

SYSTEMATIC LITERATURE REVIEW ON ARTIFICIAL INTELLIGENCE IN INDONESIA'S PUBLIC SECTOR: REIMAGINING DIGITAL GOVERNMENT

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Abstract— This study conducts a Systematic Literature Review (SLR) to critically examine the application of Artificial Intelligence (AI) in e-government within the Indonesian public sector. Addressing the limited empirical research and fragmented understanding of AI adoption in Indonesia's digital governance landscape, this review analyzes 22 peer reviewed articles published between 2021 and 2025 from reputable databases including Scopus, IEEE, ACM Digital Library, SpringerLink, and Emerald Insight. The review identifies adaptability and innovation, ethical consideration, collaboration and partnership as the most frequently cited critical success factors. Meanwhile, the top three recurring challenges are lack of awareness, skill & expertise, policy or legal uncertainty, resistance to change. To address these challenges, the study proposes a multi dimensional AI implementation strategy focusing on strengthening digital infrastructure, developing human capital through sustained capacity building, formulating clear and accountable AI governance policies, and fostering inclusive, cross sectoral stakeholder engagement. This study offers novel insights by mapping AI related factors into the Technology, Organization, Environment (TOE) framework and synthesizing practical, context-specific recommendations for Indonesian policymakers seeking to build an adaptive, inclusive, and sustainable AI based e-government ecosystem.

Keywords: artificial intelligence, digital governance, digital transformation, e-government, electronic government system.

Intisari — Penelitian ini melakukan Systematic Literature Review (SLR) untuk mengkaji secara kritis penerapan Artificial Intelligence (AI) dalam e-government di sektor publik Indonesia. Menanggapi keterbatasan penelitian empiris dan pemahaman yang terfragmentasi terkait adopsi AI dalam lanskap tata kelola digital di Indonesia, tinjauan ini menganalisis 22 artikel yang telah ditinjau sejawat dan diterbitkan antara tahun 2021 hingga 2025 dari basis data bereputasi seperti Scopus, IEEE, ACM Digital Library, SpringerLink, dan Emerald Insight. Hasil tinjauan mengidentifikasi adaptabilitas dan inovasi, pertimbangan etis, serta kolaborasi dan kemitraan sebagai faktor keberhasilan kritis yang paling sering disebut. Sementara itu, tiga tantangan utama yang paling sering muncul adalah kurangnya kesadaran, keterampilan, dan keahlian; ketidakpastian kebijakan atau hukum; serta resistensi terhadap perubahan. Untuk menjawab tantangan-tantangan tersebut, studi ini mengusulkan strategi implementasi AI yang bersifat multidimensional, dengan fokus pada penguatan infrastruktur digital, pengembangan sumber daya manusia melalui pembangunan kapasitas yang berkelanjutan, perumusan kebijakan tata kelola AI yang jelas dan akuntabel, serta mendorong keterlibatan pemangku kepentingan lintas sektor yang inklusif. Studi ini memberikan wawasan baru dengan memetakan faktor-faktor terkait AI ke dalam kerangka Technology-

Organization-Environment (TOE), serta menyintesis rekomendasi praktis dan kontekstual bagi para pembuat kebijakan di Indonesia yang ingin membangun ekosistem e-government berbasis AI yang adaptif, inklusif, dan berkelanjutan.

Kata kunci: kecerdasan buatan, tata kelola digital, transformasi digital, e-government, sistem pemerintahan berbasis elektronik.

INTRODUCTION

Artificial Intelligence (AI) has become a critical driver of digital transformation in public administration globally, including in Indonesia. Its potential to enhance service efficiency, improve decision-making, and support data-driven governance has encouraged various implementations across sectors [1],[2]. In Indonesia, AI technologies such as self-service immigration kiosks, public service chatbots, smart city systems, and cybersecurity solutions—have been gradually adopted to support e-government initiatives [3],[4],[5].

These implementations aim to streamline bureaucratic processes, increase service reliability, and foster citizen engagement, although concerns related to data privacy, public trust, and regulatory gaps remain persistent [6],[7],[8]. In the context of bureaucratic reform, AI facilitates faster decision-making and reduces administrative bottlenecks [4],[6]. In cybersecurity, it helps detect and prevent digital threats in real time [3], while also contributing to fraud detection in finance, medical diagnostics in healthcare, and threat analysis in national defense [3],[9],[10]. While these advancements reflect the growing role of AI in Indonesian public services, the broader governance implications especially regarding ethical use, accountability, and public inclusion are still underexplored [1],[7],[11]. Despite increasing interest, empirical studies examining AI implementation within Indonesia's public sector remain limited. Key issues such as the lack of a clear AI governance framework [6], inconsistent policy direction [12], [13], and low levels of public

participation in AI-based decision making [14] are rarely addressed in existing literature. Moreover, global concerns like algorithmic bias, transparency, and explainability have not been sufficiently contextualized within Indonesia's digital governance efforts [3],[7].

This study addresses these gaps by conducting a Systematic Literature Review (SLR) on AI implementation in Indonesian e-government. Specifically, it aims to analyze the current state of AI adoption in public governance, identify key success factors and challenges, and formulate adaptive strategies for sustainable, inclusive, and context sensitive AI implementation. By synthesizing 22 peer reviewed articles from major academic databases such as Scopus, IEEE, ACM, SpringerLink, and Emerald Insight, this study offers a structured perspective to inform policymaking and guide future research on AI in public sector transformation.

MATERIALS AND METHODS

A. e-Government in Indonesia

The Vision of Golden Indonesia 2045 has 8 development missions outlined in the National Long-Term Development Plan 2025 – 2045, one of which is Governance Transformation. Governance transformation must change the way the government communicates with the public through improving public services based on digital technology and centered on citizens [15]. The implementation of governance transformation in the Indonesian Government has several stages [15] which can be seen in the Figure 1.



Source: (Research Results, 2025)

Figure 1. Stages of Governance Transformation

The definition of digitalization or e-government refers to the use of information and communication technology in the government environment. In the study presented, two important aspects that occur in the process of e-government evolution are identified. First, e-government has evolved into an application that prioritizes transactional and integration processes. Second, the government has utilized technological sophistication in collaboration with organizations.

E-government can improve the quality of public service delivery, which also contributes to government performance and can improve public perception of government service delivery [12]. To ensure sustainable progress in line with the vision of the Government of Indonesia, the implementation of e-government can utilize modern information technology, one of which is AI. This study addresses a critical gap by analyzing how AI specifically contributes to the evolution of e-government in Indonesia, integrating both local context and global trends.

B. AI For Public Services

In the context of the issue in this research, how AI can contribute to service operations, accurate decision making, and data-driven processes. Over the next decade, AI will continue to have a significant impact on society. The rapid rise of AI has created many opportunities globally, from facilitating healthcare diagnosis to enabling human connections through social media and creating workforce efficiencies through automated tasks. The proper definition of AI in the context of this issue refers to advanced technologies that have improved decision making, managed risk, enhanced capabilities, and strengthened cybersecurity [3]. AI is integrated into public policy through strategic planning, predictive analytics, and integrated data sets [8]. Various AI technologies that can be utilized to improve public services in government are tailored to the needs of the organization, including deep learning, machine learning, fuzzy, data fusion, data mining, explainable artificial intelligence, multicriteria decision making, natural language processing, robotics, computer vision, and in particular generative AI which presents good opportunities for governments, as it not only changes the way they interact with the public but also integrates and leverages internal knowledge assets [1],[3].

AI is conceptualized as a strategic enabler of digital governance not just a tool for automation.

While various reviews [2],[6] have discussed opportunities and risks of AI in the public sector, these tend to emphasize global north contexts with

mature digital infrastructures. To address this gap and provide a more systematic understanding of AI adoption in public services, this study conducted a SLR. Relevant articles were retrieved from five major databases Scopus, IEEE Xplore, ACM Digital Library, SpringerLink, Science Direct and Emerald Insight using a combination of targeted keywords. Articles were included if they were published between 2021 and 2025, written in English, appeared in reputable journals or conferences, and addressed AI applications in the public sector. Exclusion criteria eliminated studies from predatory journals, articles lacking methodological transparency, or those overly focused on a single country case study. Each article was then screened through title and abstract review, full text eligibility assessment, and quality scoring to ensure that only high-quality and relevant studies informed the final synthesis. Limited research has critically evaluated AI adoption in the Indonesian public sector, especially in relation to socio political readiness, regulatory alignment, and citizen inclusion. To position this study's contribution, Table summarizes key literature and their focus areas:

Table 1. Comparative Summary of Prior Studies on AI Implementation in the Public Sector and Addressed Research Gaps

Study	Scope	Key Findings	Gaps Addressed in This Study
[1]	Overview of AI in public sector governance	Explores risks and benefits of AI use in government services	Conceptual in nature, lacks empirical data from Southeast Asian contexts such as Indonesia
[2]	Opportunities, challenges, and benefits. analyze how technological, organizational and environmental factors influence AI implementation in the public sector.	Identifies that AI improves efficiency, decision making, and service delivery, but faces challenges related to infrastructure, data governance, skills gaps, and ethical accountability	Bridges the lack of systematic analysis of enabling conditions for AI in government. Introduces an organizational perspective to complement technical studies, highlighting human, ethical, and governance dimensions often overlooked in prior research.
[3]	Artificial Intelligence Maturity Model for Government Administration and Service	Demonstrates efficiency and speed improvements via AI	Lacks evaluation of regulatory implications and societal readiness



Study	Scope	Key Findings	Gaps Addressed in This Study	Study	Scope	Key Findings	Gaps Addressed in This Study
[4]	AI in public services in Mexico	Explores implementation barriers and functional roles of AI	Context specific findings, not transferable to Indonesia's governance environment		collaboration in digital transformation	are critical success factors	strategies or governance issues
[5]	Application of digital twin in e government	Digital twin technologies enhance innovation and strategic management	Focused on digital twin concept; AI is not the primary technological focus	[16]	Trustworthiness and explainability in healthcare AI	Assesses quality, bias risk, and decision-making reliability	Sector specific to healthcare; does not address public sector governance dimensions
[6]	AI supported decision making in government functions	Highlights opportunities and ethical challenges in AI deployment in the public sector	Predominantly conceptual; limited empirical evidence from developing countries such as Indonesia	[17]	AI enabled digital identity in the public sector	Recommends inclusive and stakeholder oriented ID systems	Lacks empirical validation or application within the Indonesian context
[7]	Governance of AI in public sector	Maps existing themes, knowledge gaps, and governance models	Lacks implementation oriented analysis and region specific policy context	[18]	Competency frameworks in e government	Highlights importance of capability development for sustainability.	Does not explicitly link competencies to AI enabled transformation in public sector.
[8]	Automation, digitalization and the future of work	Identifies key enablers and challenges in AI based service delivery.	Regional focus on the Gulf, lacks relevance to Southeast Asian digital ecosystems.	[20]	Public value creation through smart technologies	AI contributes to enhanced digital service delivery and public trust	Theoretical in nature; lacks empirical analysis of real world government implementations
[9]	Dynamic capabilities and AI in government	AI supports organizational creativity and performance in UAE public institutions	Contextually limited to UAE; lacks citizen centric and ethical AI perspectives	[21]	Readiness for AI adoption in paperless governance	Explores institutional preparedness and transition barriers	No application evidence from Indonesian bureaucratic systems
[10]	Impact of AI and automation on the workforce	Highlights potential disruption and reskilling imperatives	Labor focused analysis, its not oriented toward public service transformation	[22]	Digital Transformation Strategy Comes First to Lay the Groundwork explores how organization prepare for digital transformation	Strategic groundwork through leadership commitment, cross functional coordination enables effective resource alignment	Addresses the limited empirical understanding of how strategy precedes and shapes digital transformation, offering evidence-based insights that bridge the gap between conceptual strategy models and practical implementation practices
[11]	AI based analytics for crisis policymaking	AI enhances evidence based policy responses during economic crises	Focus is limited to crisis contexts, lacks implications for routine governance processes				
[12]	Adoption of AI, IoT, and blockchain in e government	Identifies integration complexity and regulatory obstacles	Focuses broadly on multiple technologies, lacks in depth exploration of AI governance	[23]	Expanding AI adoption in public sector	Strategic alignment, governance readiness, and cross-agency collaboration are critical for effective and sustainable AI integration	Addresses the limited empirical understanding of how socio-technical and managerial factors shape AI adoption processes, bridging the gap between policy frameworks and real-world implementation.
[13]	Integration of AIoT in public services	Identifies drivers, barriers, and future research priorities	Focused on combined technologies (AIoT) does not isolate governance concerns specific to AI				
[14]	Multi stakeholder	Collaboration and alignment	Not centered on AI specific				



Stud y	Scope	Key Findings	Gaps Addressed in This Study
[24]	Application of AI in business process monitoring for anti corruption	AI mitigates KPI overload and enhances transparency in public organizations	Lacks discussion on AI governance frameworks and country-specific implementation, particularly in Indonesia

Source: (Research Results, 2025)

Although the use of AI has a significant impact on public services, not all policy makers fully

understand the innovations that AI can offer, and this is certainly a challenge that needs to be addressed [2],[18] describes the main policies that need to be considered in implementing AI in the public service sector Figure 2. While AI can replace some tasks performed by humans, there will always be aspects where it does not perform as well as human work. The combination of AI technology and human capabilities can have a positive impact on improving governance services in Indonesia, especially in terms of operational efficiency, decision making, and data processing.



Source: (Research Results, 2025)

Figure 2. Key Policy Development AI

C. TOE Framework

Using the technology environment organization (TOE) framework as a basis, this study first collects variables that influence AI implementation from the literature review and creates a hierarchical table of these variables. The TOE framework consists of three aspects (technology, organization, and environment context) of a company that influence the adoption of innovation technology.

Methodology

This section explains the methodology used in conducting the literature review. This study adopts an approach using Prisma [19]. There are three phases involved planning, implementing, and reporting.

A. Planning

In the planning phase, pre-determined criteria for study selection and data extraction were established through several steps, in order to start identifying pertinent past research, a number of guiding questions were developed. The questions were developed with the aim of comprehensively covering the literature concerning AI adoption in public services. In the first place, the review aimed to investigate the extent of AI adoption in public

services, pinpointing different domains and purposes where AI technologies have been used to improve service delivery, decision making, and efficiency. Second, the review was aimed at surveying the key determinants of effective AI implementation, i.e., organizational readiness, technology infrastructure, policy settings, and human resources. Third, the identification of limitations or challenges towards AI implementation, i.e., ethical issues, data privacy, resistance to change, shortage of skills, and regulatory barriers, was considered. These selected key questions served as the foundation for systematic literature search and the choice of relevant journal articles.

Table 2. Inclusion Criteria

Inclusion Criteria
Article published between 2021 - 2025
Article written in English
Article published in International Journal or Conference
Article officially published
Published Article on a Computer Science Topic

Source: (Research Results, 2025)

Table 2 establishes the inclusion criteria for literature selection, ensuring that only high-quality



and relevant studies are analyzed. Specifically, articles must meet the following conditions: published between 2021 and 2025, to capture the most recent developments in AI adoption in public services, written in English, to ensure accessibility and consistency in evaluation, officially published in peer-reviewed international journals or conference proceedings, to guarantee methodological rigor, and directly relevant to the field of computer science, ensuring the findings are valid and applicable to the research context. Studies not meeting these criteria were excluded to maintain the reliability and relevance of the review.

Table 3. Keywords Used For Literature Review

Database	Keyword
Scopus, IEEE, ACM, Springerlink dan Emerald Insight	strategy OR implementation AND artificial AND (intelligent OR intelligence) AND (digital OR electronic) AND (government OR public) AND (services OR service)

Source: (Research Results, 2025)

Table 3 presents the keywords used to search for literature in the Scopus, IEEE, ACM Digital Library, Springerlink, Science Direct and Emerald Insight databases. These keywords were designed to obtain research related to the strategy and implementation of AI in digital public services. The use of logical operators OR and AND ensures a broad yet relevant coverage, covering strategic aspects, digital technology, and government contexts. With this strategy, the search is expected to produce studies that discuss the application, success factors, and challenges of AI in the public sector. Specifically, a combination of keywords and logical operators was applied: strategy OR implementation AND artificial AND (intelligent OR intelligence) AND (digital OR electronic) AND (government OR public) AND (services OR service).

B. Conducting Review

Using the protocol and criteria established during the planning phase, this phase involves searching for relevant studies. Following the established procedure, the researcher performs screening by examining titles, abstracts, and related articles to answer the literature review questions of the planning phase. To assess the quality of studies, a scoring was applied based on clarity of research objectives, appropriateness of methodology,

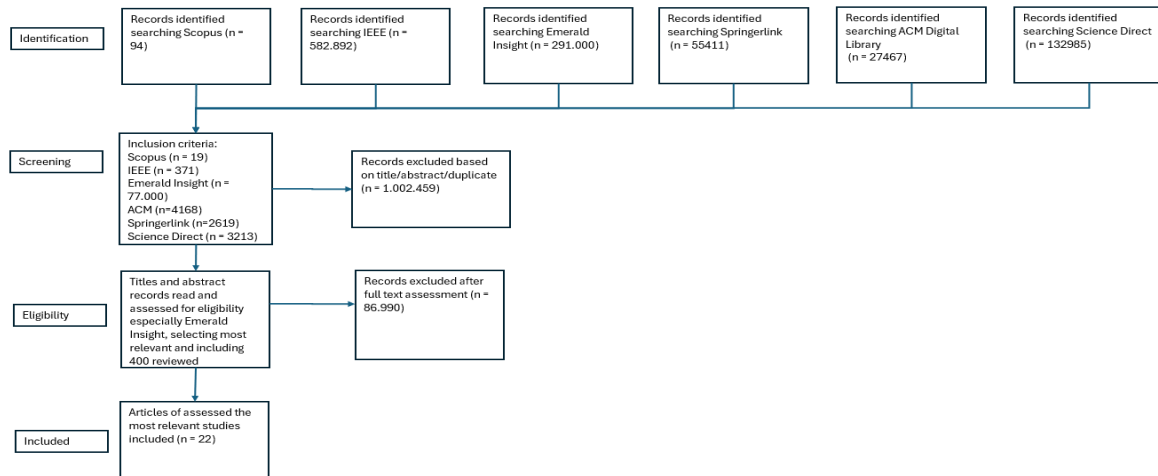
transparency of data collection and analysis, relevance to public sector AI adoption. To mitigate risk of bias, the review avoided over-reliance on single country case studies and ensured diversity across regions, sectors, and AI applications. Articles from predatory journals or those lacking methodological transparency were excluded. A structured manual coding protocol was applied to extract and categorize data.

Figure 3 illustrates the systematic literature selection process following the PRISMA protocol, encompassing four main stages: Identification, Screening, Eligibility, and Inclusion. In the Identification stage, comprehensive searches were conducted across seven reputable academic databases: Scopus (n = 94), IEEE (n = 582,892), Emerald Insight (n = 291,000), SpringerLink (n = 54,411), ACM Digital Library (n = 27,467), and Science Direct (n = 132,985).

The screening process consisted of title and abstract screening to exclude duplicates and irrelevant records, removing 1,002,459 entries. Full text review to assess topical relevance, methodological transparency, and quality, excluding a further 86,990 records. Final inclusion of 22 high quality, relevant studies for in-depth analysis.

Data extraction employed a structured manual coding protocol to ensure consistency and traceability. For each included study, information was extracted in three dimensions scope derived from the research objectives and context described in the introduction, key findings synthesized from the results capturing main contributions without reinterpretation, gaps identified from the study's explicitly stated limitations or inferred omissions in context, methodology, or scope. To categorize key themes and variables, the extracted data were analyzed using a TOE framework.

Variables were coded into thematic categories aligned with TOE dimensions: technology, organization, environment. An iterative open coding process was conducted in three stages: initial coding assigning descriptive labels to all variables and concepts mentioned in the studies, axial coding grouping related codes into sub-themes within TOE categories, selective coding refining categories to identify the most frequently cited variables as critical success factors or key challenges.



Source: (Research Results, 2025)

Figure 3. PRISMA Flow Diagram

C. Reporting

The extracted and coded data were systematically synthesized to address the guiding research questions by delineating the scope and domains of AI application within public service delivery, elucidating the critical success factors underpinning effective implementation, and examining the barriers and challenges documented in the scholarly literature. This methodological approach ensures a high degree of transparency, facilitates replicability, and reinforces the validity of the findings, while generating a coherent and analytically grounded thematic mapping of AI implementation in Indonesia's public sector.

RESULTS AND DISCUSSION

The extraction results include the field of public services, success factors for AI implementation, and challenges or obstacles faced during the AI implementation process according to the journal identification described in section III. These results were obtained from the extraction of 22 journals selected through a systematic literature review process using the Prisma methodology, as shown in Table 4.

Table 4. Primary Studies For Systematic Review

ID	Title	Year	Source & Reference
1	Artificial intelligence, task complexity and uncertainty: analyzing the advantages and disadvantages of using algorithms in public service delivery under public administration theories	2023	Scopus [20]
2	Challenges of transition to paperless management:	2021	Scopus [21]

ID	Title	Year	Source & Reference
	Readiness of incorporating AI in decision-making processes		
3	Artificial intelligence and decision making in government functions: opportunities, challenges and future research	2024	Emerald Insight [6]
4	Impact, functions, and barriers to AI in the public sector: the case of the State of Mexico	2024	Scopus [4]
5	Artificial Intelligence Maturity Model for Government Administration and Service	2022	IEEE [3]
6	Artificial intelligence capabilities, dynamic capabilities and organizational creativity: contributing factors to the United Arab Emirates Government's organizational performance	2024	Emerald Insight [9]
7	Automation in public sector jobs and services: a framework to analyze public digital transformation's impact in a data constrained environment	2024	Emerald Insight [10]
8	AI enabled digital identity inputs for stakeholders and policymakers	2022	Emerald Insight [17]
9	Digital transformation: strategy comes first to lay the groundwork	2024	Emerald Insight [22]
10	Enhancing e-government with a digital twin for innovation management	2023	Emerald Insight [5]
11	Core competencies a key to future oriented and sustainable e-governance	2021	Emerald Insight [18]

ID	Title	Year	Source & Reference
	implementation: a mixed method research		
12	Expanding AI adoption in public sector organizations: perspectives on management practices	2025	Emerald Insight [23]
13	AI governance: themes, knowledge gaps and future agendas	2023	Emerald Insight [7]
14	Integration of artificial intelligence of things (AIoT) in the public sector: drivers, barriers and future research agenda	2022	Emerald Insight [13]
15	Addressing brain drain and strengthening governance for advancing government readiness in artificial intelligence (AI)	2024	Emerald Insight [11]
16	Public sector, open innovation, and collaborative governance in lockdown times. A research of Spanish cases during the COVID-19 crisis	2021	Emerald Insight [14]
17	Automation, digitalization and Future Of Work	2024	Emerald Insight [8]
18	Artificial intelligence to counteract "KPI overload" in business process monitoring: the case of anti- corruption in public organizations	2023	Emerald Insight [24]
19	The Challenges and Opportunities in Adopting AI, IoT and Blockchain Technology in E-Government: A Systematic Literature Review	2022	IEEE [12]
20	A systematic review of trustworthy and explainable artificial intelligence in healthcare: Assessment of quality, bias risk, and data fusion	2023	Sciencedirect [16]
21	Introduction to the Issue on Artificial Intelligence in the Public Sector: Risks and Benefits of AI for Governments	2024	ACM [1]
22	Opportunities, challenges, and benefits of AI innovation in government services: a review	2024	Springerlink [2]

Source: (Research Results, 2025)

A. Scope of AI Application in Public Services

The results of the reviewed journals provide various information regarding which public service fields can apply AI technology. These fields are categorized into three types of public services according to Law Number 25 of 2009 concerning Public Services as shown in Table 5.

Table 5. Scope Of AI Application In Public Services

Category	Area
Administrative Services	1.Public Administration [20],[6],[21],[4],[9],[10],[22],[13],[5],[17],[23],[7],[3] 2.Customer Relations and Public Engagement [9],[10],[22],[23],[7],[21],[5],[14],[3]
Services	1.Healthcare and Social Services [24],[4],[9],[10],[22],[13],[11],[14],[5],[7],[12] 2.Education and Training [6],[4],[9],[10],[22],[11],[5],[1],[12],[21] 3.Public Safety & Security [7],[6],[4],[9],[5] 4.Transportation & Traffic Management [4],[13],[9],[7]
Provision of Goods	1. Infrastructure & Development [13],[9],[10],[22],[5],[3],[13],[12],[8] 2. Technology & Innovation [12],[8] 3. Economic Development [4],[10],[5],[7] 4. Agriculture [12],[4]

Source: (Research Results, 2025)

B. Key Factor For Successful AI Implementation

The key variables for the success of AI implementation mentioned in the 22 articles taken, the most cited variables were recorded and then mapped into technology, organization or environment indicators.

Table 6. Key Factors Implementing AI

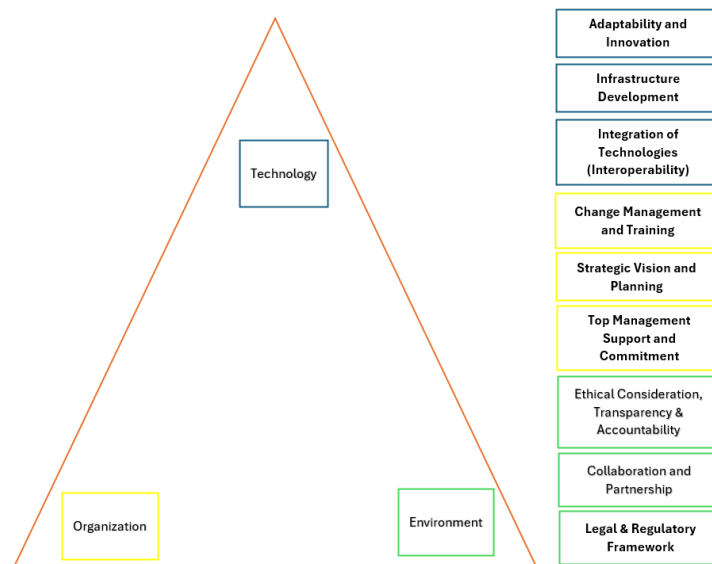
Indicator	Variable
Technology	1. Infrastructure Development [6],[4],[22],[5],[3] 2. Integration of Technologies (Interoperability) [7],[21],[5],[24] 3. Adaptability and Innovation (Continuous Evaluation) [3],[9],[22],[8],[7],[21],[5],[24] 4. Data Management & Accessibility [8],[23],[5],[13],[23] 5. Data Availability & Quality [6],[9],[10] 6. Data and Information Security [4],[3],[5] 7. Experiment Validate Scale Approach [13]
Organization	1. Strategic Vision and Planning [22],[14],[7],[5],[18],[11] 2. Top Management Support and Commitment (Leadership) [21],[6],[18],[14],[7] 3. Organizational Readiness [8] 4. Cultural Readiness [18] 5. Change Management and Training [4],[3],[13],[7],[21],[18],[23] 6. Long Term Commitment [9],[22],[7] 7. Focus on Value Creation [13] 8. Skilled Workforce [6],[9],[3],[11] 9. Resources Allocation [9],[10],[8] 10. Sufficient Funding and Investment [6],[4],[10]
Environment	1. Collaboration and Partnership [9],[22],[5],[13],[11],[23],[8],[7],[3] 2. Focus on Customer Relationship & Stakeholder Engagement [22],[5],[7],[23] 3. Ethical Consideration , Transparency & Accountability [6],[4],[22],[13],[11],[14],[7],

Indicator	Variable
	[8], [23],[23]
4. Legal & Regulatory Framework	[6],[10],[13],[11],[14], [8],[23],[5]
5. User Privacy & Trust	[6],[4],[3],[13],[5]
6. Economic Growth	[11]
7. Focus on Specific Use Case	[23]
8. Awareness & Education	[8]

Source: (Research Results, 2025)

From table 6, mind map is made according to Figure 4 maps the most frequently cited variables for AI implementation success within the TOE framework. The Technology dimension includes Adaptability and Innovation, Infrastructure Development, and Integration of Technologies (Interoperability), indicating the need for scalable systems, strong infrastructure, and seamless interoperability. The Organization dimension comprises Change

Management and Training, Strategic Vision and Planning, and Top Management Support, highlighting leadership, structured change processes, and strategic alignment. The Environment dimension features Ethical Consideration, Transparency & Accountability, Collaboration and Partnership, and Legal & Regulatory Framework, reflecting the importance of governance, inter-organizational cooperation, and policy clarity. Mapping these three most cited variables per dimension shows that they are consistently recognized as critical enablers, and their high citation frequency confirms their significant influence on AI adoption. These factors should therefore be prioritized in the planning and implementation of AI strategies in Indonesia's public sector.



Source: (Research Results, 2025)

Figure 4. Mapping Keys To AI Success into TOE

B. Obstacles or Challenges in AI Implementation

In accordance with the identified needs, the challenges or constraints in AI implementation as presented in Table 7 must be taken into account when determining the appropriate strategy for AI implementation in the Indonesian Government.

Table 7. Barriers Or Challenge Implementing AI

Barriers Or Challenge	Solution
Policy Or Legal Uncertainty [6],[4],[3],[22],[13],[11],[8],[5]	Regulatory Framework [6],[4],[3],[22],[13],[11],[8],[5]
Lack Of Awareness, Skill & Expertise [18],[4],[9],[22],[5],[13],[14],[8],[21],[3],[7],[23]	Education & Training Initiatives Program [18],[4],[9],[22],[5],[13],[14],[8],[21],[3],[7],[23],[11]

Barriers Or Challenge	Solution
Infrastructure Limitations [3],[9],[22],[14],[21],[5]	Create Fast & Reliable Network [3],[9],[22],[14],[21],[5]
Privacy And Security Issue [3],[13],[8],[5],[23]	Ensuring That Systems Are Both Ethical And Transparent In Their Data Handling [5] Data Protection [13],[8],[3],[5],[23]
Ethical And Social [6],[4],[22],[5],[7],[23]	Training Program [6],[4],[22],[5],[7],[23] Ethical And Fair AI Systems [3],[6],[4],[22],[5],[7],[23]
Fragmented Ecosystems [22]	Collaboration [22],[8]
Short-Term Focus [22]	Long Term Strategy [22]
Resistance Of Change [18],[21],[6],[22],[8],[11],[23]	Awareness And Training Program [18],[21],[6],[22],[8],[11],[23]

<i>Barriers Or Challenge</i>	<i>Solution</i>
Social Bias And Inequity [7]	Citizen-Centered Design [7]
Trust And Public Acceptance [6],[4], [8],[7],[5]	Ethical And Fair AI Systems [3],[11],[6],[4], [8],[7],[5]
Transparency And Accountability [3],[13],[14],[7]	Accountability Mechanisms [3],[13],[14],[7]
Complexity And Uncertainty In Human-AI Collaboration Tasks [9],[10],[14],[7],[5], [3]	[9],[10],[22],[14],[8]
Interoperability Standardization Issues [18],[10],[13],[11],[21]	And Develop And Adopt Standard And Protocols For Data Exchange Among Different System [18], [10],[13],[11],[21]
Fear Of Failure And System Errors [21]	Pilot Testing [21]
Organizational Change And Leadership [11],[8],[21],[7]	Change Management Programs [11],[8],[21],[7]
Fear Job Loss [21]	Focus On Upskilling And Reskilling [21]
Lack Of Proper Planning [18]	Developing Roadmap For AI Implementation [18]
Data Quality [9],[13],[8],[14],[23]	Implement Robust Data Governance [9],[13],[8],[14],[23]
Lack Of Attention To Context [6],[7]	Stakeholder Mapping & Context Analysis [6],[7]
Security Risk [4],[13]	Implement Robust Cybersecurity [4],[13]
Brain Drain [11]	Create Competitive Career [11]
Economic Constraint [6],[9],[11]	Increase Government Expenditure [6],[9],[11]
Lack Of Time And Resource [14]	Establish Flexible Framework [14]
Sustainability Of Engagement [14]	Create Long Term Strategies [14]
High Resource Cost [4],[9],[8],[23]	Provide Financial Incentives [5] Pilot Project [23]
Technology Challenge [6]	Promoting AI Research And Development (RD) [6]

Source: (Research Results, 2025)

From Table 7, which presents the barriers or challenges of implementing AI, some key issues come out that need to be investigated further to develop effective solution strategies for implementation. The challenges include policy or legal uncertainty, regulatory gaps, lack of awareness and expertise, infrastructure limitations, data privacy and security issues, ethical and social concerns, fragmented ecosystems, resistance to change, social bias, trust and public acceptance, complexity of tasks, interoperability issues, fear of failure, organizational change, and resource constraints.

Corresponding solutions include training and education programs, robust data governance, ethical and transparent AI systems, collaboration, long-term strategies, pilot testing, change management, and financial incentives, among others. These are challenges like policy or legal

uncertainty, showing the absence of clear cut regulatory guidelines on AI implementation; security and privacy, which are related to information protection and potential misuse of sensitive data; and resistance from within an organization, typically based on company inertia, fear of job loss, or mistrust of new technologies. From the analysis, it is possible to conclude that the absence of awareness, capability, and proficiency is always the most predominantly quoted impediment. Subsequently, policy and legal ambiguity concerns, as well as privacy and security fears, all of which are presenting themselves as hindrances en masse to the seamless uptake and incorporation of AI technologies into public services.

To ensure the validity and reliability of the findings presented in Table 7, a rigorous evaluation process was applied during the Systematic Literature Review. Each selected article was independently assessed by multiple researchers for methodological transparency, clarity of objectives, and quality of evidence. Any disagreements were resolved through discussion and consensus, and, when necessary, a third researcher conducted an independent review to confirm the inclusion or interpretation of the study. This internal peer-review process and structured data extraction protocol help maintain the credibility and robustness of the synthesized challenges and solutions reported in the table.

Discussion

This study utilizes the TOE framework to analyze the key success factors and challenges in implementing AI in public services. As illustrated in Figure 4, the TOE based mapping enables a systematic classification of empirical findings, thereby improving theoretical clarity and policy relevance. Compared to prior literature [12], which mainly focuses on the technical integration of AI, IoT, and blockchain within e-government platforms, this study expands the analytical lens by incorporating organizational dynamics and environmental context two dimensions frequently underexplored. For instance, while [12] acknowledge system level enablers, they do not address institutional capacity or regulatory readiness, which are essential in contexts such as Indonesia with evolving governance maturity [15]. Moreover, studies like [6] and [2] highlight general challenges in AI implementation, such as ethical risks and data quality concerns, but often lack a localized framework for action.

Key differentiators in this research include the emphasis on HR development as a critical enabler,

supported [18] who found that organizational creativity and skill sets are central to sustainable e governance. collaborative governance models [14], where open innovation and crisis resilient institutions were found vital during the COVID-19 digital response. Ethical and policy readiness, as emphasized [7], who identify governance as a gap in AI implementation roadmaps.

Table 8 presents a comparative analysis of the key challenges and underlying causes of AI implementation across different regions. The table highlights how regional context, governance maturity, infrastructure, cultural norms, and regulatory frameworks shape the adoption and integration of AI in public services. To ensure a

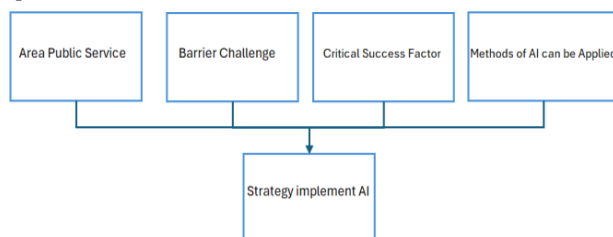
systematic and rigorous analysis, the data extracted from the selected articles were subjected to thematic analysis. First, all reported challenges and causes were coded manually to identify recurring patterns across regions. Next, these codes were grouped into broader themes, such as policy and regulatory issues, infrastructure and technical readiness, workforce capacity, and socio cultural factors. This approach enabled a structured comparison across regions, revealing common challenges as well as region-specific barriers. By applying this method, the study not only synthesizes findings from multiple sources but also ensures transparency, reliability, and replicability of the comparative insights presented in the table.

Table 8. Comparative Analysis of AI Implementation Challenges Across Regions

Region / Country	Key Challenges	Underlying Causes	Key References
Southeast Asia (Indonesia, India)	Limited digital infrastructure; policy and legal uncertainty, low AI literacy, fragmented multi-stakeholder collaboration.	Evolving governance maturity, uneven ICT access between regions, absence of comprehensive AI governance framework.	[3],[4],[6],[8],[11]
Gulf Countries (e.g., UAE, Saudi Arabia)	Resistance to change despite advanced infrastructure, preference for traditional administrative practices.	Cultural norms favoring hierarchical decision making, risk aversion in public administration.	[9],[14]
European Union (e.g., Finland, Germany)	Strict regulatory compliance, demand for algorithmic transparency and explainability.	Strong data protection regimes (GDPR), high public awareness of AI ethics	[7],[8],[10],[21],[22],[23]
America (e.g USA, Mexico)	Policy fragmentation, limited integration between AI initiatives and existing e-government systems.	Decentralized governance structures, inconsistent political commitment.	[4],[8],[12]
Developed East Asia (e.g., Japan, South Korea)	Workforce adaptation, skill gaps in emerging AI fields,	Rapid technological advancement outpacing workforce training systems.	[8]

Source: (Research Results, 2025)

Figure 5 presented outlines the main components needed to develop an AI implementation strategy in public services. Its structure consists of four main factors that contribute to shaping the overall strategy. These elements flow into the AI Implementation Strategy, which will involve a structured plan that discusses how to overcome obstacles, leverage success factors, and apply appropriate AI methods in the public service area.



Source: (Research Results, 2025)

Figure 5. Component To Develop AI

We then interviewed experts from Public Accounting Firm partners in Indonesia who have expertise in information technology, digital transformation and artificial intelligence, these experts provided recommendations on a brief summary of the research content contained in the writing of this journal.

CONCLUSION

This study identified and categorized 26 key challenges to AI implementation in Indonesia's digital governance using the TOE framework. While AI offers significant potential to enhance operational efficiency, enable evidence based policymaking, and strengthen public engagement, its adoption is constrained by inadequate digital infrastructure, regulatory gaps in data ethics and algorithmic transparency, limited AI literacy,

bureaucratic inertia, and insufficient multi stakeholder collaboration.

A holistic strategy is proposed to address these barriers. First, strengthening technological foundations through secure, interoperable national data centers and resilient infrastructure. Second, investing in human capital via continuous training, AI literacy programs, and competency based certification for civil servants. Third, developing adaptive regulatory frameworks that promote fairness and accountability, including ethical AI standards, bias mitigation protocols, and independent algorithmic audits. Fourth, fostering inclusive governance through participatory policy design and cross sector partnerships to ensure alignment with societal values and local contexts.

This research is limited by potential selection bias in the literature review, its Indonesia specific scope, and limited representation of civil society perspectives. Given the dynamic nature of AI governance, recommendations require ongoing refinement. Future studies should explore cross country comparisons, sector specific cases, and citizen perspectives particularly from marginalized groups while integrating policy analysis with empirical fieldwork. Such efforts can advance the development of AI strategies that are technologically robust, ethically sound, and socially inclusive, contributing to sustainable public sector innovation in emerging economies.

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