general public. The difference in these levels of agreement is statistically significant and suggests a position favoring more transparency for the data used by the AI systems for government managers than for the general public.

Participation by stage is the focus of exploration for the societal governance solution to a lack of transparency. The survey results reveal support for participation by both public officials and the general public. As shown in Table 7, approximately 36% of respondents consider it important for public officials to be involved in all the processes of the AI system. Among all the stages, 27% of respondents suggest that AI system development is the most important stage for public officials to be involved in. Other stages are also considered to be the most important stage for participation: goal setting (14.6%), decision making (15.5%), and impact assessment (7.1%). In addition, 25.7% of survey respondents regard the use of AI in government decision making as the most important stage for public participation. All of the above stages (23.8%) and the stage of AI system development (21.1%) follow closely as being considered as the most important for public participation.

**Table 7.** Most important stage for participation.

| **Participants /Stages** | **Public Officials** | | **Members of the General Public** | |
|---|---|---|---|---|
| Stages | Count | Percentage | Count | Percentage |
| Goal Setting for Government AI use | 47 | 14.55% | 47 | 14.55% |
| Development of the AI System | 87 | 26.93% | 68 | 21.05% |
| Use of AI Systems in Government Decisions | 50 | 15.48% | 83 | 25.70% |
| Impact Assessment of AI-Enabled Decisions | 23 | 7.12% | 48 | 14.86% |
| All of the Above | 116 | 35.91% | 77 | 23.84% |
| Total | 323 | 100% | 323 | 100% |

The results reflect the opinions of government employees regarding what stages are the most important for participation by public officials and members of the general public. The survey respondents expect public officials, more than the public, to participate in all stages of the process. Such a view could stem from the expectation of public officials responsible for all stages of the life cycle to be accountable for AI use in government. Survey respondents ranked the use of AI in government decision making as the most important stage for public participation. This opinion could result from the perceived effectiveness of having the public participate directly in AI-enabled government decision making. Therefore, the decision is informed by the members of the public who have information relevant to the decision and provide the perspective of service recipients to ensure better decisions.

## 5. Discussions

### *5.1. Implications of the Results from the Systematic Literature Review*

The results of the systematic literature review support a broad-based approach, as suggested by Bannister and Connolly, to considering the public values that are affected by AI. All three categories of the public values—duty-oriented, service-oriented, and socially oriented—have received scholarly attention. Such attention is congruent with the broad public value implications of AI systems in the public sector that extend beyond a narrow perspective of efficiency and effectiveness or the profit focus of the private sector [15,24]. The duty of government, government service, and societal considerations should serve as the broad but necessary set of public values that are prioritized in the development of public-sector AI systems. For the duty-oriented values, the results suggest the need for the thorough consideration of legal requirements and responsibility to citizens as important public values. For the service-oriented values, the results imply the salience of transparency followed by effectiveness and efficiency. For the society-oriented public values, further identification and articulation would be helpful for the inclusiveness of diverse public values. The recognition of the importance of these public values being connected to the governance of AI systems in the public sector is helpful for both their identification and use to guide AI system development and implementation. Doing so moves beyond a traditionally narrower focus on effectiveness and efficiency.

In practice, the comprehensive consideration of duty-oriented, service-oriented, and society-oriented public values is necessary for effective governance. To address the tendency to focus narrowly on efficiency and effectiveness, the consideration of societal values such as accountability, equity, fairness, justice, privacy, and security, as suggested in the literature, is recommended. Additionally, making these public value goals explicit as a guide helps identify the affected public values and advance them accordingly. Policy documents with AI goals and principles are useful sources of public values.

Moreover, the systematic literature review has implications for the key governance challenges and solutions associated with three categories: (a) public values; (b) data quality, processing, and outcomes; (c) societal governance. For public values, the prominence of the transparency challenge supports the need for further research into its governance as one of the main concerns about AI systems in the public sector. Moreover, the literature review underscores the need for research into a variety of public values and their trade-offs. For the public value governance solution, the literature review points to explainable AI to ensure further transparency for AI development and implementation. The practical implications of public value challenges and solutions include the rigorous pursuit of explainable AI as a means to advance transparency as well as the full consideration of various public values and their trade-offs.

For data quality, processing, and outcomes, the systematic literature review offers important research and practical implications. Research should focus more on understanding the sources of biases and inequality as well as governance solutions to address them. For AI-enabled algorithms, biases in the data can result in discrimination, wrongful judgments, and increases in inequality [49,89]. Regulations regarding data are considered to be a generic solution to potential biases and other public value impacts arising from the data used for AI development and implementation [35,82]. In practice, the development of rules and regulations that specifically address data biases and their implications would be productive. The specific regulations could focus on data disclosure, audits, or assessments, and data audits governed by an oversight committee are proposed as a governance solution [81].

For societal governance challenges and solutions, the development of broader frameworks to consider the societal challenges of AI is important. These challenges include job displacement [1,12] and the erosion of human autonomy in discretionary decisions [39,64,81]. A salient focal research area includes the dynamics and effectiveness of cross-sector and multilevel governance solutions to societal challenges posed by AI. In practice, the disci-

pline to consider societal impacts is important for AI governance as well as the use of AI governance frameworks and solutions that consider multiple sectors [80,96] and levels [24].

### *5.2. Implications of the Results on the Perspective of Government Employees*

The empirical survey results regarding the potential public value impacts of AI from the perspective of public employees have implications for both research and practice. Public employees are concerned that AI use in government targeted primarily at efficiency and effectiveness will affect important public values, which is in line with the tendency to emphasize efficiency and effectiveness in e-government [42]. In fact, the survey results of government employees indicate the relevance of a broader set of values, such as improvement in decision making, to be responsible to citizens as well as have accountability to broad societal concerns. Research into a wide range of public values while recognizing the emphasis on efficiency and effectiveness is needed for advancing scholarship. The practical implication of the survey results is on the value of understanding the sources of the government employees' focus on the efficiency and effectiveness of AI use in government. Understanding the role that policies, guidelines, and programs play is also critical in realizing the substantial or transformative potential of AI on public values.

The empirical survey results on governance challenges underscore transparency as an important AI governance challenge, and they are among the first to provide evidence of government employees' recognition of the existence of such a challenge. Moreover, the results indicate that the erosion of discretionary authority is an important AI governance challenge for government employees. The existing literature raises the concern about government employees gradually losing their discretionary authority when decisions are increasingly made by information systems and then by AI-enabled algorithms [39,40]. This study's finding lends empirical support to that concern, especially as expressed by government employees, about AI use in government. Additionally, the results reveal the governance challenges associated with considering a broader set of social values regarding AI use in government. The identification of such a challenge furthers the need for research into how to move beyond a narrow set of public values such as efficiency and effectiveness. In practice, the survey findings on governance challenges reveal the usefulness of understanding the definition and perception of transparency by government employees. Furthermore, exploration of the ways in which AI use in government can erode or remove discretionary authority is likely to inform an appropriate division of authority in the automation of government decisions.

The survey results on transparency underscore the need for AI governance to consider multiple perspectives. Existing research into the governance of digital technologies indicates the diverse views of various stakeholders [97,101]. However, these survey results provide one of the important perspectives: that of government employees. Moreover, the results advance AI governance scholarship by providing empirical support for specific areas of transparency, including the development of algorithms and the data used by AI systems. Additionally, the findings further point out the prioritization of stakeholders in receiving information, with government employees placing their need for transparency above that of the general public. Such evidence supports the need to explore which stakeholder groups should be prioritized to receive information on AI algorithm development and data use. These are nuances that are important to gain a better understanding of the diversity of stakeholder views on AI governance solutions as well as the prioritization of various stakeholder groups in the delivery of solutions.

In practice, the survey results on transparency governance solutions offer specific areas of activities in which AI governance can engage. These include transparency of the information that is pertinent to the development of algorithms and the data used by AI systems. Such transparency is an important step toward addressing the negative impacts of AI use in government.

The results regarding the relative importance that government employees assign to stakeholder groups and stages for participation have implications for both research

and practice. For research, the differentiation in the level of participation at all stages between government officials and the general public suggests the importance of exploring such nuances. The results provide initial empirical evidence of the need for making such distinctions between stakeholder groups. Moreover, the results suggest an important need for further distinguishing between the stages of AI development and implementation in government. In practice, the governance of government AI systems must consider both the stakeholder groups involved and the stages of development and operation. More specifically, the results suggest a stronger role for public officials than the public in all stages as well as a need for public officials to focus on the development stage of AI systems, while the public focuses on the use of AI systems. These suggestions could guide the development of recommendations for the design and implementation of participation initiatives.

## 6. Conclusions

The overarching goal of this article is to advance the knowledge of interconnections between public values and AI systems as well as the governance challenges of and solutions to public value creation. This study uses a systematic literature review to investigate these connections as well as governance challenges and solutions. The most-identified public values that are being affected are effectiveness, effectiveness, and transparency for service-oriented values and, compliance with laws, and responsiveness to citizens for duty-oriented values. For socially oriented values, accountability, equality, fairness, privacy, justice, due process, and security are mentioned. The inclusiveness of these values reflects the literature's recognition of the types and range of public values.

The literature review outlines governance challenges and solutions with three focuses: public values, data processing and outcomes, and societal governance. The primary public value governance challenge is to advance transparency, and the main solution is the development and implementation of governance mechanisms to improve transparency. For data processing and outcomes, the primary governance challenges lie in the identification of any biases and rectification of these biases both in the development of AI algorithms and decision making. Governance solutions to improve practice include regulations and audits to assess and address biases as sources of negative impacts on public values. For societal governance, the governance challenges involve addressing the impact of AI use on human employment and autonomy, and the proposed solutions include cross-sector collaborative governance and a multilevel approach. The solutions in each of the three focuses serve as guides for a more effective practice of AI governance.

Moreover, this study explores the perspective of government employees via a national survey of U.S. government employees on the salient aspects identified by the literature review. The finding regarding public values supports the emphasis on efficiency and effectiveness as the main public values among those considered. Regarding governance challenges, government employees recognize the potential negative impact that AI has on transparency, and they underscore the potential loss of discretionary authority due to automation. The lack of full consideration of societal values beyond efficiency is also noted by government employees. The exploration of governance solutions reveals the relevance of transparency in the data used in AI and information on algorithm development as well as the priorities given to two stakeholder groups: government managers and the general public. Moreover, the survey results indicate the emphasis on public officials' involvement in all stages of government AI development and implementation over that of the general public.

The survey findings complement the literature review by offering empirical data for a key stakeholder group, namely, government employees, regarding the use of AI in government. For research, the survey results support the need for the inclusive consideration of diverse public values, the pursuit of those values, and the potential trade-offs. Additionally, a productive research focus would be on the nature and types of transparency governance challenges as well as their respective solutions. Nuances in stakeholder-specific and stage-specific transparency and participation are also potential areas for research. In

practice, the survey findings offer support for the comprehensive consideration of public values that are duty-oriented, service-oriented, and society-oriented. Efforts to provide governance solutions can be productive by focusing on the specific stakeholders and their transparency needs and solutions. Additionally, it would be useful to draw distinctions between the stages and stakeholders for targeted governance solutions.

The scope and focus of this research have limitations that also serve as research opportunities. The systematic literature review is based on relevancy scoring by the Web of Science and Google Scholar and then by the scoring of the authors. Future research can further refine the systematic literature review with a more focused and timely update, especially given the rapid advancement of research on the implementation and governance of AI in the public sector. Moreover, the focus on government employees limits the findings to that specific perspective. Future studies can consider the opinions of the general public to explore the salience of various public values affected by AI and the preferred AI governance challenges and solutions.

Collectively, the findings of the systematic literature review and the government employee survey suggest several productive research avenues. First, there is the examination of the extent to which scholarly attention on a wide range of public values has been translated into practice. Next, there is the exploration of governance challenges and solutions with various stakeholder groups beyond government employees. Such an advancement in understanding would assist in the design of transparency measures and institutional mechanisms that address the potentially different priorities of stakeholder groups. Last, there is the need to move from a generic governance solution to more specific ones to advance society's overall knowledge of AI use. Focusing on a key capability of AI (e.g., predictive analytics) applied in a public service area (e.g., policing or healthcare) is likely to provide insights into how public values interact with AI systems and what configuration of governance design could be most effective.

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**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study. Our survey was conducted through Amazon MTurk, and participation was voluntary and dependent on individual consent. Prior to beginning the survey, all potential participants were presented with a consent form outlining the study's purpose, potential risks or discomforts, potential benefits, confidentiality protections, the voluntary nature of participation, and contact information for the principal investigator. Participants only proceeded to the survey if they indicated their informed consent by clicking "OK" at the bottom of the consent form. Importantly, all participants had the option to withdraw from the survey at any point before or after starting, without any negative consequences.

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