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ARTIFICIAL INTELLIGENCE (AI) IN PUBLIC POLICY REFORM: APPROACHES, CHALLENGES, AND OUTCOMES

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ABSTRACT

Artificial Intelligence (AI) plays a crucial role in driving public policy reform by enhancing bureaucratic efficiency, improving the quality of decision-making, and enabling the personalization of public services. Technologies such as machine learning, predictive analytics, and automated decision-making systems enable governments to process large-scale data, anticipate societal needs, and optimize service delivery across various sectors. This study employs a Systematic Literature Review (SLR) by analyzing 40 peer-reviewed articles published between 2010 and 2024 to examine approaches to AI implementation, associated challenges, outcomes, and adoption patterns in public policy. The findings indicate that AI has been widely adopted in sectors such as healthcare, security, and public administration. The implementation of these technologies has demonstrably improved operational efficiency, enhanced decision-making quality, and supported more adaptive and personalized public services. Nevertheless, the application of AI in the public sector continues to face significant challenges, including algorithmic bias, ethical concerns, technical limitations, regulatory constraints, and data privacy risks. Cross-sectoral analysis also reveals disparities in adoption levels, with developed countries exhibiting higher degrees of AI integration than developing countries. Overall, this study highlights the substantial potential of AI in advancing data-driven governance. Therefore, ethical AI governance, transparent regulatory frameworks, and cross-sector collaboration are essential to ensure the responsible and sustainable implementation of AI.

A. INTRODUCTION

In the era of globalization and rapidly advancing digitalization, the integration of Artificial Intelligence (AI) into the government sector has become a crucial aspect requiring serious attention. The digital transformation occurring across various fields, including public administration, demonstrates that AI is being adopted in the public sector for service delivery, policy analysis, and administrative processes (Longo, 2024; Mellouli et al., 2024). AI technology has evolved rapidly and holds the potential to revolutionize the way governments provide public services. AI offers significant benefits such as increased efficiency and improved decision making (Henman, 2020; Wirtz et al., 2018).

The increasing complexity of public administration necessitates innovative approaches to decision-making and policy formulation. AI, with its capability to manage and analyze vast amounts of data, presents significant opportunities for enhancing policy effectiveness through a more scientific and

measurable approach. The utilization of AI enables real time data processing and in-depth analysis, which is crucial for formulating targeted and sustainable public policy strategies. Amid global pressures to enhance accountability and transparency, AI utilization becomes a key element in optimizing the public policy reform process. Countries such as Estonia, Singapore, and the United States have adopted AI to improve administrative services, manage population data, and conduct data-driven policy analysis. In the public sector, AI applications include automated decision-making, chatbots, security operations, and agricultural policy formulation (Henman, 2020; Sánchez et al., 2020).

The rapid advancement of information and communication technology has driven the emergence of a new paradigm in public policy formulation. The application of AI in public administration not only transforms information processing mechanisms but also shifts traditional decision-making paradigms towards a more intelligent and integrated system. The implementation of AI in government requires careful consideration of public values, ethical implications, and governance structure (T. Chen, 2023; Paul, 2022). A comparative analysis of AI policies across different regions, particularly China, the United States, and the European Union, reveals diverse approaches to data governance and regulation (Bisson et al., 2023), highlighting the importance of developing contextual and specific policies.

AI has already been widely applied in various domains of the public sector, enhancing efficiency in administrative workflows, security, and governance (Wirtz et al., 2018). Many governments have leveraged AI-driven automation to reduce bureaucratic inefficiencies, accelerate response times, and provide citizens with more accessible services. Additionally, AI-driven analytics contribute to evidence-based policymaking, allowing officials to derive insights from vast data sources to inform regulations and governance decisions (Henman, 2020). As a result, AI plays a pivotal role in modern governance, streamlining operations while fostering innovation in public service delivery.

Despite these advancements, concerns remain regarding AI's ethical and societal implications in governance. Issues such as algorithmic bias, data privacy, and accountability in AI decision-making must be addressed to ensure fair and just public service delivery. Without clear regulatory frameworks, AI-driven policies risk exacerbating existing disparities, making it essential to establish ethical AI governance models (Busuioc, 2020). Addressing these concerns is critical in fostering public trust and ensuring that AI applications in governance align with democratic values and human rights (Chen et al., 2023).

While some countries have made significant progress in AI adoption, disparities exist in AI integration strategies worldwide. Differences in technological infrastructure, regulatory frameworks, and governance priorities influence the extent to which AI is embedded within public administration. For instance, China has focused on AI-driven surveillance and citizen monitoring, whereas the European Union emphasizes ethical AI deployment and regulatory oversight (Bisson et al., 2023). Such regional variations highlight the necessity for comparative policy analysis to understand best practices and potential pitfalls in AI adoption.

The scientific novelty of AI integration in governance lies in its transformative potential for policy development, service efficiency, and decision-making accuracy. Unlike traditional public administration methods, AI facilitates data driven, predictive analytics, which enhances the responsiveness and adaptability of government institutions. By leveraging machine learning algorithms, governments can automate complex decision-making processes, optimize resource allocation, and enhance crisis management (Longo, 2024). This represents a paradigm shift in governance, where AI driven methodologies replace conventional bureaucratic procedures with more agile, responsive systems.

Given the significance of AI in governance, identifying best practices for AI integration is imperative. Governments must balance efficiency gains with ethical considerations, ensuring that AI serves the public interest without compromising transparency and accountability. As AI technology continues to evolve, research must explore new frameworks for AI governance, addressing legal, ethical, and operational challenges (Paul, 2022). Understanding these factors is crucial in designing AI-driven policies that align with democratic principles while enhancing administrative efficiency.

However, the implementation of AI in public service policy reform still faces various challenges related to accuracy, bias, transparency, and accountability (Henman, 2020; Wirtz et al., 2018). To address these challenges associated with AI adoption, researchers emphasize the importance of stakeholder participation, collaborative governance approaches, and robust accountability mechanisms (Busuioc, 2020; Chen et al., 2023). As AI continues to evolve within public administration, ongoing research and policy development are essential to maximize its benefits while mitigating potential risks.

AI's influence on governance extends beyond administrative efficiencies to encompass broader societal impacts. The integration of AI in the public sector raises critical concerns about labor displacement, digital divides, and the ethical use of AI in law enforcement and security operations. Policymakers must address these challenges proactively, developing AI strategies that promote inclusivity and minimize socio-economic inequalities (Sánchez et al., 2020). Future research should examine the long-term implications of AI-driven governance, ensuring that AI adoption aligns with human-centric and sustainable development goals.

As governments increasingly turn to AI for public administration, interdisciplinary research is essential to bridge the gap between technological capabilities and policy considerations. Collaboration between policymakers, technologists, and social scientists can foster holistic AI governance frameworks that balance innovation with ethical safeguards (Chen et al., 2023). Additionally, international cooperation is necessary to establish standardized AI governance principles that prevent misuse and promote responsible AI deployment in public administration.

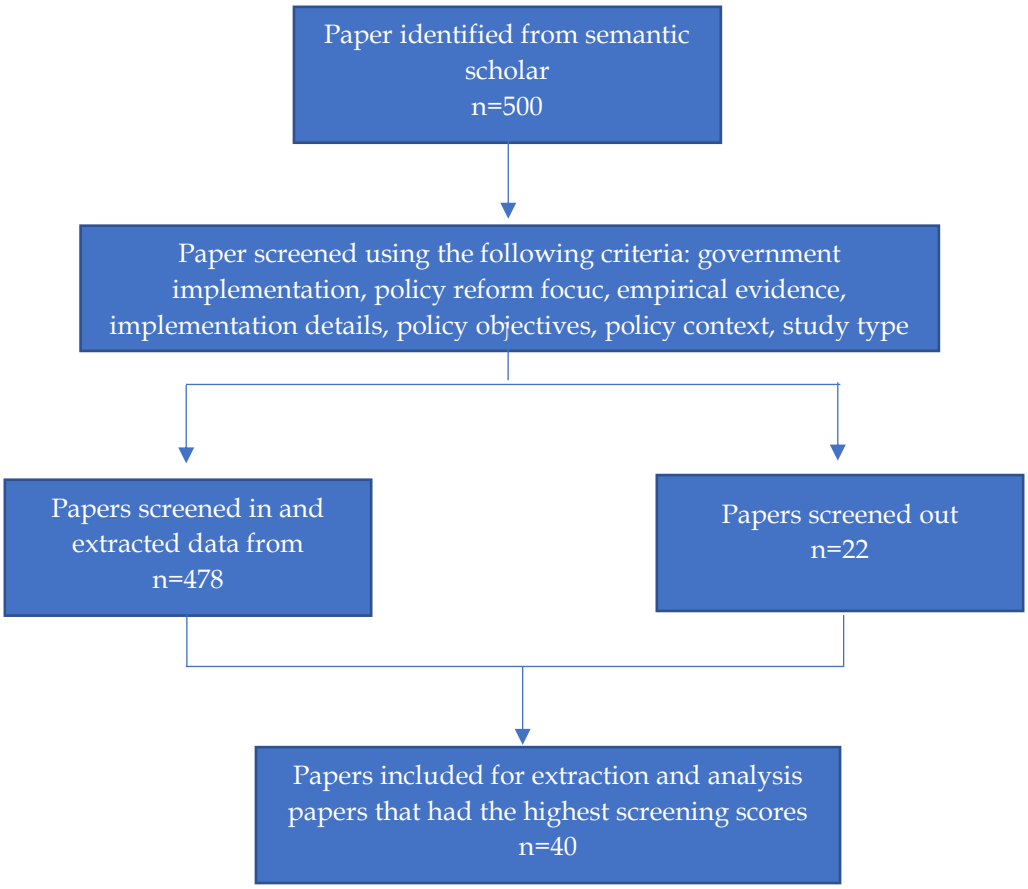
Given the increasing reliance on AI for policy formulation, it is crucial to assess its impact on democracy and public trust. AI-driven decision making processes must remain transparent, accountable, and subject to public scrutiny to prevent abuses of power. Governments should implement robust auditing mechanisms to evaluate AI-generated decisions and ensure compliance with ethical and legal standards (Busuioc, 2020). These measures are essential in maintaining public confidence in AI-enhanced governance.

As the complexity of problems faced by governments such as social, economic, and technological dynamics increases, research on AI usage becomes even more relevant in efforts to find new approaches to public policy reform. This study aims to uncover the current approaches, challenges, and outcomes of artificial intelligence implementation in public policy reform across different government sectors between 2010-2024 using the Systematic Literature Review (SLR) approach. By collecting and synthesizing various theories and recent case studies from reputable literature, this research constructs a comprehensive analytical framework to support public policy innovation and modernization.

The SLR approach is expected to provide a strong theoretical foundation and create room for practical contributions to improving government systems while emphasizing the urgency of digital transformation in public administration. This study is designed to explore in-depth how AI implementation approaches, challenges, outcomes and cross-sector patterns in public policy through the SLR method. By integrating various perspectives from empirical and theoretical studies, this research provides a comprehensive overview of how technological advancements can address bureaucratic inefficiencies and enhance the performance of public institutions while establishing a conceptual framework underlying public policy reform in the digital transformation era.

B. METHOD

This study employs the Systematic Literature Review (SLR) method based on PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure accuracy and transparency in literature selection. The study retrieved relevant literature from the Semantic Scholar, selecting 500 of the most pertinent papers related to AI in public policy and 22 papers screened out. The research process follows a structured approach that includes paper selection, screening, data extraction, and thematic analysis. The primary objective is to synthesize empirical findings and theoretical perspectives on AI-driven policy transformations. The screening process applied criteria such as government implementation, policy reform focuc, empirical evidence, implementation details, policy objectives, policy context, study type. A total of 40 high-scoring papers were analyzed to extract data on AI implementation approaches, challenges, outcomes and cross-sector patterns in public policy. Studies were categorized based on methodology, geographic focus, and implementation strategies. Thematic analysis was conducted to identify patterns and insights regarding AI's impact on public policy.



Source : Author, 2025
Figure 1: Research Process

C. RESEARCH FINDING AND DISCUSSION

Findings indicate that AI is widely utilized across multiple government sectors, including public health, security, and citizen services. Machine learning and predictive analytics are the most commonly employed AI technologies, facilitating data-driven decision-making and improving service efficiency. Automated decision-making systems are increasingly integrated into administrative processes, reducing bureaucratic delays and optimizing resource allocation.

The following studies provide a broad analysis of AI applications, methodologies, and their impact across different regions and domains. Several studies highlight AI's role in multiple public sector applications. Alhosani & Alhashmi (2024) examine AI applications in public health, citizen services, and public management, with a focus on machine learning, natural language processing (NLP), and predictive analytics. Similarly, Engstrom & Ho (2020) explore AI in securities enforcement, patent classification, and social security, emphasizing machine learning, NLP, predictive analytics, and automated decision-making. Other studies take a broader look at governance, such as Valle-Cruz et al., (2020), which discusses AI in public health, education, and security using big data analytics, robotics, and automated systems in Mexico and Spain. Pencheva et al., (2018) also analyze AI applications in local government, taxation, and healthcare, incorporating machine learning, NLP, virtual agents, and computer vision. AI is also impacting security and law enforcement. Henman (2020) explores machine learning and automated decision-making in public safety and security, while Hardy (2021) focuses on security-related applications using qualitative and mixed methods.

The studies employ various research methods to analyze AI implementation in the public sector. Many focus on theoretical and conceptual reviews, including Androutsopoulou et al., (2019), Medaglia et al., (2021), Mergel et al., (2023), Yerlikaya & Erzurumlu, (2021). Some studies adopt qualitative and case study approaches, such as Supriyanto & Saputra (2022) which examine AI's impact on export-import, agriculture, trade, and tourism in Indonesia, and Kuziemski & Misuraca, (2020a), which analyze AI in immigration, employment services, and digital services in Canada, Poland, and Finland. Several researchers take an empirical analysis approach, including Loukis et al., (2020), which investigates AI's role in economic policy in Greece, and David et al., (2023), which use mixed methods to study AI in governance and administration. Systematic reviews are another key method, with Goyal & Shekhawat (2023) providing a review of AI in policy-making, health, education, and the environment in India. Hakimi et al., (2024) focus on pharmacy practice, while (Reis et al., 2019) discuss AI's influence on public administration, governmental law, and business economics.

AI's impact varies across different regions. Androutsopoulou et al., (2019) and Loukis et al., (2020) focus on Greece, while Valle-Cruz et al., (2020) study Mexico and Spain. (Noordt & Misuraca, 2022) investigate AI applications in the European Union, and Sun & Medaglia (2019) examine IBM Watson's role in China's public health sector. (Gati et al., 2021) analyze AI applications in Indonesia, while Leslie, (2019) provides insights into the UK's adoption of AI in healthcare, education, and transportation.

AI Implementation Approaches

The reviewed literature highlights diverse AI implementation approaches in the public sector. One key approach is strategic integration, which involves developing policy frameworks and fostering cross-sector collaboration. Studies like Yerlikaya & Erzurumlu (2021) emphasize the importance of national AI strategies to enhance competitiveness and maintain security. These policies serve as blueprints for AI adoption, ensuring alignment with national priorities. Additionally, structured partnerships between government, academia, and private sectors play a crucial role in AI integration. Mikhaylov et al., (2018) highlight that collaborative model enable knowledge sharing, resource pooling, and co-development of AI-driven solutions, ensuring a more effective and sustainable implementation.

Indonesia's National Strategy for Artificial Intelligence (STRANAS AI) 2020-2045 exemplifies this strategic integration approach adapted to a developmental state context. Rather than adopting the prescriptive regulatory stance of global models such as the EU AI Act, Indonesia implements a quadruple-helix collaboration model involving government, industry, academia, and civil society, explicitly grounded in Pancasila and the Indonesian Constitution. This framework departs fundamentally from Western governance models by establishing AI ethics and policy rooted in constitutional values emphasizing belief in God, humanitarianism, national unity, and social justice providing indigenous legitimacy alongside global best practices. The strategy systematizes collaboration through four focus areas (ethics and policy, talent development, infrastructure and data, research, and innovation) aligned with Vision Indonesia 2045 of a sovereign, advanced, just, and prosperous nation (Badan Pengkajian dan Penerapan Teknologi, 2020). This approach parallels ASEAN's principle-based governance framework articulated in the ASEAN (2025) Guide on AI Governance and Ethics, which emphasizes voluntary adoption, proportionate regulation, and regional interoperability accommodating diverse institutional capacities across Southeast Asia. Indonesia's establishment of the AI Council (Dewan Kecerdasan Artifisial) and sectoral coordination mechanisms demonstrates recognition that strategic integration in middle income countries must balance global standards with localized institutional realities, constitutional values, and development priorities fundamentally different from high-income country approaches that assume existing institutional maturity

Technological approaches are another critical aspect of AI adoption in the public sector. Machine learning and predictive analytics are widely applied in areas such as fraud detection, traffic management, and public service optimization (Wirtz et al., 2018). These technologies enable governments to process vast datasets and make data-driven decisions. Natural Language Processing (NLP) and chatbots further improve citizen-government interactions by automating responses and streamlining communication channels (Androutsopoulou et al., 2019). Automated decision-making systems also play a significant role, with studies like (Engstrom & Ho, 2020) discussing their potential to enhance administrative efficiency and optimize bureaucratic processes.

Indonesia's public sector technological readiness varies significantly across ministries and administrative levels, constrained by infrastructure gaps, digital penetration disparities, and technical

capacity limitations that differentiate Southeast Asian implementation contexts from developed nations. ASEAN's expanded guidance on trusted development and deployment emphasizes safety-first technical practices reinforcement learning, grounding methods, and guardrails ensuring outputs remain contextually appropriate and culturally sensitive rather than simply technically efficient. For Indonesia specifically, technological implementation must account for archipelagic infrastructure challenges (17,000+ islands), extreme linguistic diversity (700+ regional languages), uneven broadband penetration (particularly in rural areas), and distributed ministerial IT systems creating integration complexity. The development of Indonesia's National AI Supercomputer Center and initiatives supporting Bahasa Indonesia natural language processing reflect recognition that global technological solutions require substantive localization and adaptation for effective public service delivery in Southeast Asian contexts. ASEAN's collective regional response exemplified by Thailand's ThaiLLM, Vietnam's PhoGPT, and Singapore's SEA-LION multilingual models supporting Bahasa Indonesia, Thai, Vietnamese, and other regional languages, directly addresses persistent gaps in Western-developed global AI systems regarding linguistic representation and cultural sensitivity. This collaborative technological development model demonstrates how Southeast Asian nations can simultaneously adopt international best practices while building indigenous capabilities, enabling proportionate governance calibrated to sectoral risk profiles and institutional maturity rather than applying uniform technical standards designed for different governance environments (ASEAN, 2025; Badan Pengkajian dan Penerapan Teknologi, 2020)

AI implementation varies across different sectors, reflecting its versatility in addressing public administration challenges. In public health, AI technologies like IBM Watson assist in diagnosing diseases, optimizing hospital resource allocation, and predicting outbreaks (Sun & Medaglia, 2019). AI also plays a crucial role in security and law enforcement, where it is used for facial recognition, crime prediction, and surveillance (Hardy, 2021). Moreover, public management and administration benefit from AI applications that enhance efficiency, automate routine tasks, and support evidence-based policymaking, making governance more responsive and transparent.

Indonesia's STRANAS AI strategically designates five priority sectors directly addressing acute development challenges and institutional constraints rather than technology push adoption (Badan Pengkajian dan Penerapan Teknologi, 2020). In healthcare, AI applications respond to documented capacity crises. Indonesia's physician to population ratio of 86 per 100,000 falls below WHO standards of 100 per 100,000. Critically, 70% of health professionals concentrate on Java and Sumatra, leaving vast archipelagic regions underserved. The proposed 4P Health model (Predictive, Preventive, Personalized, Participatory) leverages AI for predictive disease modeling, prevention-focused public health, personalized medicine, and community participation directly addressing capacity constraints through technological augmentation rather than infrastructure expansion alone. For bureaucratic reform, the Electronic Government Systems (SPBE) initiative and Satu Data Indonesia framework enable AI-driven process automation, evidence-based policy analytics, and service optimization across fragmented ministerial systems, critical for a developing nation where bureaucratic efficiency directly impacts citizen welfare ASEAN's governance framework articulates nine ecosystem dimensions (accountability, data, trusted development, incident reporting, testing, security, content provenance, safety-alignment, and AI for public good) providing structured guidance for sectoral implementation while maintaining proportionate risk management tailored to varying institutional readiness (ASEAN, 2025). Critically, ASEAN emphasizes shared responsibility models and incident reporting frameworks to clarifying stakeholder accountability across value chains directly addressing governance gaps endemic to developing-nation public sectors where institutional coordination remains fragmented and capacity limited. Indonesia's sectoral focus on food security (addressing rice insufficiency), maritime services (exploiting archipelagic geography), and smart energy management reflects demand-driven prioritization of sectors providing high development impact and comparative advantage, contrasting sharply with technology-first adoption patterns in developed nations.

A significant trend in AI adoption involves data-driven approaches, particularly big data analytics. Governments increasingly leverage AI-powered data analysis to optimize economic policies, forecast trends, and improve service delivery (Loukis et al., 2020). Open data initiatives further facilitate AI implementation by making government datasets accessible for research and innovation. These initiatives promote transparency, foster public-private collaborations, and support AI-driven solutions that address complex governance challenges.

Indonesia's Satu Data Indonesia (Presidential Regulation No. 39/2019) represents a foundational policy shift from sectoral data silos toward integrated, standardized data governance essential for training representative AI systems. The framework mandates standardized data management, metadata documentation, data interoperability codes, and reference standards across government institutions recognizing that fragmented government datasets of varying quality undermine AI implementation and evidence-based policymaking. However, implementation faces documented challenges, such as sectoral organizational cultures resist data sharing (ego-silo behaviors), cybersecurity infrastructure remains vulnerable (data theft risks), and data quality disparities across government systems complicate governance effectiveness. ASEAN's complementary data governance strategy amplifies Indonesia's national approach by facilitating regional data sharing, collaborative language model development (ThaiLLM for Thai, PhoGPT for Vietnamese, SEA-LION supporting Bahasa Indonesia with major regional dialect extensions), and harmonization of personal data protection standards through the ASEAN Framework on Personal Data Protection and the ASEAN Data Protection and Privacy Forum (ASEAN, 2025). Indonesia's distinctive advantage Bahasa Indonesia as unifying national language coupled with Javanese, Sundanese, and hundreds of minority language communities creates substantial datasets for natural language processing while presenting localization challenges requiring continuous model refinement. Indonesia's proposed Data Ethics Board and data broker ecosystem aim to facilitate responsible data exchange while protecting privacy and supporting innovation, implementing ASEAN's principle of shared responsibility across data value chains. The strategic approach of combining public open datasets, private sector data sharing, and synthetic data generation directly reflects ASEAN's recognition that middle-income countries must accelerate AI capability development while maintaining data sovereignty, privacy protections, and institutional capacity alignment, fundamentally different from data strategies in high-income countries that assume existing infrastructure maturity and democratic institutional oversight

Finally, ethical and governance frameworks are crucial for ensuring responsible AI adoption in the public sector. Many scholars, including (Leslie, 2019), emphasize the need for clear ethical guidelines to mitigate risks such as algorithmic bias, discrimination, and privacy concerns. AI systems must be designed with transparency, accountability, and fairness to maintain public trust. Establishing governance frameworks that regulate AI deployment, monitor its societal impact, and ensure compliance with ethical principles is essential for fostering sustainable and equitable AI-driven policy reform.

Indonesia's ethical approach to AI governance is uniquely grounded in Pancasila as the nation's foundational constitutional philosophy emphasizing belief in God, humanitarianism, national unity, participatory democracy, and social justice. This philosophical constitutional basis fundamentally differentiates Indonesia's framework from utilitarian or rights-based approaches dominant in Western models, providing indigenous legitimacy and cultural resonance for AI ethics implementation that resonates across government institutions, civil society, and public consciousness. The Ministry of Communication and Information is developing comprehensive AI ethics guidelines addressing responsible development and deployment, reflecting growing institutional commitment to integrating ethical governance with rapid technological adoption rather than treating them as competing priorities. ASEAN's seven guiding principles for AI governance that consist of transparency and explainability, fairness and equity, security and safety, human-centricity, privacy and data governance, accountability and integrity, and robustness and reliability establish a regional ethical framework accommodating diverse national constitutional traditions while maintaining harmonized governance standards. Critically, ASEAN emphasizes human-centric AI that enhances rather than displaces human agency, recognizing that automation in Southeast Asian contexts occurs amid significant employment transitions, social welfare gaps, and labor market vulnerabilities requiring active management and social policy coordination. Algorithmic bias and discrimination represent particularly acute ethical concerns in Indonesia given intersecting vulnerability dimensions such as extreme geographic disparities (urban-rural infrastructure gaps), linguistic marginalization (minority language communities), gender inequality, and socioeconomic stratification across the archipelago. ASEAN's detailed guidance on fairness and equity addresses these concerns through emphasis on bias detection methodologies (BOLD metrics, toxicity evaluation), representative training data composition, and inclusive participatory design processes incorporating affected communities. Indonesia's development of the AI Ethics Board and institutional compliance frameworks aims to operationalize principles through mechanisms for audit, incident reporting, and proportionate enforcement recognizing that

effective ethics governance in developing nations requires simultaneously building administrative capacity and establishing stakeholder accountability rather than assuming institutional maturity. The framework's emphasis on shared responsibility across value chains (developers, deployers, government oversight, civil society monitoring) reflects institutional reality that middle income countries cannot concentrate ethical governance authority in single agencies, requiring collaborative governance grounded in clear role delineation, mutual accountability, and capacity-building support

Table 2. Indonesia-ASEAN Integration: Key Insights

Dimension	Global Pattern	Indonesia-ASEAN Adaptation
Governance Foundation	Rights-based or utilitarian frameworks	Pancasila-based constitutional grounding providing indigenous legitimacy
Policy Approach	Prescriptive regulation (EU) or market-driven (US)	Proportionate, voluntary, principle-based frameworks accommodating diverse institutional capacities
Sectoral Focus	Technology-driven adoption	Demand-driven: health capacity, bureaucratic efficiency, food security, smart infrastructure
Talent Development	Existing skilled workforce	Demographic dividend strategy coupled with educational system capacity building
Data Governance	Data maximization for innovation	Balanced: data sovereignty + privacy + innovation acceleration + institutional capacity
Language & Culture	Global English-dominant AI systems	Regional multilingual models (ThaiLLM, PhoGPT, SEA-LION) addressing linguistic representation gaps
Accountability	Centralized regulator oversight	Shared responsibility across quadruple-helix stakeholders with clear role delineation
Risk Management	Uniform standards	Proportionate, sector-specific, maturity-aligned governance mechanisms

Source: processed data by researcher, 2025

This integration demonstrates that effective AI governance in Southeast Asia requires simultaneous attention to global interoperability, local constitutional grounding, sectoral development priorities, institutional capacity building, and equitable distribution of AI benefits across diverse populations fundamentally different from governance approaches designed for high-income nations with established institutional maturity.

AI Implementation Challenges

The literature review reveals several recurring challenges in implementing AI in Policy Reform:

Table 2. Key Challenges in AI Implementation in the Public Sector: Impact, Mitigation, and Sectoral Prevalence

Challenge Category	Impact Level	Mitigation Strategies	Sector Prevalence
Algorithmic Bias	High	Diverse data sets, reguler audits, ethical guidelines	Cross-sector

Challenge Category	Impact Level	Mitigation Strategies	Sector Prevalence
Ethical Concerns	High	Ethical frameworks, transparency measures,public engagement	Cross-sector
Technical Limitations	Medium	Capacity building, infrastructure development, cross-sector collaboration	Varies by sector
Legal/Regulatory Challenges	High	Policy development, regulatory frameworks, international cooperations	Cross-sector
Implementation Barries	Medium	Change menegement, skills development, resource allocation	Varies by sector
Data Privacy Issues	High	Data protection measures, consent mechanisms, anonymization techniques	Cross-sector

Source: processed data by researcher, 2025

Algorithmic bias is a major challenge in AI implementation within the public sector, as it can lead to unfair or discriminatory outcomes. This issue arises when AI systems rely on historical data that reflect existing societal biases, resulting in biased decision-making processes. The impact of algorithmic bias is particularly significant in sectors such as law enforcement and social services, where biased AI models can lead to wrongful arrests, unfair resource distribution, or discriminatory policy enforcement. Misra et al. (2020) suggest that mitigating bias requires the use of diverse and representative datasets, as well as regular audits to identify and correct bias in AI algorithms. Cross-sector AI governance frameworks must include bias detection mechanisms to ensure fair decision-making, preventing harm to vulnerable communities and upholding public trust in AI-driven governance.

Ethical concerns present another significant challenge in AI adoption, as they influence public trust and the legitimacy of AI-driven decisions. AI technologies deployed in government services must align with ethical principles such as transparency, accountability, and fairness. However, AI's opaque decision-making processes often make it difficult to assess the rationale behind automated decisions, raising concerns about bias, discrimination, and lack of accountability. Leslie (2019) emphasizes the necessity of developing comprehensive ethical guidelines and governance frameworks to regulate AI use in the public sector. Establishing ethical AI practices requires multi-stakeholder collaboration, with policymakers, technologists, and civil society organizations working together to create AI models that uphold democratic values and human rights. Ensuring AI's ethical implementation will be crucial in maintaining public confidence and preventing unintended harm caused by AI-driven policies.

Technical limitations pose another barrier to AI adoption in public services, as they affect system efficiency and overall effectiveness. AI applications require high-quality data, advanced computational infrastructure, and skilled personnel to function optimally. However, many government agencies lack the necessary expertise and resources to develop and maintain AI-driven systems, leading to inefficiencies and suboptimal outcomes. Campion et al., (2020) highlight the importance of addressing skills gaps through workforce training and capacity-building initiatives. Additionally, AI's effectiveness varies across sectors, with complex fields such as healthcare requiring advanced AI models that can process vast amounts of sensitive medical data. Governments must invest in AI infrastructure, research, and training programs to ensure that technical challenges do not hinder AI's potential benefits in public administration.

Legal and regulatory challenges significantly affect AI adoption in the public sector, as they determine the legality, accountability, and oversight of AI systems. Governments must establish clear legal frameworks that define AI's permissible applications, data usage policies, and mechanisms for accountability. However, existing legal frameworks often struggle to keep pace with rapid AI advancements, leading to regulatory gaps and uncertainties. Kuziemski & Misuraca (2020) stress the importance of updating laws and policies to ensure AI compliance with human rights, privacy laws, and ethical standards. Regulatory challenges are particularly significant in highly regulated sectors such as healthcare, finance, and law enforcement, where AI decisions can have profound societal

consequences. Addressing these challenges requires continuous legal adaptation and international collaboration to create standardized regulations for responsible AI deployment.

Implementation barriers further slow AI adoption, as they involve organizational constraints, bureaucratic resistance, and risk aversion. Many public institutions struggle with outdated infrastructures, rigid hierarchies, and limited budgets, making AI integration difficult. Mikhaylov et al., (2018) argue that overcoming these barriers requires organizational reform, leadership support, and the promotion of innovation-friendly cultures within government agencies. AI adoption must be accompanied by change management strategies that encourage public servants to embrace AI tools, addressing fears of job displacement and decision-making automation. Policymakers should also implement pilot programs and phased rollouts to gradually introduce AI in government services while mitigating risks and addressing stakeholder concerns.

Data privacy issues are among the most pressing concerns in AI-driven public governance, as they impact both public trust and regulatory compliance. AI systems rely on large datasets, often containing sensitive personal information, raising concerns about data security and misuse. Without robust data protection measures, AI implementation risks violating privacy rights and eroding citizen trust in government institutions. Pencheva et al. (2018) emphasize the need for comprehensive data protection policies, encryption methods, and secure data-sharing protocols to safeguard personal information. Addressing privacy concerns requires governments to implement strict AI governance policies that balance innovation with individual rights, ensuring ethical and lawful data usage in AI-driven decision-making.

AI Implementation Outcomes

The literature review reveals a range of outcomes from AI implementation in the public sector:

Table 3. AI Implementation Outcomes in Public Sector: Success Indicators, Challenges, and Sector Performance

Outcome Type	Success Indicators	Limiting Factors	Sector Performance
Efficiency improvements	Reduced processing time, cost savings	Technical limitations, implementation barriers	High in administrative tasks, moderate in complex decision-making
Decision-making enhancement	Improved accuracy, faster response times	Data quality issues, algorithmic bias	High in data-rich environments, moderate ini nuanced policy areas
Service personalization	Increased user satisfaction, tailored services	Privacy concerns, data integration challenges	High ini citizen services, moderate in regulatory functions
Cost reduction	Budget savings, resource optimization	Initial investment costs, maintenance requirements	High in repetitive tasks, moderate in specialized services
Improved public service delivery	Increased accessibility, faster service provision	Digital divide, user adoptian challenges	High ini information service, moderate in complex service delivery
Data analysis capablities	Enhanced predictive power, improved policy insights	Data quality, analytical skill gaps	High ini research-oriented sectors, moderate in operational areas

Source: processed data by researcher, 2025

Artificial Intelligence (AI) has demonstrated substantial potential in enhancing efficiency within public sector operations. By automating administrative tasks, streamlining workflows, and optimizing resource allocation, AI significantly reduces processing times and operational costs (Governing with Artificial Intelligence, 2024). Nevertheless, technical limitations, inadequate infrastructure, and resistance to organizational change often hinder these efficiency gains. AI performs effectively in routine administrative functions but remains less reliable in complex decision-making contexts where ethical and contextual judgment is essential.

Beyond improving operational efficiency, AI supports data-driven policymaking by enhancing the accuracy and timeliness of decisions. Through real-time data processing and predictive analytics,

policymakers gain deeper insights and more precise recommendations (Engstrom & Ho, 2020). However, algorithmic bias and poor data quality can distort analytical outputs, underscoring the need for robust data governance and continuous human oversight, particularly in sensitive policy domains.

AI has also enabled personalized public services, improving citizen engagement and satisfaction through tailored service delivery (Androutsopoulou et al., 2019). Despite its promise, data privacy concerns and fragmented information systems limit the scalability of such personalization efforts. Citizens' reluctance to share personal data and uneven integration across government databases remain major barriers.

Cost efficiency represents another key advantage of AI implementation. Automation and predictive analytics reduce administrative expenditure and minimize losses from inefficiencies or fraud. However, substantial upfront investment and maintenance costs can offset short-term savings, particularly in specialized domains such as healthcare and security, which demand high customization and skilled personnel.

Additionally, AI technologies have improved accessibility and responsiveness in public service delivery. Governments increasingly deploy chatbots, virtual assistants, and automated processing systems to reduce wait times and enhance engagement. Yet, issues such as the digital divide and varying levels of user adoption constrain the equitable distribution of these benefits.

AI's growing role in data analytics further strengthens evidence-based governance. Predictive modeling and large-scale data analysis improve policy design and foresight capabilities (Loukis et al., 2020). Still, the effectiveness of these systems depends on data quality, interpretive capacity, and institutional readiness to translate insights into actionable policy.

Overall, while AI delivers transformative benefits including operational efficiency, improved decision-making, personalized services, and enhanced analytics. Its success depends on addressing persistent ethical, technical, and regulatory challenges. Building transparent governance frameworks, mitigating algorithmic bias, and safeguarding data privacy are imperative to ensure that AI adoption contributes meaningfully to effective and equitable public sector transformation.

Cross-Sector Patterns and Insights

The successful implementation of AI in government sectors is often driven by several key factors. Strong leadership and a clear national vision play a crucial role, as emphasized by (Yerlikaya & Erzurumlu, 2021). Effective AI adoption requires well-defined policies and strategic roadmaps to guide integration. Cross-sector collaboration is another vital component, with Mikhaylov et al. (2018) highlighting the benefits of partnerships between academia, government, and the private sector. Ethical governance is equally critical, as (Leslie, 2019) stresses the need for ethical frameworks to ensure responsible AI deployment. Additionally, data quality and accessibility are fundamental to AI effectiveness, with Loukis et al. (2020) pointing out that reliable and well-structured datasets enhance AI's predictive and analytical capabilities.

AI implementation varies significantly across government sectors, reflecting domain-specific challenges and opportunities. In healthcare, studies like Sun & Medaglia (2019) highlight AI's potential in diagnostics and personalized medicine, though data privacy and integration remain hurdles. In public safety and security, Hardy (2021) explores AI's role in predictive policing and threat detection, but concerns over surveillance and civil liberties persist. Public administration benefits from AI's ability to automate routine tasks and enhance citizen services. Environmental management has also seen AI-driven improvements in monitoring and predictive modeling, as discussed by Rakšnys et al., (2021) where AI helps governments address climate change and sustainability challenges.

The evolution of AI implementation strategies reveals a shift from isolated pilot projects to comprehensive, organization-wide integration. Early research focused on individual AI projects, whereas recent studies explore systemic AI deployment across government functions. Ethical AI considerations have gained prominence, as Kuziemski & Misuraca (2020) note a growing emphasis on fairness, accountability, and bias mitigation. Explainable AI has become increasingly important, with newer research advocating for transparency in AI-driven public decision-making. Additionally, regulatory compliance now plays a significant role in shaping AI adoption, as governments align their strategies with evolving AI policies and data protection laws.

Several emerging trends indicate the expanding role of AI in governance. AI is increasingly used for policy analysis, with Valle-Cruz et al., (2019) discussing its role in enhancing policy formulation and evaluation. Citizen-centric AI is another growing focus, as Androutsopoulou et al., (2019) highlight AI-

driven personalization to improve citizen engagement. Additionally, AI is proving valuable in crisis management, particularly in emergency response and disaster preparedness, as seen in recent studies examining AI's role in global crisis mitigation efforts. These trends reflect the potential of AI to enhance both governance efficiency and public service effectiveness.

Despite these advancements, persistent challenges continue to hinder AI adoption in the public sector. The lack of AI expertise remains a major barrier, as Campion et al., (2020) identify a significant skills gap among public sector employees. Legacy systems further complicate AI integration, as outdated government IT infrastructure struggles to accommodate advanced AI solutions. Public trust remains a crucial challenge, with citizens expressing concerns over AI decision-making transparency and accountability. Addressing these barriers requires targeted strategies, including workforce training, system modernization, and proactive public engagement efforts.

Geographic variations also influence AI adoption, as contextual factors shape implementation strategies in different regions. While many challenges are universal, studies focusing on specific countries, such as Indonesia, India, and Visegrad states, reveal unique socio-political and economic conditions that impact AI deployment. Differences in regulatory frameworks, infrastructure readiness, and cultural attitudes toward AI contribute to varied implementation outcomes. Understanding these geographic nuances is essential for designing AI policies that align with local governance needs and public expectations.

D. CONCLUSION AND RECOMMENDATION

Conclusion

The study confirms that AI has emerged as a major driver of public sector reform by enhancing bureaucratic efficiency, improving the accuracy and timeliness of data-driven decision-making, and enabling more adaptive and personalized public services in domains such as health, security, and public administration, while at the same time revealing serious challenges including algorithmic bias, privacy risks, technical and infrastructural limitations, regulatory gaps, and uneven levels of adoption between countries and sectors, all of which make clear that AI's benefits in governance can only be realized sustainably when supported by robust ethical, legal, and institutional safeguards.

Recommendation

Building on these findings, it is recommended that Indonesia adopt an integrated AI ethics and governance framework for the public sector that combines clear principles such as fairness, transparency, accountability, human oversight, and respect for privacy with concrete mechanisms like mandatory bias and impact assessments for high-risk government AI systems (e.g., social assistance targeting, predictive policing, and AI-supported diagnostics in public hospitals), humanin the loop requirements for automated administrative decisions (permits, benefits, and case prioritization), standardized data governance aligned with Satu Data Indonesia to ensure secure and high-quality training data, and institutional arrangements such as an independent AI ethics committee and sector-specific guidelines grounded in Pancasila and STRANAS AI so that every deployment in ministries and local governments is evaluated not only for efficiency gains but also for its effects on equity, rights protection, and public trust.

Future research should explore the long-term societal impact of AI in public administration, focusing on public trust, ethical AI implementation, and the balance between automation and human oversight. Additionally, further comparative studies across different governance models could provide deeper insights into best practices for AI-driven policy reform. By addressing these areas, AI can continue to evolve as a tool for enhancing governance while ensuring fairness, accountability, and inclusivity in public policymaking.

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