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ADAPTIVE IT INVESTMENT FOR SMARTER GOVERNANCE: A FRAMEWORK FOR AI-BASED DECISION SUPPORT SYSTEMS IN PUBLIC SECTOR

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ABSTRACT

Objective: This research aims to explore the development of an adaptive Information Technology (IT) investment framework for artificial intelligence-based decision support systems (AI-DSS) in government, with a focus on improving strategic decision-making, transparency, and inclusive public services in the Indonesian public sector.

Research Design & Methods: The research used a systematic literature review approach that refers to the PRISMA protocol. It analyzed 14 Scopus-indexed articles published between 2015 and 2024. Bibliometric analysis was conducted with the help of VOSviewer software to identify keyword trends and research clusters relevant to AI, decision making, and governance.

Findings: AI-DSS contributes to strengthening decision-making in the public sector through real-time data processing, predictive analytics, and more agile responses to policy dynamics. However, challenges remain, such as the digital divide, regulatory limitations, a lack of technical competencies, and integration difficulties with legacy systems.

Implications & Recommendations: The government is advised to implement a phased investment strategy supported by agile governance principles, strengthen the legal framework, and integrate inclusive technologies such as Big Data and Blockchain.

Contribution & Value Added: This research provides a conceptual and practical framework for adaptive IT investment in AI-DSS, bridging technology and governance.

Keywords: Decision Making, IT Investment, Public Sector, E-government.

JEL codes: H83, O33, C88
Article type: research paper

INTRODUCTION

There has been a significant transformation in government management in recent years, shifting from a traditional model to a more inclusive and varied approach (Caiza et al., 2024). This change from an established system involves comprehensively examining the various aspects that require updating to ensure effective public service delivery. The key factor driving this transformation is the incorporation of technology, especially artificial intelligence (AI), which not only aids rapid decision-making but also encourages government entities and society to adapt to the ever-changing landscape. Along with the growing demand for transparent, efficient, and citizen-responsive governance, governments worldwide are increasingly relying on AI to support and improve decision-making processes. AI-powered Decision Support Systems (DSS) offer the potential

to process massive volumes of data in real time, generate predictive insights, and facilitate strategic planning with a level of speed and accuracy previously unattainable through traditional methods (Gill and Hansnata, 2024; Paul et al., 2024).

A comprehensive and diverse strategy for effective government management has dismantled outdated mental frameworks derived from traditional theories in countries that want to move away from standardized public systems. This process includes an in-depth examination of sectors that require modernization to ensure adequate provision of public services. Unfortunately, these modifications require larger financial investments and are designed to improve efficiency and effectiveness in administration within the constraints of available financial resources (Mehr, 2017). Artificial Intelligence (AI) improves the efficiency and accuracy of public service delivery by automating routine tasks and facilitating data-driven decision making (Power, 2016). Identifying patterns helps forecast challenges in critical areas such as disaster management and public health, promoting proactive governance, transparency, and public trust (Jefferies, 2016).

Artificial intelligence automates routine and time-consuming tasks in public services, allowing human resources to focus on strategic decision-making, thereby improving efficiency in healthcare, education, and agriculture sectors. AI's ability to detect patterns and trends in data enables early prediction and prevention of problems, especially in critical areas such as disaster management, national security, and public health (Dolla et al., 2020). The increased availability of AI-related government reports and policies provides valuable insights into the strategies, challenges, and impacts of AI adoption in public administration, supporting the development of more transparent and effective governance (Hassan et al., 2022).

In the public sector, where policy outcomes affect large populations and involve complex stakeholder interests, decision-making must balance strategic outlook with ethical and socio-political accountability. AI can improve this process through advanced data analysis, natural language processing, and adaptive algorithms that can simulate scenarios, identify patterns, and suggest optimal actions (Büber and Seven, 2025). For example, AI integration enables adaptive decision models that dynamically adjust to regulatory changes, emerging public needs, and crises such as pandemics or natural disasters, thus supporting more agile forms of governance.

However, integrating AI in public decision-making is not without its challenges. Many governments, especially in developing countries and countries in transition, face limitations related to financial resources, digital inequalities between agencies, fragmented data infrastructure, and a lack of skilled personnel capable of managing AI technologies (Tkachenko and Mezhyrytskyi, 2024). These constraints underscore the importance of adopting an adaptive investment framework that aligns AI implementation with institutional capacity, strategic priorities, and long-term public value.

Therefore, an Adaptive IT Investment Framework is crucial to ensure that AI adoption is not only technologically feasible but also economically sustainable and socially inclusive. Such a framework enables governments to align their technology investments with strategic policy agendas, evaluate risks, and ensure compatibility across the digital government ecosystem (Gill and Hansnata, 2024). The framework promotes an architectural model in which digital initiatives, especially those involving AI, are continuously reassessed and updated to reflect shifting public demands and administrative objectives.

The emergence of generative AI and large language models also introduces new possibilities for collaborative governance. These technologies enable inclusive participation of various stakeholders by democratizing access to information and supporting deliberative policymaking (Dolant and Kumar, 2025). AI-based agents can mediate and simplify complex decision environments, improving not only operational efficiency but also the legitimacy and transparency of public decisions.

This research explores how AI affects government decision-making by investigating its role, limitations, and strategic implementation within public institutions. This research builds a conceptual and practical framework for integrating adaptive AI in public sector decision-making

systems. This research proposes a structured approach to building smart, ethical, and sustainable decision support environments in the AI era. Integrating artificial intelligence into government decision-making processes can improve the efficiency, transparency, and quality of public services; however, it also poses considerable challenges that require careful management. Therefore, conducting research in this area is essential to thoroughly understand its consequences and to optimize profits while minimizing associated risks.

LITERATURE REVIEW

IT Investment in the Public Sector

Information technology (IT) investments in the public sector not only have a financial impact but also generate indirect benefits that are difficult to measure quantitatively, such as increased transparency, citizen participation, and strengthened public trust (Alencar et al., 2013). Therefore, evaluation approaches that can accommodate these non-financial values are needed. Valuation methods that consider the intangible benefits of IT investments, such as contributions to public safety and media information support, are needed (Alencar et al., 2013). The conceptual framework categorizes the value of IT investments into two levels: the value to the implementing agency and the value to stakeholders such as society and policymakers (Chircu et al., 2003). They also highlighted the importance of considering the political value and risk of IT in investment decision-making (Chircu et al., 2003).

According to Bovens and Zouridis (2002), information technology may eventually replace all other communication and information flow structures. Previous research has focused on the initial concept of artificial intelligence or function simplification (Cordella and Tempini, 2015; Hadden, 1986; Hurley and Wallace, 1986). Several studies have also investigated the impact of learning technologies on public administration activities and decision-making (Agarwal, 2018). This shift will occur with the transition towards learning technologies that offer procedural equivalence to systems that produce similar outcomes (Dunleavy and Margetts, 2015). However, empirical research on the impact of artificial intelligence on institutions is still relatively scarce. With the advancement of artificial intelligence, the potential applications in administration and governance are expanding; however, some institutions are notoriously slow to adopt new technologies, and public institutions tend to be cautious about software innovation. With the technology available today, most human tasks can likely be performed more efficiently by artificial intelligence. More than two decades after Bovens and Zouridis observed the rise of system-level institutions, they concluded that the work performed by lower-level employees could be supported or automated by artificial intelligence.

AI-Based Decision Support Systems

AI-Based Decision Support Systems (AI-DSS) are intelligent systems developed to assist humans in making complex decisions by utilizing data analysis capabilities, scenario modeling, and providing algorithm-based recommendations. This system is a combination of the traditional DSS approach that focuses on analyzing data and preparing alternative solutions, with AI technology that is adaptive and predictive. In the public sector, DSS aims to create a more efficient, transparent, and accountable decision-making process, considering the economic, political, and risk dimensions of information technology investments made by the government (Chircu et al., 2003). AI-DSS utilizes machine learning, natural language processing, and data analysis to assist with complex decision-making processes (Power, 2002). In public administration, AI-DSS helps optimize services and predict policy outcomes.

Theoretically, AI-DSS is rooted in several important foundations. First is the theory of DSS, which explains that these systems are set up to support decision-making in semi-structured or unstructured conditions, where human intuition remains necessary to complement the system's analysis. DSS enables the integration of statistical and simulation models to help users make the best choices based on available data (Chircu et al., 2003). The second theory is Artificial Intelligence, which allows systems to mimic human thought processes, such as learning from experience, logical

reasoning, and adaptation to new situations. In the context of AI-DSS, technologies such as machine learning and natural language processing extract patterns from historical data and provide accurate predictions on which to base decision recommendations (Kataria et al., 2022). The development of AI-DSS utilizes the theory of Knowledge-Based Systems that combines expert rules with data-driven learning to generate flexible and contextualized decisions (Singh, 2007). In addition to technical aspects, user acceptance is crucial, as described in the Technology Acceptance Model (TAM), which emphasizes the importance of perceived usefulness and ease of use.

METHODS

This research method applies a systematic literature review approach using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) model. The literature search was conducted through the Scopus database with a combination of keywords: "artificial intelligence" OR "machine learning" OR "deep learning" dikombinasikan dengan "government" OR "public administration" OR "public sector", serta "decision making" OR "policy making" OR "governance". The screening process was conducted with several restrictions: publication year 2015 to 2025, journal article document type, final publication stage, English language, available in open access, and specialized in relevant keywords such as AI Governance, Public Policy, E-government, Decision Support Systems, and limited to author affiliation from Indonesia. This PRISMA approach ensures systematicity, transparency, and accountability in the literature selection process.

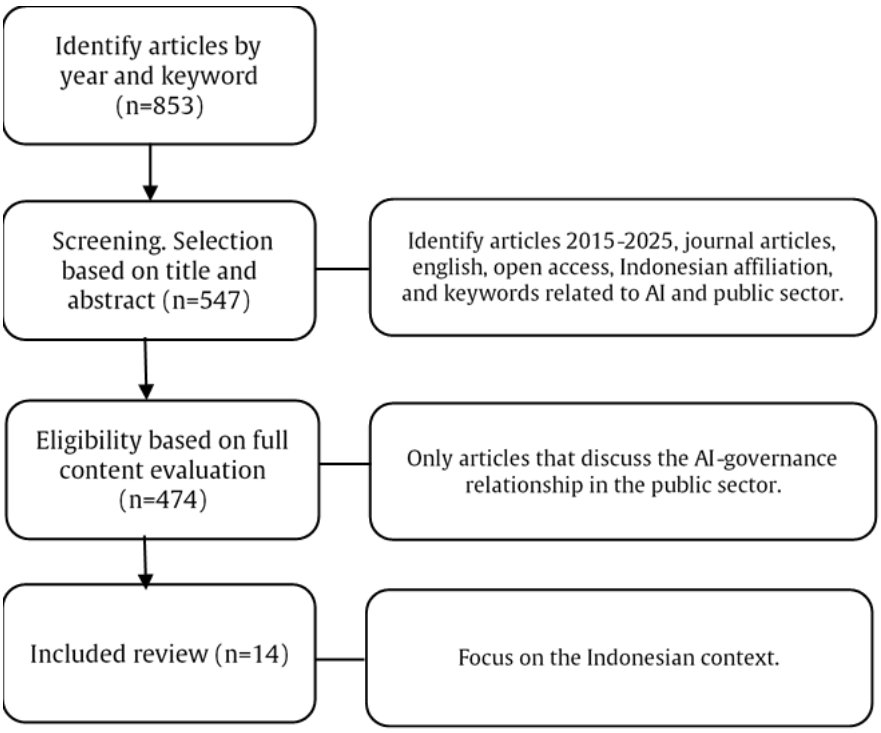

Figure 1. PRISMA flowchart

RESULT

The results of data processing using VOS-viewer revealed patterns of keyword connectedness in the literature addressing the application of Artificial Intelligence (AI) in public sector decision-making. There are several clusters formed from keywords that co-occur frequently, suggesting a dominant research focus in this area. Keywords such as "artificial intelligence," "decision making," "public administration," and "governance" indicate high frequency and central position in the network, indicating that the topic is a major node in the related literature. Some clusters also show a link between "machine learning" and "policy making," signalling the trend of integrating machine learning approaches in supporting public policy making. In addition, the

emergence of terms such as "transparency," "digital government," "accountability," and "e-government" indicates that the dimensions of ethics, governance, and digitization of public services are important themes in scholarly discourse.

Furthermore, the analysis showed a close relationship between the development of AI-based decision support systems (DSS) and sustainable development goals, citizen engagement, and data-driven bureaucratic reform. The distribution of keywords also highlights the importance of a multidisciplinary approach involving technology, law, and policy. As such, these results provide a visual and empirical understanding of how research related to AI and the public sector is evolving and affirm the strategic direction of technology-based policy development at the government level.

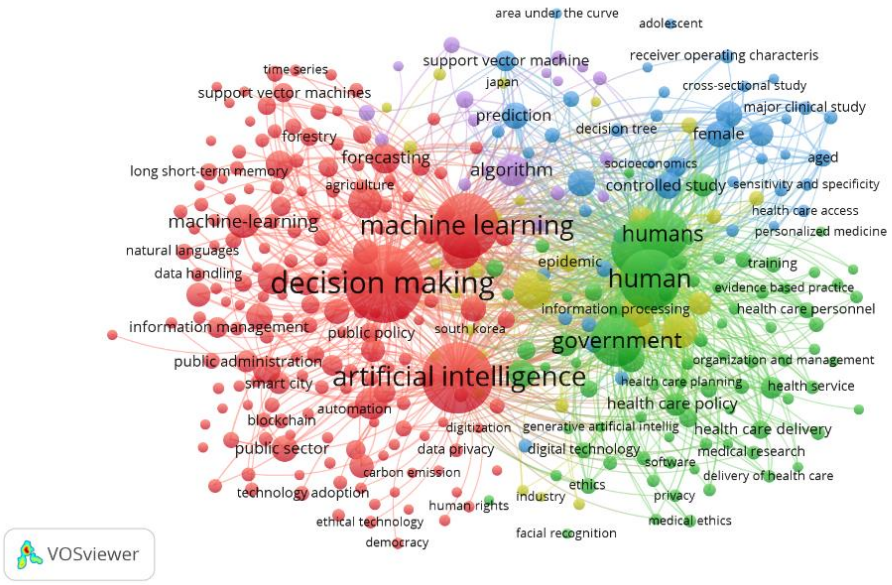

Figure 2. Co-occurrence network of keywords.

In terms of temporal trends, keywords such as "generative artificial intelligence", 'ChatGPT', and "digital government" have the latest average publication year (2024-2025), suggesting that the development of generative AI technologies has become mainstream in academic and public policy discourse. This finding reflects a shift in focus from traditional predictive AI towards AI that can interact more naturally and provide support in narrative-based decision-making processes. Meanwhile, keywords such as "economic and social effects" and "AI technologies" show high average citation scores, reflecting research's significant academic and social impact in this area. This shows that AI discourse in the policy context is not only growing in quantity, but also has a substantial influence on evidence-based policy development and public trust.

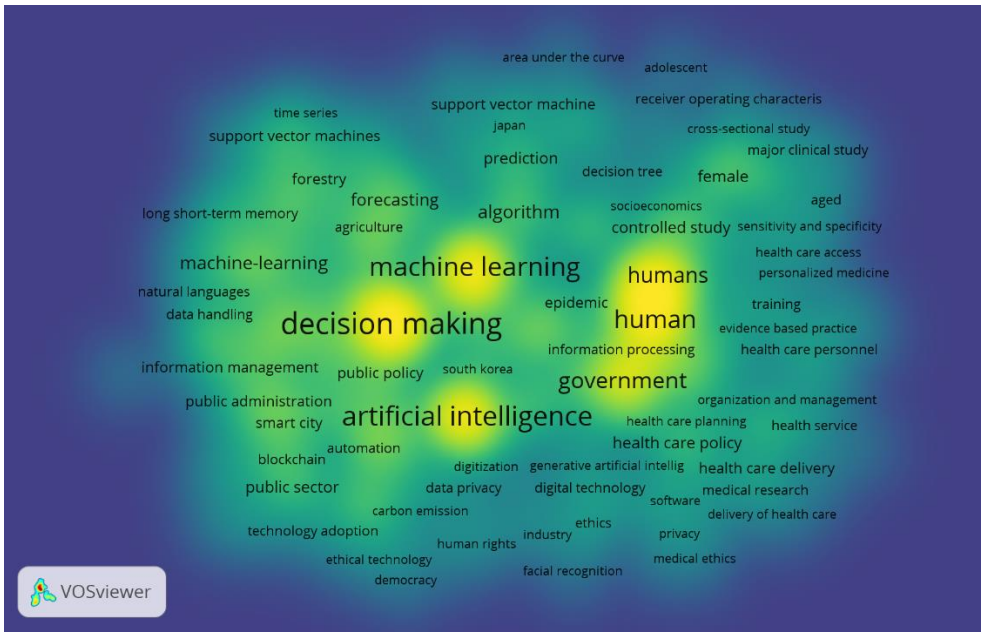

Figure 3. Keyword co-occurrence visualization

Overall, the analysis shows that integrating AI in public decision-making has become a fast-growing strategic area. The findings also confirm the importance of adaptive IT investment frameworks, inclusive data governance policies, and AI-based multi-stage decision-making models to realize a responsive, efficient, and public-oriented digital government.

Table 1. Summary of AI Roles, Challenges, and Strategies in Public Decision Making

Source	Roles	Limitations	Strategic Implementation
(Djatmiko et al., 2025)	Driving digital transformation in the public sector by adopting AI technology to support inclusive and data-driven decision-making.	Unequal access to digital technology and cultural resistance to using AI-based systems, especially in vulnerable communities.	Integrate digital inclusion principles, strengthen citizens' digital literacy, and design AI-DSS systems that are responsive to the needs of marginalized groups.
(Kencono et al., 2025)	Accelerate artificial intelligence adoption in public services to improve efficiency, transparency, and speed of response to community needs through Sapawarga and Jaki applications.	There are data security risks, a lack of specific regulations on using AI in government, and concerns regarding user privacy.	Establish ethical frameworks and data governance policies for AI-DSS implementation and conduct risk evaluations and organizational readiness assessments before implementation.
(Agusta et al., 2024)	Strengthening AI's role in decision support systems for real-time data-driven policy planning and adaptive learning in the public sector.	Barriers to the adoption of adaptive technology include a lack of digital competence among government employees and limited IT infrastructure.	Improving ASN's digital capabilities through continuous training and investment in cloud-based IT infrastructure to support AI-DSS scalability.
(Hardianto et al., 2024)	Combining rule-based and machine learning enables hybrid AI-based systems to be used in government decision-making.	The complexity of integration between legacy systems and new AI technologies, as well as challenges	Design adaptive architectural frameworks that support gradual integration between traditional systems and

Source	Roles	Limitations	Strategic Implementation
		in data interoperability.	modern AI platforms based on modular and microservices.
(Wadipalapa et al., 2024)	Development of governance models to adaptively integrate AI technologies in public systems, increasing accountability and stakeholder engagement.	Lack of clarity in AI ethical standards, algorithmic transparency challenges, and resistance from traditional policy makers.	Implement "AI Governance by Design" principles, integrating ethics, transparency, and stakeholder engagement from the early stages of AI-DSS investment and development.
(Suwarningsih and Nuryani, 2024)	Explaining AI adoption factors in public organizations, identifying that perceived usefulness and ease of use strongly influence adaptive IT investment decisions.	Resistance to technological change and concerns over data security are the main barriers to accepting AI-DSS.	Developing a change management strategy based on a human-centric approach and strengthening data security assurance to increase adoption confidence.
(Fadrial et al., 2024)	Demonstrate how the application of AI in public services can improve organizational agility and adaptive response to community needs.	Limited human resources trained in AI and reliance on external technology vendors.	Train internal employees in AI and minimize vendor dependency through open-source solutions and internal capacity building.
(Madyatmadja et al., 2023)	Develop an adaptive framework for AI integration in the public sector, based on agile and continuous improvement approaches to improve decision-making performance.	Challenges in adapting old regulations to fit the dynamic and fast-changing new AI-DSS model.	Establish agile governance units within public institutions to regularly accommodate the development, evaluation, and adaptation of the AI-DSS framework.
(Witarsyah et al., 2020)	Develop data-driven decision-making methods to improve the effectiveness of DSS with AI integration based on predictive and adaptive analytics.	Challenges in data quality, integration of heterogeneous data sources, and the need for continuous algorithm updates.	Building a strong data governance-based IT investment system and implementing adaptive AI for real-time data processing in the public sector.
(Setiawan et al., 2021)	Providing machine learning-based models to improve predictive capabilities in the government sector decision-making.	Limitations on data bias, lack of interpretability of AI models, and risk of misprediction in public critical contexts.	Establish regular evaluation of predictive models and use of Explainable AI (XAI) to improve transparency of decisions in the public sector.
(Rahman et al., 2022)	Examine AI applications in digital government and encourage adaptive investment in building an AI-DSS ecosystem based on local needs.	Barriers from legal frameworks that are not yet adaptive to the use of AI, as well as data ethics concerns in the public sector.	Promote regulatory reform and the development of ethical frameworks for using AI in government decision-making.
(Yusriadi et al., 2023)	Discusses adaptive frameworks to enhance the security of AI-based systems in the context of government digital decision-making.	Threats of cyberattacks, protection needs of sensitive data, and challenges in building trust in AI systems.	Embedding cybersecurity by design in AI-DSS IT investments and implementing data protection standards and continuous security audits.

Source	Roles	Limitations	Strategic Implementation
(Fernando et al., 2023)	Artificial Intelligence is used to improve the efficiency of public services by automating routine tasks and analyzing rapid data.	Ethical and legal challenges, and the need for community engagement in discussions about the role of AI in public policy.	AI integration in legal drafting and e-legislation processes, taking into account community values and needs.
(Brillianto et al., 2024)	Artificial Intelligence is used to automatically detect inefficiencies in bureaucratic processes through machine learning and data analysis.	Lack of algorithm interpretability by non-technical staff and the need for HR training.	Implementing a recommendation system for adaptive public service improvement and human resource capacity building in understanding AI.

DISCUSSION

The Role of AI-Based DSS in Adaptive IT Investment in the Government Sector

AI-based DSS is crucial in supporting strategic and dynamic decision-making in information technology investments in the government sector. It enables real-time data processing to produce more accurate predictive analysis and simulation of policy scenarios. Thus, decisions are no longer based solely on intuition or political preferences, but are reinforced by objective and contextual data evidence, creating a responsive mechanism to social, economic, and policy changes needed in modern governance (Büber and Seven, 2025). Djatmiko et al. (2025) asserted that adopting AI allows the decision-making process to be more inclusive and data-driven, strengthening the government's ability to respond to community needs more precisely and purposefully. Additionally, using AI in public services speeds up administrative processes, increases operational efficiency, and strengthens transparency, resulting in better quality decisions (Kencono et al., 2025). Furthermore, application of AI-DSS can strengthen the policy planning process by providing real-time data and adaptive learning mechanisms, ensuring that government policies remain relevant and responsive to changing social conditions (Agusta et al., 2024). Technical support to decision-making can develop data-driven decision-making models by integrating AI predictive and adaptive analytics, improving the system's effectiveness in presenting policy recommendations (Witarsyah et al., 2020). Machine learning-based models can improve the predictive ability of DSS, so that decisions made by the government can be more accurate, measurable, and by the actual needs of the community (Setiawan et al., 2021). With these contributions, AI-based DSS not only enriches information for decision makers but also promotes a more adaptive, transparent, and responsive government ecosystem to today's challenges.

Besides supporting strategic decision-making, AI-DSS also plays a vital role in aligning the direction of information technology investments with the evolving needs of public services. In a dynamic governmental environment, frequently confronted with crises, public pressures, and policy changes, the ability of AI-DSS to adaptively map the actual needs of society becomes critically important. This system can link service request data with fiscal policies and the performance of digital systems, thereby enabling the government to adjust budget allocations to the most urgent sectors (Agusta et al., 2024). Integrating a hybrid-based system, a combination of rule-based and machine learning, provides flexibility and precision in decision making, making the system more responsive to changes in the field (Hardianto et al., 2024). Thus, AI-DSS not only addresses immediate needs but also improves the quality of long-term sustainable investment planning. Meanwhile, the importance of building an AI-DSS ecosystem based on local needs is to ensure that information technology investments remain relevant and oriented towards improving public services, especially in areas requiring a more context-specific approach (Rahman et al., 2022). Therefore, AI-DSS serves not only as a decision-making tool but also as a foundation in optimizing the allocation of government resources more effectively and efficiently.

One major challenge in IT investment in the public sector is managing the risks and uncertainties associated with technology projects that often require the allocation of large and far-reaching funds. Here is where AI-DSS shows its relevance by providing an in-depth data-driven analysis of the risks that may occur in each project stage. AI-DSS not only relies on decision-makers' intuition but also presents scenario simulations that allow the government to predict the possible possible outcomes (Chircu et al., 2003). This system can assess the probability of project success, identify obstacles that may arise, and calculate trade-offs between costs and benefits more systematically. AI-DSS enables a broader perspective in decision-making by considering the viewpoints of stakeholders, such as policymakers and communities (Chircu et al., 2003). The role of AI in transparency and accountability in the government sector is significant, especially in ensuring that decisions related to budget management, public policy, and technology investment can be accounted for openly and accurately. AI-Based DSS improves the clarity of the decision-making process by providing a systematic record of every step taken in the flow of a policy or project. This not only creates accessible and auditable documentation but also facilitates internal and external oversight of the use of public resources.

Transparency in this context means that entire decision-making processes, from problem identification and policy planning to implementation and evaluation, can be understood and accessed by the public and other stakeholders. AI-based systems allow the government to provide detailed, easy-to-understand reports and analysis on how decisions are made and what data they are based on. For example, using AI to analyze budget data and ongoing projects allows the public and the legislature to see how funds are being spent, what the expected outcomes are, and whether the project is meeting its stated objectives.

Accountability is enhanced because AI enables tracking decisions and outcomes throughout the policy cycle. The system records every decision, who made the decision, and the basis for the decision, so that any failures or deviations from established goals can be easily tracked and corrected. This data-driven evaluation process also helps reduce the potential for budget misuse or ineffective policies. Comprehensive documentation of the IT-based evaluation process is crucial in building legitimacy and public support for government policies, as the public tends to have more confidence in policies that can be audited and seen transparently (Alencar et al., 2013).

However, AI in data management also makes it possible to mitigate the risk of information leakage or misuse of personal data. This is especially important in the public sector, which must adhere to strict security and privacy standards. AI can be integrated with security technologies to ensure the information processed is kept secure and only used for legitimate purposes. Adaptive framework strengthens the security of AI-based systems in government decision-making (Femi and Medugu, 2025). With this system in place, accountability is ensured, as well as the protection of data integrity and individual privacy.

Limitations and Challenges in AI-DSS Implementation

The adoption of AI-based mechanisms in the public sector is rising, but there are still challenges in public understanding and acceptance. One of the key factors is the perception of its benefits. If the public believes that AI can improve the efficiency and effectiveness of public services by speeding up responses and simplifying bureaucratic processes, public support will be greater. However, while AI can potentially transform the way decisions are made in government, it also risks threatening existing democratic values. Therefore, it is important to develop public trust through transparent and ethical policies (Gesk and Leyer, 2022; Harrison and Luna-Reyes, 2022).

Artificial Intelligence (AI) technology adoption in the public sector faces significant limitations and challenges. One of the main challenges is the lack of a deep understanding of the factors that can drive or hinder the adoption of AI in government. Research by Tangi et al. (2023) revealed that factors such as organizational capacity, lack of in-house technical expertise, and legal barriers to the application of developed AI systems, are barriers that need to be overcome for the successful implementation of this technology. Moreover, the success of AI implementation is highly dependent on the readiness of the organization to make the necessary adjustments, both in terms

of human resources and technology infrastructure. This aligns with findings from Keller and Drake (2021) research that highlight the challenges of ensuring transparency and oversight of AI systems, especially with the increasing reliance on automated decision-making that risks reducing meaningful public engagement.

Another major challenge is existing governance frameworks, which are often not flexible enough to accommodate the new needs brought about by AI technologies. Concerns about the gap between existing data governance and national regulatory practices may exacerbate inequalities in AI adoption in the public sector (Kuziemski and Misuraca, 2020). These limitations also can exacerbate existing disparities in access to technology and expertise, which may hinder the utilization of AI's potential to improve public services. This challenge is further complicated by the emerging issues of exclusivity and paternalism associated with setting goals and criteria within the AI framework for standardized and regulatory accountability (Keller and Drake, 2021). Another limitation is related to human competence in managing AI technologies. Integrating AI in public organizations affects personnel's roles, skills, and responsibilities (Maragno et al., 2023). Using technologies such as chatbots, in addition to efficiency, also presents significant challenges in managing organizational change and adapting staff who must work with new systems. Effective AI development and deployment require the presence of skilled human competencies.

Implementing AI-DSS in the public sector faces complex structural and technical challenges. Unequal access to digital technology and cultural resistance to using AI-based systems in vulnerable communities are significant initial obstacles. Other obstacles arise from the low digital competence of the state apparatus and limited information technology infrastructure, which slows the adoption process of AI-based adaptive systems. The complexity of integration between old systems and new technologies, plus data interoperability issues, further complicate the transition to AI-based systems. Meanwhile, the absence of clear ethical standards, algorithmic transparency, and resistance from traditional policy actors hinder the legitimacy of AI-DSS adoption. Concerns over data security, resistance to technological change, limited skilled human resources, and reliance on external vendors add another layer of complexity. The slow pace of regulatory adaptation to the dynamic development of AI-DSS contributes to the mismatch between the old legal framework and the needs of new technologies, compounded by data quality issues, integration of heterogeneous data sources, and the need for continuous algorithm updates. Issues of data bias, low model interpretability, and high risk of prediction error amplify the ethical and technical challenges of AI implementation in the public sector. Furthermore, unresponsive legal frameworks to data ethics issues deepen institutional resistance, while the threat of cyberattacks and the need to protect sensitive data emphasize the importance of building public trust in AI-based systems.

Adaptive IT Investment Implementation Strategy

In developing an adaptive IT investment strategy in the government sector, artificial intelligence and a multi-stage approach are crucial to ensure decision-making accuracy amid the complexity of modern bureaucratic environments. One approach that has proven effective is the use of multi-stage decision-making, which combines analytics and machine learning methods such as CNN, RNN, and LSTM to optimize decisions based on the risks and potential benefits of investments (Suwarningsih and Nuryani, 2024). The integration of these technologies not only accelerates the evaluation process but also improves accuracy in the selection of IT projects that have the potential to deliver high value, especially in the context of dynamic changes in the evolving needs of public services.

Furthermore, adaptive strategies require the adoption of the principle of flexibility in investment planning, where investment decisions must be modular, scalable, and able to be adjusted based on policy changes, technological advances, and increased public expectations. This approach is strengthened by applying agile IT governance principles, which emphasize the importance of short iterations, continuous learning, cross-sector collaboration, and accurate data-based evaluation (Fadrial et al., 2024). AI-based decision support systems play an important role in helping the government make quick adjustments to investment strategies based on real-time

operational feedback and external trend analysis, thereby maintaining the relevance and effectiveness of public digitization programs.

Moreover, adaptive investment implementation must consistently consider data security and user privacy protection. With the increasing adoption of AI in data management and decision-making automation, the need to implement high-level security protocols has become more urgent to maintain public trust in government digital systems (Madyatmadja et al., 2023). The inability to effectively manage data security can not only disrupt operations but also potentially pose major legal and reputational risks to public institutions. It is also important to consider the adoption of Big Data and Blockchain technologies as an integral part of an adaptive IT investment strategy. Big Data enables real-time analysis of citizen needs and performance evaluation of public services. Blockchain offers greater transparency in the recording of transactions and improves accountability for using government investment funds (Setiawan et al., 2021; Witarsyah et al., 2020).

Implementing an adaptive IT investment strategy in the government sector, the integration of social innovation is a crucial factor to consider. Effective decision-making in smart cities relies heavily on organized data sharing between government, industry, and society, which can strengthen collaboration between the public and private sectors to create more responsive solutions (Bokhari and Myeong, 2022). At the practical implementation level, an adaptive investment framework should be developed based on sectoral needs analysis and projections of long-term social, technological, economic, and political trends. In addition to technical considerations, these strategies should always be oriented towards constitutional law principles, including public accountability, transparency in resource management, and efficient use of funds (Rahman et al., 2022). AI application in the public sector holds great potential for improving operational efficiency and personalized service delivery. However, it also demands adjustments to existing data governance and regulatory frameworks to not increase the digital divide between different layers of society (Kuziemski and Misuraca, 2020). Therefore, adaptive IT investment strategies should prioritize improvements in human resource capacity, both technical and non-technical, to ensure long-term sustainability and maintenance of AI systems (Tangi et al., 2023). Along with evolving digital transformation, the government should adopt a more structured methodology, including improved organizational design, as well as strengthening public participation in decision-making to create more inclusive and responsive digital governance (Benbunan-Fich et al., 2020; Maragno et al., 2023).

Finally, to ensure the sustainability and relevance of the adaptive investment strategy in the long term, a multi-criteria decision-making (MCDM) method can be implemented. This approach allows the government to assess investment priorities based on a combination of cost factors, social benefits, level of risk, contribution to innovation, and the project's strategic value to strengthen public service capacity (Yusriadi et al., 2023). Thus, investments in IT should be planned by considering dynamic changes in technology, policies, and people's needs to achieve efficient, transparent, and sustainable governance.

Contribution to the Development of Conceptual Framework

Building a conceptual framework for adaptive IT investment in the public sector demands attention to the complementary contributions of recent research. One fundamental dimension that needs to be integrated is digital transformation based on the principle of social inclusion. In line with this, IT investments in the public sector should ensure that e-Government services are not solely oriented towards improving bureaucratic efficiency. However, they can also reach and empower previously underserved marginalized communities (Djatmiko et al., 2025).

Developing a conceptual framework for adaptive IT investment in the public sector requires a holistic approach and is responsive to dynamic changes in society and technology. Along with the development of digital transformation, the concept of social inclusion becomes an important cornerstone. In creating sustainable e-Government, government digital services must reach all levels of society, including marginalized groups that are often underserved (Kencono et al., 2025). Analysis of public sentiment, reflected in people's opinions on government digital service

applications, can be a key instrument in designing IT investments that are more responsive to people's real needs (Kencono et al., 2025). Therefore, it is important for decision-makers to consider social sustainability and distributional equity at every stage of IT investment.

Hermansyah et al. (2024) introduced the concept of agile governance, emphasizing the need for flexibility and rapid adaptation in public sector IT decision-making. Investment decisions should not be static but iterative and continuously evolving based on evaluation results and feedback. Suwarningsih and Nuryani (2024) expand on this concept by proposing a multi-stage decision-making approach, where investments are made in several stages, with periodic evaluations to adjust project priorities and objectives according to the dynamics at hand. This approach allows the government to adjust IT project priorities based on the evaluation results at each stage, thereby responding more efficiently and measurably to the changing needs of society.

Meanwhile, in terms of technology infrastructure, greater attention needs to be paid to interoperability and system security. The ecosystem enables seamless and automated integration of e-Government services through AI-Decision Support Systems (AI-DSS) (Madyatmadja et al., 2023). This will speed up the decision-making process and improve the quality of public services. Using Big Data Analytics in big data management will provide the strategic insights needed to manage increasingly complex IT projects (Witarsyah et al., 2020). With this technology, the government can obtain more in-depth information about trends and patterns of public service usage, which can then be used to design policies that are more effective and responsive to the community's needs. Furthermore, transparency in IT investment management is an aspect that cannot be ignored. Application of Blockchain technology as a solution to ensure the clarity and reliability of public sector investment data (Setiawan et al., 2021). With the decentralized nature and immutable system of record, Blockchain can serve as a powerful auditing tool, ensuring that every transaction related to IT investments can be monitored and verified in real-time. The implementation of this technology will strengthen public trust in the management of public funds and increase government accountability in managing digital projects.

Besides technological aspects and transparency, legal aspects also play an important role in developing the conceptual framework of IT investment. Public sector IT investments must comply with the legal principles of public administration, including accountability, transparency, and efficiency in the use of public resources (Rahman et al., 2022). Legal compliance not only increases the legitimacy of IT investments but also prevents potential misuse of funds and ensures that every step taken is by applicable legal requirements.

Finally, to increase objectivity in prioritizing IT investments, Yusriadi et al. (2023) proposed using a Multi-Criteria Decision Making (MCDM) approach. MCDM allows decision makers to evaluate various factors that affect the success of a project, including cost, social impact, risk, and potential for technological innovation. By comprehensively considering all these aspects, the government can ensure that IT investments are made in a rational and evidence-based manner, ultimately contributing to long-term success. Thus, contributions from these studies form a solid basis for developing a conceptual framework for adaptive IT investments that can adapt to social needs, strengthen governance, increase transparency, and optimize the use of public resources. By applying these principles, the public sector can leverage technology to deliver better, more efficient, and fairer services to the people.

CONCLUSION

This research comprehensively examines the role, challenges, and strategic implementation of AI-based DSS within the framework of IT adaptive investment in the Indonesian public sector. Through a PRISMA-based systematic literature review approach and bibliometric analysis using VOSviewer of 14 selected articles, it was found that AI-DSS integration plays a strategic role in improving the quality of government decision-making through real-time data processing, predictive analysis, and adaptive flexibility to socio-economic and policy dynamics.

The main roles of AI-DSS include supporting strategic decisions, managing investment risks, strengthening transparency and public accountability, and adjusting resource allocation based on society's real needs. However, significant challenges arise from technical and institutional aspects, such as limited human resource competencies, an unadaptive regulatory framework, ethical and data privacy issues, and the complexity of integration with legacy systems.

The studies in this review demonstrate successful adaptive IT investment strategies, including agile governance approaches, multi-stage decision-making, utilization of Big Data and Blockchain, and strengthening inclusive legal and governance frameworks. These findings collectively support the importance of building a conceptual framework that integrates AI technologies, social inclusion principles, legal accountability, and continuous evaluation to ensure AI adoption in the public sector is ethical, responsive, and sustainable.

This study implies the need for the Indonesian government to develop an IT investment framework that is not only technologically adaptive but also responsive to local social and policy contexts. The integration of AI in public decision-making must be accompanied by digital capacity building, regulatory reform, and strengthening cross-sector collaboration to promote more efficient, transparent, and inclusive governance.

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