Adoption Frameworks for Artificial Intelligence in the Public Sector: A Systematic Review of Literature

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Abstract

This systematic review aims to examine how the public sector may leverage artificial intelligence (AI) use through the exploration of AI adoption frameworks and how such frameworks can steer best practices of AI implementation and governance in the sector. Through inclusion and exclusion criteria, 30 articles were retrieved from academic databases, specifically Science Direct, Springer Link, and Wiley Online Library.

The AI adoption frameworks are categorized into four groups: Regulatory frameworks, normative frameworks, applicative frameworks, and evaluative frameworks. Regulatory frameworks can provide standardizing and prescriptive guidelines to public sector organizations adopting AI technologies. Normative frameworks can strengthen the ethical and human rights aspects of AI adoption instead of devaluing human skills and eroding human agency. Applicative frameworks can help public sector organizations achieve positive and responsible outcomes for AI adoption. Alternatively, evaluative frameworks can spell improvements in the quality of public service delivery after identifying areas for improvement in an evaluation of AI systems.

Keywords
Artificial Intelligence, AI Systems, AI Adoption Frameworks, Public Sector, Ethics.

1. Introduction
The increasing interest in Artificial Intelligence (AI) will have corresponding societal implications, which can influence the direction of policymaking and decision-making. AI is a broad topic that has been referred to by a lot of terms, such as 'machine learning', 'machine intelligence', 'algorithms', and 'intelligent systems', amongst others. AI is described as a machine with the ability to think, reason out, and make human-like decisions (AlSheibani et al. 2018). Fueled by the power of data, AI technologies are expected to deliver positive outcomes in enabling government functions, thereby transforming the development of public policy and the delivery of public services. Nevertheless, AI is confronted by significant adoption barriers as well as negative deployment impacts (Hernandez 2020).

Why a standard AI adoption framework should be in place in the public sector is because it can enhance safety and fairness in the adoption of AI systems. Additionally, it can influence similar frameworks at the local level towards leveraging AI use. Through an AI adoption framework, the public sector can embed the national values and earn public trust while putting humans at the core of technological advancement. Congruently, institutional theory provides insights into management commitment and trust, which should be considered in AI adoption (Li et al. 2021). While the private sector aims to maximize value over minimizing risk with regard to AI adoption, the public sector aims to minimize risk and maximize value. In order to do this, the public sector needs AI adoption frameworks in order to implement AI efficiently. It should have the needed IT applications and related technical resources to pursue an AI development effort. If not, it should promote existing or new partnerships to access the needed technical resources. In aligning themselves with their partners, public sector organizations assess risk against value, which can be either high or low (Dezousa et al. 2020).

The motivation of this research is anchored on the necessity of the public sector to conduct its public service delivery more effectively and efficiently, in which AI use can play an important role. While there is justified scepticism that

AI adoption in the public sector can lead to technocracy, increased inequalities, and threatened democracy, there is also a plethora of opportunities, such as enhanced communication between government and citizens (Androutsopoulou et al. 2019; Berryhill et al. 2019), improved decision making (Wilson and van der Velden 2022), improved quality of public services (Kuziemski and Misuraca 2020), and increased value creation (Misuraca et al. 2020) which AI use can bring about. Knowledge management, process automation, and threat detection are some of AI application areas which a public sector organisation can benefit from (Neumann et al. 2022).

Of important point, this study fills the research gap regarding the underdeveloped state of AI adoption frameworks in the public sector (Neudert and Howard 2020; Pegorer et al., 2020). Current regulations are often not enough to provide guidance for the fair use of AI. In this context, appropriate solutions should be identified by critically evaluating the means through which AI can tackle governance challenges. This should be accompanied by ensuring the sustainability of AI systems with regard to human talent and government support (Yigitcanlar et al. 2021). In order to minimise potential risks, the adoption of AI technologies should be coupled with ethics and values frameworks, regulatory frameworks, and governance frameworks (Butcher and Beridze 2019).

1.1 Objectives
The objectives of this systematic review are as follows:
(1) To examine how public sector organizations may leverage AI use by using AI adoption frameworks.
(2) To investigate how AI adoption frameworks can steer best practices of AI governance in the public sector.

2. Literature Review
According to Misuraca and van Noordt (2020), a strategic AI framework should take a human-centric approach, which focuses on investment targets and implementation measures that allow monitoring and analysis of the strategy's success rates. This should come with an understanding of governance mechanisms and regulatory frameworks which take into account the ethical aspect of AI adoption, with due consideration of public interest, which directly affects citizens' trust in the government.

Moreover, as the government plays an important role in promoting inclusion, an AI adoption framework should ensure that AI implementation should be aligned with governance strategies (Tariq and Abonamah 2021). Government officials must determine suitable solutions by critically assessing how governance challenges can be tackled through AI, accompanied by AI sustainability in terms of human talent and government support. Along with winning public trust, it is important to safeguard individual privacy and national interest by effectively managing data, cybersecurity, and confidentiality (Ramizo 2021).

Further, a framework that integrates AI and good governance is discussed in Neudert and Howard (2020), discussing how to overcome technical and organisational challenges in adopting AI systems. This framework includes a policy portfolio and informed procurement, where issues around acquiring and developing AI, alongside design and specifications, are being considered. Similarly, an AI adoption framework in public health is being proposed in Harwich and Laycock (2018) to control the purchase products which are complicated to use and thus can hinder service delivery.

Almarzooqi (2019) explored an AI-expanded leader framework within the UAE context, which can provide essential capacities for leaders to leverage a broad variety of competencies pertaining to AI-based technologies. This framework provides an opportunity for leaders to utilise AI systems and overcome associated challenges. The framework can also be adopted by the government for leadership development through innovative approaches. On the other hand, Chomchaiya and Esichaikul (2016) explored a consolidated framework for assessing the performance of AI adoption in the public sector, placing increased attention to the role of internal stakeholders such as the management, service users, and service support employees. This consolidated framework can provide useful guidelines in the development of performance measurement systems in AI adoption.

Conversely, Stenberg and Nilsson (2020) examined the factors that influence government officials in adopting AI, highlighting the ethical aspects in AI adoption process. Using the Technology Organization Environment (TOE) framework, which was found to be appropriate for analyzing AI adoption in the public sector, the factors that influence AI adoption were relative advantage, complexity, and management support, amongst others. Similarly, Schaefer et al. (2021) revealed that the TOE framework can be used to examine AI deployment in organizations. The technological

aspect of the deployment includes innovation and technologies as they can usher new prospects for an organization. The organizational aspect deals with the resources and characteristics of the organization, such as size and free and unused resources. Alternatively, the environmental aspect deals with external influences, such as regulatory frameworks and industry pressure. Al Mutawa and Rashid (2020) noted the important attention given to regulatory issues in AI adoption, including the governance framework, which should be carried out in various areas in the public sector.

Moreover, having found that AI is less focused on healthcare, education, and social services and its practical adoption is being ignored, Sharma et al. (2020) presented an organizing framework which describes various areas relating to governance. These areas include environmental sustainability, transportation, policy making, healthcare, ICT, and economic and financial applications. The ignored areas were identified as areas for future research agenda. Similarly, Chatterjee (2020) identified security and issues of governance as areas that should be focused on when framing a policy on AI.

Alternatively, Yfantis and Ntalianis (2019) proposed a gamification framework to describe the intention of stakeholders to use AI. Referred to as Octalysis, the framework involved eight core drives that described motivations and game elements in an existing chatbot of the public management sector of Dubai. The study suggested certain game elements to enhance the system's overall score and help in successful adoption of AI technologies.

On the same note, Pegorer et al. (2020) stressed the lack of AI-related adoption framework in the public sector, supported by empirical evidence. Thus, they developed a comprehensive AI adoption model to help public sector organizations in implementing AI solutions. Their findings were focused on an AI adoption framework in public administration to support public sector managers in improving the implementation of AI solutions in the public sector setting. The outcome of their study was a holistic model that involves strategic factors and operative procedures, towards driving public sector managers in AI adoption.

Similarly, the work of Dignum (2017) focused on developing a framework for responsible AI, taking into account that AI must be understood within a socio-technical context, in which education plays an important role for the advancement of knowledge on AI. This is congruent to Winfield and Jirotka's (2018) study, which identified a range of elements, including ethics and standards, amongst others, as a framework that can be used to guide AI ethical governance. They highlighted the importance of ethical governance for establishing public trust in AI adoption. Similarly, McKay et al. (2022) argued for the need of a strong public governance framework that can help strengthen accountability in the use of AI technology. Correspondingly, diffusion of innovations theory states that people will only promote the diffusion of innovations if they find it useful and non-threatening (Lund et al. 2020).

The need for this research springs from the fact that in light of the prevailing controversies about AI, it explores AI adoption frameworks which can be used to bridge the gap on lack of established frameworks for AI. These frameworks can guide technology leaders and public sector organizations to effectively build and leverage AI capability, allowing them to streamline their functions smoothly (AlSheibani et al. 2018). Hence, the study lays the groundwork for a more efficient deployment of AI technologies through AI adoption frameworks. It contributes uniquely to research by providing an empirical basis to the use of AI adoption frameworks in the public sector, specifically through regulatory, normative, applicative, and evaluative guidelines for the governance of AI use.

3. Methods

This study uses a systematic review method. Published articles were explored to eliminate any biased assumptions about the given research area. This allows the study to provide informed knowledge on the topic. By using this method, systematic and reproducible approaches were used to review a clearly formulated question for identifying and critically appraising related studies and for collecting and analyzing data from the included studies (Ngulube, 2020). Inclusion and exclusion criteria were applied in selecting the studies for the review. These are shown in the Table 1 below:

Table 1. Inclusion and exclusion criteria

Inclusion	Exclusion
1. Articles that deal with AI adoption and AI adoption frameworks in the public sector	Related to AI but not in the context of the public sector
2. Journal articles and conference articles only	Books/textbooks, unpublished theses/dissertations, blogs, and notes
3. Only articles published within five years	Articles that are older than five years
4. Only English language published articles	Non-English published articles

Specific keywords were used to search for articles. Boolean operators like "AND" and "OR" were used to either narrow down or broaden the results. The keywords are shown below:
1. AI adoption framework AND public sector OR government
2. AI framework OR AI adoption framework AND public sector OR public sector organizations
3. Artificial intelligence AND AI framework AND public sector OR government

Using the specified keywords, a total of 1,229 articles were retrieved, from which only 30 were chosen for the review. The academic databases for the search were Science Direct, Springer Link, and Wiley Online Library.

4. Data Collection
The association and quality of coded characteristics were analyzed in this review. The AI adoption frameworks in each article were listed. All studies that did not directly examine or discuss AI adoption in the public sector were excluded. The articles were examined more thoroughly by looking into their titles and abstracts. Those that did not bear AI adoption frameworks in the public sector were eliminated. Duplicate articles were also removed. A full review of articles was then conducted, eliminating those lacking eligibility. The quality of the contents of the articles was assessed by using a quality test in or in order to yield evidence of good quality. In particular, a quality assessment checklist was used, applying values to score the quality of each article, as adopted by AlGhanem et al. (2020) n their own study. This is shown in Table 2.

Table 2. Quality assessment questions

Questions	Partially Yes (0.5)	Yes (1)	No (0)
1. Are the research aims clearly defined?			
2. Does the article deal with AI in the public sector?			
3. Is an AI adoption framework specified in the article?			
4. Do the results contribute to the literature?			

The 30 articles were examined based on the above checklist. Only articles that answered Yes to all four questions were considered. Those articles which only partially answered Yes or answered No to even one question were eliminated. Correspondingly, all 30 articles received a score of 1 for each question, fulfilling the quality assessment. All of them had clearly defined aims; they dealt with AI in the public sector, and a certain AI adoption framework. Also, all of them had results that contributed to the literature.

5. Results and Discussion
Thirty articles published within five years (2017-2022) in Science Direct, Springer Link, and Wiley Online Library were reviewed in this paper. These articles explored AI adoption frameworks in the public sector based on the aims of the review. Table 3 shows the AI adoption frameworks embodied in each study, along with the methods used and countries on which the studies were emphasized.

Table 3. Details of included studies

Author/s	AI Adoption Framework	Method	Country
1. Ashok et al. (2022)	Novel ontological framework	Systematic literature review	None
2. Bedue and Frizche (2022)	Framework for building trust in AI	Interview method	None
3. Campion et al. (2022)	Improved legal framework for AI adoption	Case study	UK
4. Carter (2020)	Global governance framework for AI	Desk research	UK
5. Donahoe and Metzger (2019)	Universal human rights framework for AI	Desk research	None
6. Firdaus (2019)	Framework for national AI strategy	Desk research	Indonesia
7. Floridi et al. (2018)	Ethical framework	Desk research	None
8. Harrison et al. (2019)	Data management framework	Desk research	None
9. Henman (2020)	Legal framework for AI	Desk research	None
10. James and Whelan (2022)	Ethical AI framework	Institutional ethnographic approaches	Australia
11. Kuziemski and Misuraca (2020)	AI impact evaluation framework	Literature and regulatory review, semi-structured interviews and case studies	None
12. Makasi et al. (2020)	Public service value-based framework	Desk research	None
13. Mikalef et al. (2021)	Technology Organisation Environment (TOE) framework	Survey	Norway, Germany, Finland
14. Misuraca et al. (2020)	Ad hoc classification framework	Review of policy and practitioner-documents	EU countries
15. Montecalvo et al. (2018)	Integrated reporting framework	Longitudinal content analysis and interviews	New Zealand
16. Munoz et al. (2021)	Ethical framework for AI	Desk research	Colombia
17. Nagitta et al. (2021)	Human-centred AI framework	Documentary review analysis, focus groups and interviews	Kenya and Uganda
18. Ojo et al. (2019)	Realist evaluation framework	Systematic literature review	None
19. Pencheva et al. (2018)	Policy cycle framework	Comprehensive literature review	None
20. Rubenstein (2021)	Comprehensive framework for ethical AI acquisition	Desk research	None
21. Schiff et al. (2020)	AI governance framework	Document analysis	None
22. Smuha (2019)	AI governance framework	Desk research	European countries
23. Sun and Medaglia (2019)	Regulatory framework for AI	Case study approach, interview method	China
24. Surya (2019)	Conceptual framework for AI impact evaluation	Conceptual approach	None
25. Twizeyimana and Andersson (2019)	E-government public value framework	Literature review	None
26. van Noordt and Misuraca (2020)	AI success factors framework	exploratory multiple case study	EU countries
27. Wilson and van der Velden (2022)	Framework for ethical AI	Systematic literature review	None
28. Winfield and Jirotka (2018)	AI ethical governance framework	Desk research	None

29. Yigitcanlar et al. (2021)	Conceptual framework of responsible AI urban innovation	Literature review	None
30. Yu et al. (2018)	Ethical decision framework	Desk research	None

5.1 Graphical Results

Figure 1 shows the methods used in the included studies. Some of these studies had more than one method of research. Desk research was mostly used (12 studies), followed by interview method (5 studies), and case study method (4 studies).
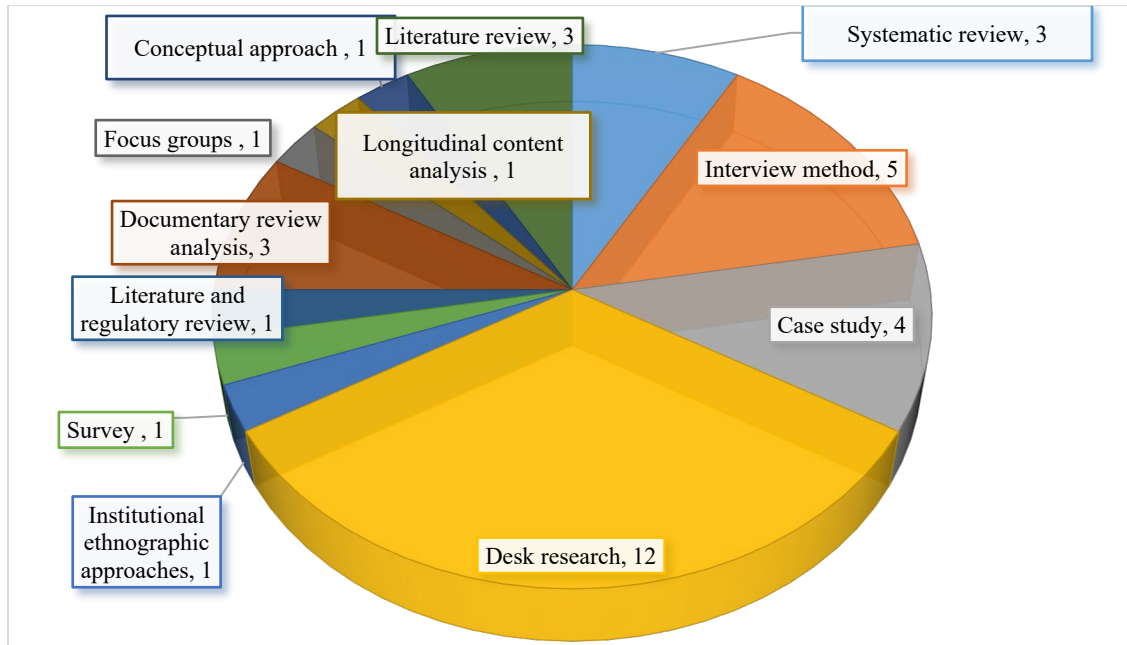

Figure 1. Methods used

Figure 2 shows that 18 studies did not mention any country. Two studies each focused on UK and EU member states. There was only one study each about the remaining countries covered in this review.
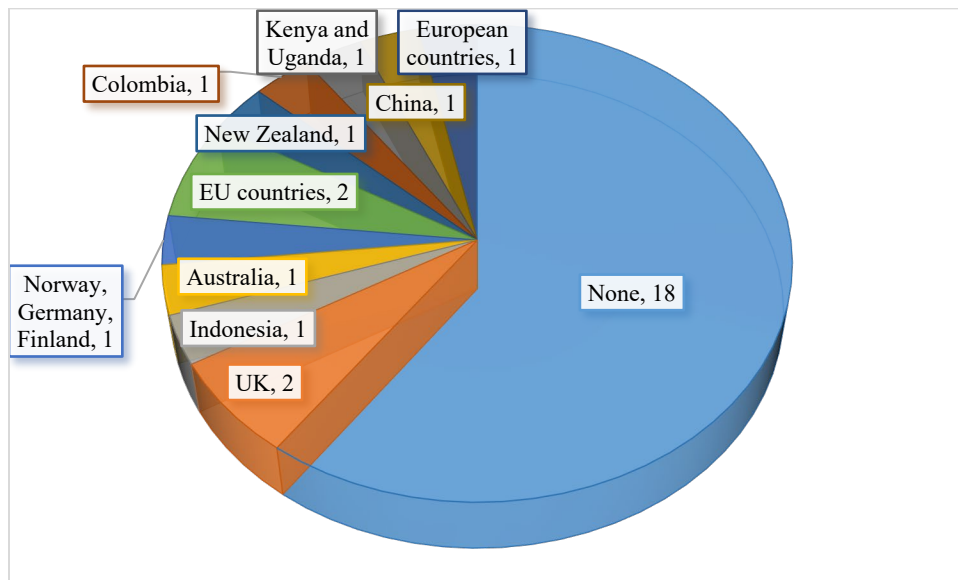

Figure 2. Countries covered in the studies

The AI adoption frameworks in the included studies were grouped into regulatory, normative, evaluative, and applicative. The number of AI adoption frameworks based on these categories are shown in Figure 3. Normative frameworks had the most number while applicative frameworks had the least.
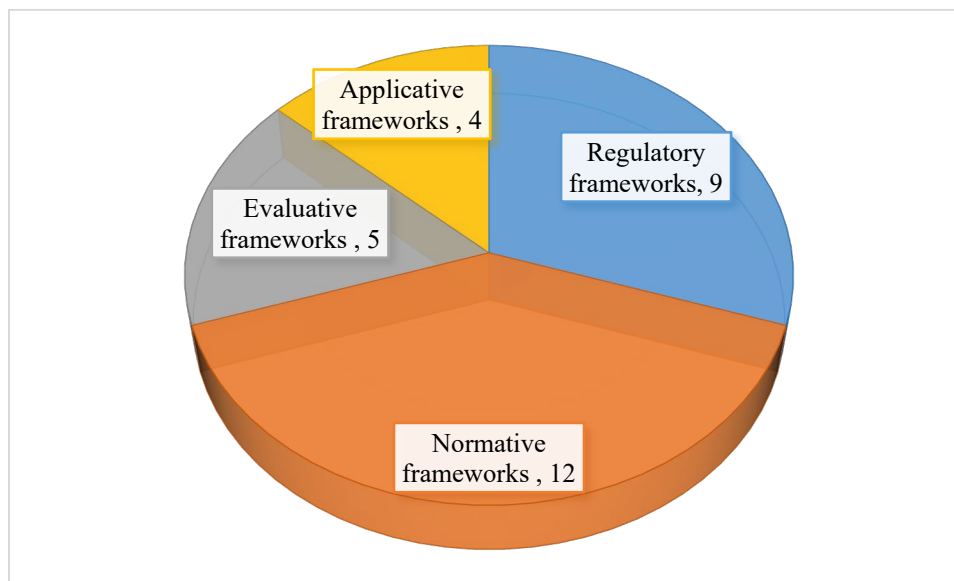

Figure 3. AI Framework categorisations

5.2 How May the Public Sector Leverage the Use of AI Through AI Adoption Frameworks?

Based on the findings of the reviewed studies, the adoption of AI in the public sector can be leveraged by the standardising and prescriptive character of regulatory frameworks. These are: legal framework for AI adoption (Campion et al. 2022; Henman 2020), policy cycle framework (Pencheva et al. 2020), AI governance framework (Carter 2020; Schiff et al. 2020; Smuha 2019), data management framework (Harrison et al., 2019), regulatory framework for AI (Sun and Medaglia 2019), and a framework for national AI strategy (Firdaus 2019). These frameworks can influence AI adoption forward by aligning the public sector to the roadmap of public service delivery.

Similarly, normative frameworks can potentially improve the ethical aspect of AI adoption and citizens' trust in the government. Specifically, these are: a framework for building trust in AI (Bedue and Frizche 2022), universal human rights framework for AI (Donahoe and Metzger 2019; Nagitta et al. 2021), ethical AI governance framework (Floridi et al. 2018; James and Whelan, 2022; Munoz et al. 2021; Rubenstein 2021; Wilson and van der Velden 2022; Winfield and Jirotka 2018; Yu et al. 2018), and framework for public-based value AI (Makasi et al. 2020; Twizeyimana and Andersson 2019). Through these normative frameworks, the public sector can enhance its AI adoption by placing higher importance on ethics, human agency, and trust in the government. They provide a prescriptive landscape for potential unregulated threats and can be used to guard the intended application of AI from unintended harms, such as reduced privacy, loss of accountability, and bias (Ramizo 2021).

Moreover, the actual application of AI adoption frameworks in public service delivery can influence positively AI governance in the public sector. Four studies were identified under the applicative frameworks, namely: novel ontological framework (Ashok et al. 2022), ad hoc classification framework (Misuraca et al. 2020), integrated reporting framework (Montecalvo et al. 2018), and conceptual framework of responsible AI urban innovation (Yigitcanlar et al. 2021). The applicative frameworks can help policymakers achieve responsible outcomes for AI systems by providing evidence of experience (e.g., Montecalvo et al. 2018). Similarly, the use of evaluative frameworks can leverage AI adoption in the public sector by increasing the functioning and value creation of AI adoption in the public sector. The studies identified under this category were: AI impact evaluation framework (Kuziemski and Misuraca 2020), TOE framework (Mikalef et al. 2021), realist evaluation framework (Ojo et al. 2019), conceptual framework for AI impact evaluation (Surya 2019), and AI success factors framework (van Noordt and

Misuraca 2020). These frameworks can guide government planners to make improvements in local and/or national domains through AI systems.

5.3 How Can AI Adoption Frameworks Steer Best Practices of AI Governance in the Public Sector?

The legal frameworks for AI adoption can encompass legal clarifications around responsibility in AI-related decision-making (Henman 2020). By using an AI regulatory framework, the public sector organization would be able to understand the policy decision-making process and the complex activities and drivers relating to AI use (e.g., Pencheva et al. 2020). AI governance frameworks can provide guidance and regulation on the issue of transparency and bias, as well as actionable protection of personal data and cybersecurity (e.g., Carter 2020; Schiff et al. 2020). Likewise, they can support the government's focus areas for a national AI strategy governed by ethics and policy (e.g., Firdaus 2019).

The normative frameworks can enable decision-makers to demonstrate a best practice of formulating a national AI strategy that is attuned to democratic accountability and enjoyment of human rights. This is amidst reliance on AI-based decisions, such as the universal human rights frameworks for AI (e.g., Donahoe and Metzger 2019; Nagitta et al. 2021). These frameworks will also allow the public sector to generate AI-related opportunities, including enhanced human agency and increased societal capabilities, instead of risks in the form of devalued human skills and eroded human self-determination. Ethical AI governance frameworks have emphasised these (e.g., Floridi et al. 2018; James and Whelan, 2022; Munoz et al. 2021; Rubenstein 2021; Wilson and van der Velden 2022; Winfield and Jirotka 2018; Yu et al. 2018).

Further, evaluative frameworks can allow decision-makers to conduct a detailed analysis of the impact of AI on public benefits, which can transform the quality and functionality of public services, as shown by a conceptual framework for AI impact evaluation (Surya 2019). Similarly, a best practice can focus beyond the data and algorithm development towards key factors that contribute to a successful adoption of AI, as in the case of AI success factors framework (e.g. van Noordt and Misuraca 2020).

6. Conclusion

This paper focused on how public sector organizations may leverage AI use through AI adoption frameworks, as well as how these frameworks can steer best practices of AI governance in the public sector. The literature was systematically reviewed to address these objectives. Thirty articles were selected based on a set of inclusion and exclusion criteria and analyzed according to the objectives identified. A quality assessment checklist was used to assess the quality of these articles.

The AI adoption frameworks were categorized as regulatory frameworks, normative frameworks, applicative frameworks, and evaluative frameworks. The regulatory frameworks can help align the public sector towards improved public service delivery, owing to their standardizing and prescriptive nature. The normative frameworks can leverage AI adoption by focusing on ethics, human agency, and trust in the government. Applicative frameworks can leverage the public sector by helping policymakers attain actionable outcomes for AI use. Moreover, evaluative frameworks can help increase the functioning and value creation of AI use in the public sector.

AI adoption frameworks can foster best practices. The legal frameworks can support AI decision making in the government by providing legal clarifications around responsibility in decisions relating to AI. A policy cycle framework can allow the public sector to demonstrate an understanding of decisions on AI use through the policy decision-making process. Likewise, AI governance frameworks can provide guidance and regulations on transparency and bias relating to AI adoption. Ethical frameworks will enable the public sector to promote human agency and societal capabilities instead of devaluing human skills and wearing away self-determination.

A proposed improvement to the paper is the use of comparison of AI adoption frameworks across different countries. This can further allow the research to yield conclusive findings on the potential differences in different governance contexts with regard to AI adoption.

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