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Futurology of Artificial Intelligence Governance in a Smart Government for Achieving a Sustainable and Efficient Structure for Utilizing Advanced Technologies

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Abstract

The primary objective of this study is to explore the impact of artificial intelligence (AI) on governance processes and to identify potential governance structures that could be implemented to manage AI effectively. This study aims to address the current research gap by examining the key variables influencing AI governance and proposing strategic scenarios based on a structured analysis. This research employs a descriptive design, utilizing an extensive literature review and MICMAC (Matrix of Cross-Impact Multiplications Applied to Classification) analysis. The literature review provided foundational data by identifying significant criteria and sub-criteria related to AI governance from academic journals, policy reports, and governmental publications. These variables were then analyzed using the MICMAC method, which involves constructing a cross-impact matrix to map the interdependencies among variables. The analysis classified variables into categories such as autonomous, dependent, linkage, and driving, providing a comprehensive understanding of the dynamics involved. Scenario development was also carried out to propose governance strategies. The MICMAC analysis revealed critical variables that drive AI governance, including transparency, data protection, ethical considerations, risk management, and sustainability. The study identified the significant interdependencies among these factors and classified them into categories that highlight their roles in governance. Strategic scenarios were developed, emphasizing the importance of continuous policy review, ethical frameworks, and collaboration among stakeholders. The findings suggest that effective AI governance requires adaptable strategies that support innovation while protecting public interests and ensuring long-term sustainability. This study concludes that AI governance in smart governments must be comprehensive and dynamic, addressing both technological advancements and societal needs. The proposed scenarios highlight the necessity of global coalitions, transparent information sharing, and proactive risk management. While this research provides a preliminary understanding of AI governance structures, further empirical studies are needed to validate and refine these strategies. The study emphasizes the importance of ongoing research and collaboration to ensure AI technologies are leveraged responsibly and effectively for societal benefit.

Keywords: *Futurology, AI Governance, Smart Government, Sustainable Structure, Advanced Technologies*

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1. Introduction

It is anticipated that artificial intelligence (AI) will become a superhuman force in most tasks it is assigned within this century. Such advancements could bring numerous opportunities and risks for humanity. According to various experts, in the coming decades, AI capabilities will manifest in ways that radically transform existing power, wealth, and welfare. This transformation, in terms of scope, can be compared to the Industrial Revolution. AI governance is essentially the study of how to manage the transition to advanced AI systems, focusing on various political, economic, military, governmental, and ethical dimensions. This report serves as an introduction to this topic. AI governance is often discussed alongside AI safety, both aiming to help humanity maximize AI's benefits. However, AI governance focuses on the institutions and contexts where AI is created and utilized. Advanced AI can play a critical role in addressing global challenges, from climate change to international tensions. Astonishingly, advanced AI can contribute to health, happiness, well-being, science, and self-understanding. These benefits must be weighed against the potential catastrophic risks of AI, such as reinforcing totalitarianism, escalating nuclear war between major powers (with AI complicating the crisis cycle of such wars), and conflicts with human values. AI changes the nature of wealth and power, altering the interests and capabilities of powerful actors and potentially bringing new ones to the forefront. These actors may either compete or collaborate to further their interests [1].

AI may pose serious risks. The significant considerations in transformative AI development include public adaptability, the necessary values and ethics for researchers, national wealth, national security, and more. AI policy addresses how the evolving technical landscape might alter domestic policy, international political economy, and global security, and how the strategies of powerful actors might shape AI development [2]. If the current trend continues, where AI benefits are primarily controlled by large companies (like Google), a global AI monopoly may emerge. Nations without AI industries worry about being excluded from the global AI benefits. There are concerns in the U.S. and Europe that China may leverage economic power to surpass Western companies technologically. This concern possibly motivated Trump's trade war with China. These worries may lead to AI nationalism and AI protectionism, with nations investing heavily in AI development and aggressively supporting domestic AI champions. Various countries and companies are exploring ways to maximize AI's economic benefits, including creating successful AI-based companies or supporting domestic ones. Fundamental questions arise: What advantages might a country like China gain (compared to other nations) from managing its vast economy and outpacing competitors? What are the possible dynamics of an AI-driven global economy? Is it acceptable for nations to support their domestic AI companies to compete better with leading global AI industries? [3]

Technological shifts impact countries differently, and they react by implementing diverse policies. International security concerns include the possibility of fierce AI competition among nations, necessitating detailed research into scenarios and management strategies for future studies on international security and economy [4-6]. AI and its related technologies will likely have significant implications for national and international security. In the short and medium term, AI may have transformative strategic impacts. In the long term, AI could become a fundamental asset for nations, prompting efforts to secure and control AI-related R&D. AI's strategic and military advantages may intensify global arms races [7]. Understanding the logic of this competition and methods to prevent or resolve it is crucial. In the coming years, AI will introduce new security challenges, such as autonomous weapons, AI-driven cyber operations, and politically influential AI campaigns [8]. Many of these challenges are potentially transformative, requiring awareness and preparedness.

Sastry and Heim (2024) explored computational power and AI governance, emphasizing how policymakers can leverage computation to enhance AI oversight, allocate resources for beneficial outcomes, and impose restrictions against irresponsible AI use, but highlighted discrepancies in readiness for implementation, with some concepts being experimentally tested while others face fundamental research barriers; they also warned that simplistic or poorly scoped governance approaches pose significant risks, including privacy violations, economic impacts, and power concentration [9]; Babaeian et al. (2023) focused on AI’s role in public policy cycles, categorizing AI's applications, methods, benefits, and challenges into four main themes, emphasizing evidence-based policy design and advanced techniques like machine learning, while acknowledging challenges such as ethical concerns, human resource gaps, and societal biases [2]; Gonbad (2023) analyzed China’s AI governance strategies, emphasizing AI's potential to transform society and international politics and discussing

China's rapid AI investments and regulatory challenges, with a focus on global coordination for AI governance [10].

Today, most fundamental AI research is open, with researchers keen to publish findings for recognition, although some semi-private research for proprietary benefits exists. If AI becomes viewed as dangerous or economically and militarily strategic, this openness may change. As AI dissemination becomes perceived as potentially disastrous, leading AI experts might restrict AI capabilities from the public. Advanced AI could provide immense wealth and power to its owners [11]. If this holds true, and AI's strategic and economic benefits are substantial, international competition over AI seems inevitable. Given AI's advantages, actors may deprioritize balancing AI ownership with values like health, transparency, accountability, and democracy. The main concern is the insufficient precautions in using advanced AI systems, raising numerous questions for policymakers. With the likelihood of intense AI competition, strategies to avoid or end such conflicts are necessary. Common political solutions include increasing transparency and establishing norms, agreements, or treaties, which can be bilateral, multilateral, or global. Norms define mutual understandings of unacceptable behaviors and imposed responses, though they may be criticized for being unjust or insufficient. International customary laws are less effective in the absence of an authoritative legal body for major powers. Diplomatic agreements work if well-defined and rely on cooperation. Organizations like the World Trade Organization create bureaucracies that clarify ambiguities and facilitate future negotiations. International collaboration often begins with norms, leading to regional or multilateral agreements and, eventually, institutional establishment. Strategies to avoid hostile AI competition include standards-setting, third-party enforcement, and oversight. A practical model is creating an international agency to define and enforce AI safety standards [12]. This step would lay the foundation for shared AI governance knowledge. Another model involves establishing an organization capable of negotiating and forming new agreements. The final model proposes a global AI framework independent of major powers' control, with strategic technology ownership but requiring meticulous organizational design to ensure cooperative incentives. The primary objective of this study is to explore the impact of artificial intelligence (AI) on governance processes and to identify potential governance structures that could be implemented to manage AI effectively. This study aims to address the current research gap by examining the key variables influencing AI governance and proposing strategic scenarios based on a structured analysis.

2. Methodology

This study utilized a descriptive research design, focusing on understanding the impact of artificial intelligence (AI) on governance processes and identifying potential governance structures. The research was structured around a comprehensive literature review and MICMAC (Matrix of Cross-Impact Multiplications Applied to Classification) analysis to explore and map out the key variables influencing AI governance. The approach was chosen to systematically assess the relationships and interdependencies among these variables and to develop strategic scenarios for AI governance.

Data were collected through an extensive literature review. Academic journals, policy reports, governmental publications, and other credible sources published between 2010 and 2024 were reviewed to identify critical concepts, trends, and insights related to AI governance. The literature provided the foundational data for identifying key criteria and sub-criteria, which were subsequently analyzed using the MICMAC method. The selection of sources was based on relevance to AI governance, governance models, and the socio-economic implications of AI integration.

The data analysis was conducted using MICMAC analysis, which is a structured approach for exploring the interdependencies among various factors. The analysis process included the following steps:

Identification of Variables: From the literature review, essential criteria and sub-criteria impacting AI governance were identified and categorized.

Cross-Impact Matrix Development: A cross-impact matrix was constructed to map the relationships among the identified variables. Each relationship was scored based on its influence and interdependence, ranging from strong to weak impacts.

MICMAC Analysis: The matrix was analyzed using MICMAC software to classify variables into four categories: autonomous, dependent, linkage, and driving variables. This classification helped in understanding the dynamic interactions and critical drivers of AI governance.

Scenario Development: Based on the MICMAC analysis, strategic scenarios were developed to propose governance structures. The analysis highlighted the most influential factors and how they could shape AI governance outcomes.

This scenario-based approach provided actionable insights for policymakers and researchers.

3. Findings

Each criterion identified through MICMAC analysis was incorporated into scenario writing. At this stage, based on four criteria and 25 sub-criteria, a suitable scenario was identified using Scenario Wizard software analysis. Initially, a cross-impact matrix was formed. The Cross-Impact Balance (CIB) matrix was utilized to gather expert opinions on the probability and impact of one descriptor's occurrence on another using verbal expressions.

Table 1. Components Labeled in Scenario Wizard

Phrase	Symbol in Scenario Wizard
Long-term Targeting	A1
Increasing Public Trust	A2
Innovation and Process Improvement	A3
Data Protection and Privacy	A4
Ethics in Artificial Intelligence	A5
Innovation and Competitiveness	A6
Creating Technological Infrastructure	A7
Training and Empowering Human Resources	A8
Performance and Efficiency Evaluation	B1
Risk Management and Problem Prediction	B2
Sustainability and Long-term Impact Review	B3
Supporting Innovation and Development	C1
System and Information Integration	C2
Encouraging Public Participation	C3
Monitoring Social and Ethical Impacts	C4
Policy and Regulatory Review	C5
Stakeholder Feedback Analysis	C6
Continuous Algorithm and Model Updates	C7
Benchmarking Against Global Standards	C8
Social Justice and Inequality Reduction	D1
Transparency and Accountability	D2
Technical Standards and Regulations	D3
International Collaborations	D4
Launching Pilot Projects	D5
Enhancing Security and Sustainability	D6

Based on these four criteria and 25 associated sub-criteria, the structure of the cross-impact matrix was identified.

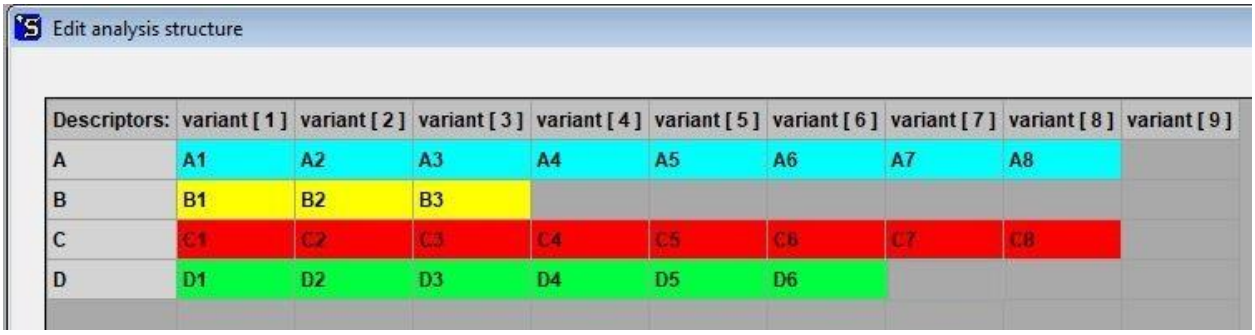

Figure 1. Cross-Impact Matrix Structuring

Next, the cross-impact matrix was weighted using scores ranging from 3 to -3.

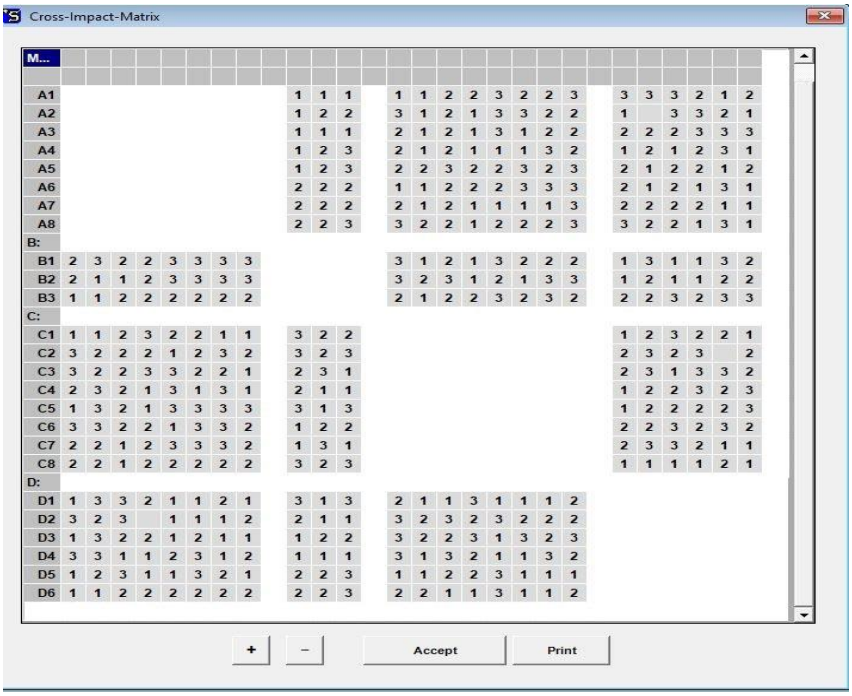

Figure 2. Cross-Impact Matrix Completion

To achieve scenarios with the highest compatibility, the cross-impact matrix was homogenized.

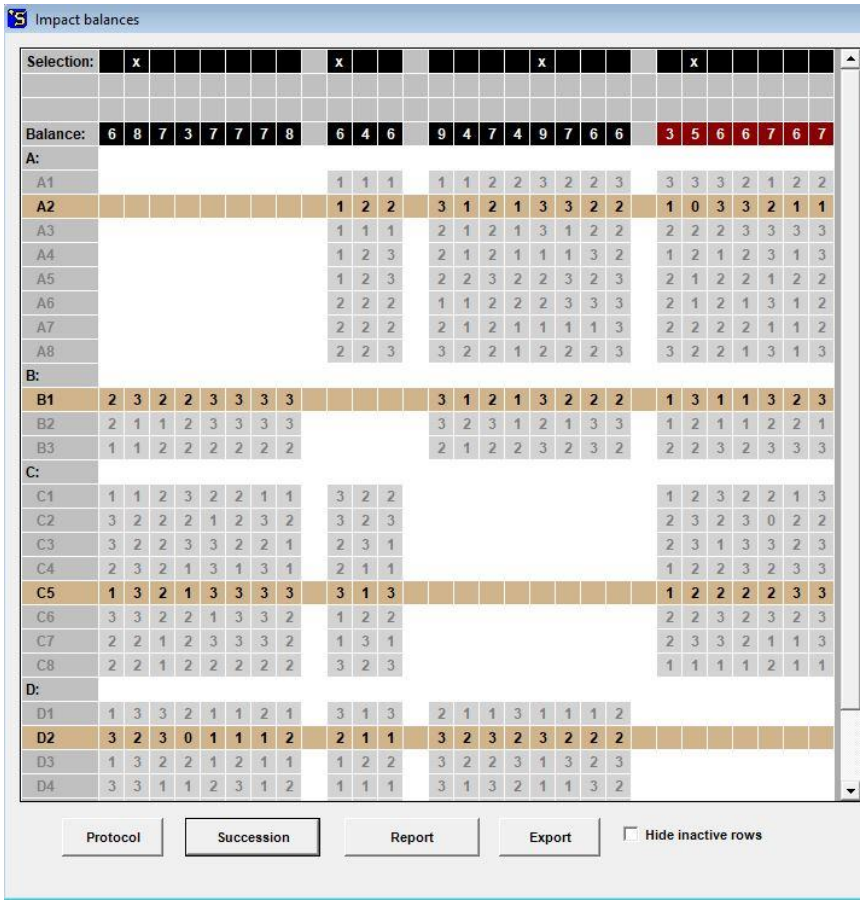

Figure 3. Cross-Impact Matrix Homogenization

Ultimately, considering the importance of all four components, 25 scenarios were identified using Scenario Wizard software.

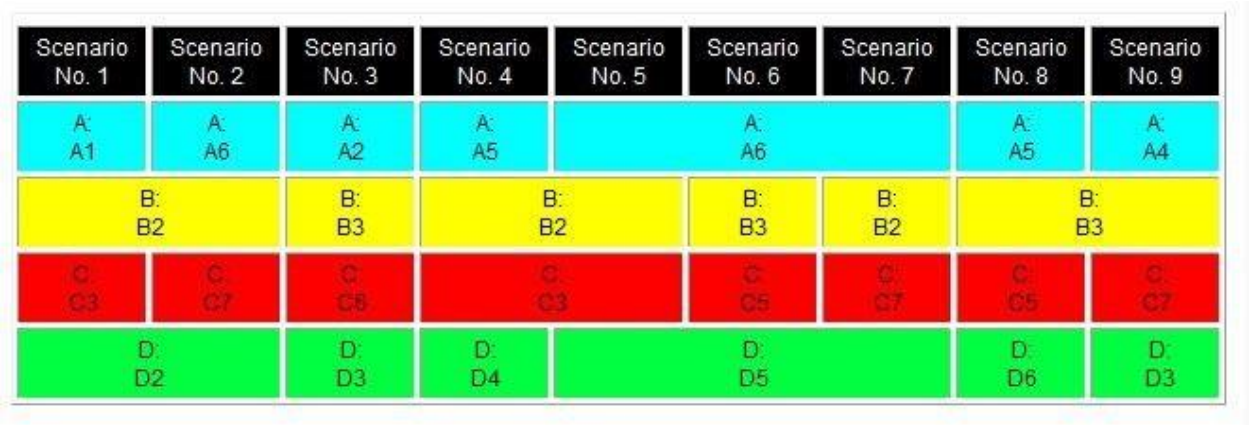

Figure 4. Identified Scenarios

None of the other scenario elements conflicted with this assumption. Scenario analysis identified nine scenarios, each specified by sub-criteria:

Table 2. Scenario 1: Includes Components A1, B2, C3, D2

Component	Symbol
Long-term Targeting	A1
Risk Management and Problem Prediction	B2
Encouraging Public Participation	C3
Transparency and Accountability	D2

In developing AI governance in a smart government, long-term targeting must aim to achieve a sustainable and efficient structure for leveraging advanced technologies. This includes developing robust digital infrastructure and supporting AI innovation, which can help solve complex problems and enhance the quality of public services. Long-term plans should account for AI's future impacts on social, economic, and political structures. One possible future scenario involves formulating overarching policies to integrate AI across all government levels and creating smart and sustainable work environments. These policies must also remain flexible to adapt to rapid technological changes. AI, with its decision-making and process automation power, presents unique opportunities but also comes with significant challenges such as security risks, privacy concerns, and algorithmic biases. A smart government must improve risk management and anticipate potential problems to mitigate these threats. Foresight scenarios in this area include designing stronger monitoring systems and using AI-based tools to identify and manage emerging risks. Developing AI systems that can predict economic, social, and environmental problems will help governments proactively address future crises and make strategic, optimized decisions using these technologies.

In the smart government of the future, transparency and encouraging public participation will be among the most crucial factors for successful AI governance. Governments must demonstrate accountability and gain public trust by providing open access to data and AI-driven reports. A proposed scenario in this area is the creation of open government platforms where citizens can access AI decision-making processes and share their opinions. These platforms can raise public awareness of AI's impacts and provide continuous feedback to improve smart systems. Ultimately, such transparency and accountability will help maintain public trust and strengthen cooperation between the government and its citizens.

Table 3. Scenario 2: Includes Components A6, B2, C7, D2

Component	Symbol
Innovation and Competitiveness	A6
Risk Management and Problem Prediction	B2
Continuous Algorithm and Model Updates	C7
Transparency and Accountability	D2

In developing AI governance in a smart government, innovation and competitiveness are foundational for long-term success. Leveraging AI across various government sectors, from enhancing public services to improving strategic decision-making efficiency, can drive widespread transformation. A potential scenario is for governments to use AI not only to enhance efficiency but also to boost global competitiveness by facilitating access to AI technologies and infrastructure. By investing in research and development (R&D) and supporting innovation, a future smart government can lead in global technology, particularly by training specialized human resources and fostering international collaborations.

As AI expands in smart governance, risk management, and problem prediction, alongside continuous updates to intelligent algorithms and models, will be crucial. AI-related risks, such as privacy concerns, data security, and algorithmic biases, require proactive and ongoing measures. In this scenario, governments must continuously update AI algorithms and models to mitigate risks and enhance performance. Establishing robust AI-based monitoring systems to detect and analyze emerging threats is another essential action to prevent potential crises. A smart government must predict economic, social, and political challenges and dynamically update AI algorithms to maintain efficiency and respond to environmental changes.

A critical challenge in developing AI governance in a smart government is transparency and accountability. Given the widespread impact of automated decision-making by AI, governments must be answerable and transparent about AI processes. A future scenario envisions the creation of accessible, transparent platforms where citizens can obtain accurate, up-to-date information on AI usage in public services. Such transparency can build public trust and improve system performance oversight. Additionally, the government must be accountable for any errors or deficiencies caused by AI decisions and establish reliable mechanisms for correction and review.

Table 4. Scenario 3: Includes Components A2, B3, C6, D6

Component	Symbol
Increasing Public Trust	A2
Sustainability and Long-term Impact Review	B3
Stakeholder Feedback Analysis	C6
Enhancing Security and Sustainability	D6

In developing AI governance in a smart government, increasing public trust will be one of the most critical factors for acceptance and long-term success. A future scenario in this regard could focus on creating transparent and accessible processes, enabling citizens to easily understand how AI-based systems function and how data is used in government decision-making. Actions such as providing regular reports on AI performance, establishing open communication channels to receive citizen feedback, and ensuring user privacy will help strengthen public trust. Future smart governments must reassure citizens that AI technologies are used responsibly and under strict oversight, prioritizing public welfare.

Widespread AI use in governments requires continuous assessment of its sustainability and long-term impacts on society and the environment. In a future-oriented scenario, governments should periodically conduct studies to evaluate the social, economic, and environmental effects of AI technologies. These assessments could include examining ways to reduce social inequalities, improve access to public services, and decrease the consumption of natural resources using AI. These efforts will assist policymakers in designing strategies that harness AI's benefits while managing its long-term challenges. Additionally, planning for workforce changes resulting from process automation and providing necessary training for workers should also be considered.

Stakeholder feedback analysis is one of the most critical tools for the continuous improvement of AI systems. In a future scenario, governments could establish mechanisms to collect and analyze feedback from citizens, government employees, and other stakeholders to enhance the efficiency and security of these systems. This feedback will play a fundamental role in identifying weaknesses and improving systems. Moreover, enhancing the security and sustainability of AI-based systems to counter cyber threats and maintain system stability is essential. In this scenario, governments must make significant investments in cybersecurity infrastructure and implement secure protocols for sensitive data to prevent cyber-attacks and security breaches. Empowering systems for long-term sustainability and data and algorithm protection will be key to successful AI governance in future smart governments.

Table 5. Scenario 4: Includes Components A5, B2, C3, D4

Component	Symbol
Ethics in Artificial Intelligence	A5
Risk Management and Problem Prediction	B2
Encouraging Public Participation	C3
International Collaborations	D4

In developing AI governance in a smart government, adhering to ethical principles in using this technology is of particular importance. The future scenario in this domain focuses on establishing ethical frameworks to ensure the responsible use of AI in government decision-making. Governments should implement specific laws and regulations to guarantee that AI is designed and used in ways that do not exacerbate social inequalities or algorithmic biases. Additionally, protecting citizens' rights, including privacy and respect for human dignity, should be ethical priorities. In a future-oriented scenario, smart governments may regularly review AI ethics and update algorithms to ensure transparency, fairness, and accountability, guaranteeing that AI operates for the public good without bias.

One of the fundamental challenges in developing AI in smart governance is risk management and problem prediction. AI can come with risks such as security threats, privacy breaches, and algorithmic discrimination. The future scenario involves building robust systems to predict and manage these risks, enabling governments to proactively respond to these challenges. These systems should be capable of data analysis and identifying potential problems, using advanced algorithms to mitigate negative impacts. The future scenario suggests that smart governments will utilize advanced AI techniques to assess emerging risks and establish rapid response protocols. This will help strengthen public trust and ensure safe and responsible AI use.

Encouraging public participation and fostering international collaborations are essential elements for the long-term success of AI in smart governance. In the future scenario, governments will engage citizens in AI decision-making and development processes through digital platforms and collaborative tools. This public involvement will enhance transparency and system performance while increasing societal trust in AI. On the other hand, international collaborations in AI are crucial for managing risks and leveraging global opportunities. The future-oriented scenario indicates that smart governments will promote multilateral agreements and strengthen international cooperation in research and security by sharing knowledge, experiences, and ethical standards. This approach will allow governments to harness AI capabilities in a global context and manage shared challenges in a coordinated manner.

Table 6. Scenario 5: Includes Components A6, B2, C3, D5

Component	Symbol
Innovation and Competitiveness	A6
Risk Management and Problem Prediction	B2
Encouraging Public Participation	C3
Launching Pilot Projects	D5

In developing AI governance in a smart government, innovation and competitiveness are key factors for improving public services and increasing government efficiency. The future scenario emphasizes the need to create

an innovative ecosystem where AI technologies are continuously evolving and being updated. Smart governments should support research and development, establish technology accelerators, and create innovation centers to foster a conducive environment for AI startups and encourage practical innovations. Additionally, this competitiveness can be bolstered by synergizing with the private sector and academia, where knowledge exchange and shared experiences enhance public service quality and improve governmental decision-making. In this scenario, governments must prioritize learning from international experiences and adopting best practices in innovation and competitiveness.

Risk management and problem prediction from implementing AI in smart governance are essential for preventing unintended consequences and maximizing social benefits. In the future scenario, governments must develop comprehensive systems to identify and evaluate risks associated with AI use. These systems should be designed to quickly address security threats, privacy breaches, and ethical issues from algorithmic biases. Furthermore, governments should strengthen their capabilities to predict problems by analyzing data and employing advanced AI models. These measures will enable governments to respond proactively to challenges and prevent potential crises. This approach not only enhances AI governance efficiency but also boosts public trust and technology acceptance.

Encouraging public participation and launching pilot projects are crucial components in developing AI governance in smart governments. The future scenario suggests that governments actively involve citizens, NGOs, and stakeholders in AI decision-making and implementation processes. By creating platforms to collect citizens' opinions and experiences, governments can improve AI service design and implementation. Additionally, launching pilot projects allows governments to test ideas and innovations on a small scale, identifying strengths and weaknesses before broader deployment. These projects can serve as successful models for other government sectors and promote a culture of innovation and participation in society. Consequently, these approaches improve public service efficiency, strengthen social cohesion, and increase public trust in smart governments.

Table 7. Scenario 6: Includes Components A6, B3, C5, D5

Component	Symbol
Innovation and Competitiveness	A6
Sustainability and Long-term Impact Review	B3
Policy and Regulatory Review	C5
Launching Pilot Projects	D5

In today’s world, innovation and competitiveness are fundamental pillars of AI governance in smart governments. The future scenario indicates that governments must continuously identify and adopt new technologies to respond more swiftly to social and economic challenges. This requires creating appropriate platforms for research and development and encouraging startups and tech companies. Governments can facilitate the exchange of knowledge and innovative ideas by establishing effective collaborations with universities and research centers, while also creating accelerators and innovation hubs to nurture new talents and capabilities. In this scenario, competitiveness is considered a key factor in attracting investment and improving public services, ultimately enhancing citizens' quality of life.

Evaluating sustainability and long-term impacts is also crucial in developing AI governance. The future scenario suggests that governments need to carefully assess the social, economic, and environmental effects of AI use. This evaluation can include analyzing impacts on the labor market, the quality of public services, and changes in social behaviors. Given the rapid pace of technological change, governments must regularly review their strategies to ensure alignment with societal needs and expectations. Utilizing advanced analytical tools and collaborating with researchers and experts can help governments gain deeper insights and make better decisions.

Reviewing AI-related policies and regulations is a necessary step toward effective governance of this technology. The future scenario shows that governments should continually update their laws and regulations to keep pace with rapid technological advancements. These updates should support innovation and development while protecting public interests. Additionally, launching pilot projects allows governments to test AI applications' capabilities and challenges in a controlled, small-scale environment. These projects can serve as successful models for broader expansion into other areas. By analyzing the results, governments can optimize policies and regulations based on

real data and experiences, ensuring the sustainability and effectiveness of AI governance, which in turn enhances citizens' quality of life and social welfare.

Table 8. Scenario 7: Includes Components A1, B2, C7, D5

Component	Symbol
Long-term Targeting	A1
Risk Management and Problem Prediction	B2
Continuous Algorithm and Model Updates	C7
Launching Pilot Projects	D5

Long-term targeting is a key pillar in the process of developing AI governance in smart governments. The future scenario emphasizes the need for setting clear and measurable objectives for the effective use of AI technologies. These objectives should include improving public service quality, enhancing managerial efficiency, and increasing citizen satisfaction. To achieve these goals, governments need to establish a strategic framework linking AI initiatives and projects coherently with national development plans. Additionally, regular evaluation systems should be created to measure progress and refine strategies based on feedback, ensuring the sustainability and success of these programs.

Risk management and problem prediction are crucial aspects of AI governance that must be carefully addressed. The future scenario shows that governments should take measures to identify and evaluate the risks associated with AI to minimize potential negative consequences. Advanced data analysis and simulation techniques can assist in identifying future challenges, enabling proactive planning and response. It is also important to acknowledge that AI algorithms and models may be influenced by social and ethical biases, necessitating transparency measures and fairness assurances in decision-making processes.

Continuous updates of algorithms and models are vital for maintaining the efficiency and effectiveness of AI governance systems. The future scenario suggests that governments should regularly update and optimize their algorithms to stay in step with technological advancements and societal needs. These updates should be based on new data and ongoing analysis. Launching pilot projects enables governments to test innovative ideas and solutions in a controlled environment, collecting necessary feedback. These projects can act as real-world laboratories for assessing algorithm performance and evaluating social and economic impacts. This approach allows governments to continuously improve their services and ensure that AI technologies are used effectively and responsibly for public benefit.

Table 9. Scenario 8: Includes Components A5, B3, C5, D6

Component	Symbol
Ethics in Artificial Intelligence	A5
Sustainability and Long-term Impact Review	B3
Policy and Regulatory Review	C5
Enhancing Security and Sustainability	D6

In the process of developing AI governance in smart governments, adhering to ethical principles is a fundamental pillar. The future scenario suggests that to build public trust and ensure responsible AI use, governments must seriously address ethical issues. This includes clarifying data collection and use, preventing discrimination, and ensuring fairness in algorithm-based decisions. Establishing ethics committees and consulting with diverse stakeholders, including experts, academics, and community representatives, can assist governments in formulating effective ethical policies. These policies should be regularly reviewed to stay aligned with technological advancements and societal needs.

Sustainability and long-term impacts of AI use are also significant considerations in AI governance. The future scenario indicates that governments should continually assess the social, economic, and environmental effects of AI technologies. These assessments should address not only direct impacts on citizens' quality of life but also indirect consequences such as changes in the labor market and social

behaviors. Predictive models and simulations can help governments anticipate the outcomes of their decisions and develop suitable strategies for managing long-term changes.

Reviewing policies and regulations is of special importance in AI governance. The future scenario proposes that governments should regularly update AI-related laws to prevent negative societal impacts. These updates should strike a balance between supporting innovation and protecting citizens' rights against automated decisions. Additionally, enhancing the security and sustainability of AI systems must be prioritized. This includes developing security infrastructures, managing risks, and utilizing advanced techniques to prevent misuse and cyber threats. With AI technologies rapidly evolving, ensuring their security and stability is a primary government responsibility, which can improve citizens' quality of life and increase public trust.

Table 10. Scenario 9: Includes Components A4, B3, C7, D3

Component	Symbol
Data Protection and Privacy	A4
Sustainability and Long-term Impact Review	B3
Continuous Algorithm and Model Updates	C7
Technical Standards and Regulations	D3

In developing AI governance in smart governments, data protection and privacy are top priorities. The future scenario suggests that as AI use in public services increases, privacy and data security risks also grow. Governments must establish strong laws and protocols for collecting, storing, and processing personal data to prevent potential misuse. These protocols should be transparent, informing citizens of their rights concerning personal data. Creating independent regulatory bodies and employing encryption technologies can help increase public trust and ensure that data is managed securely and ethically.

Assessing the sustainability and long-term impacts of AI use should also be a central focus. The future scenario indicates that governments should continuously evaluate the economic, social, and environmental effects of AI technologies. These evaluations can include studying impacts on employment, social behavior changes, and environmental consequences of complex algorithms. Predictive modeling and data analysis can help identify potential challenges and design appropriate strategies to address them. Governments must also engage in public participation and incorporate societal feedback into their decision-making processes.

Continuous updates of algorithms and models are critical components of AI governance. The future scenario recommends that governments regularly review and update their algorithms to keep pace with technological advancements and societal changes. These updates should be informed by new data and ongoing analysis to maintain the quality and accuracy of AI decision-making. Establishing technical standards and regulations for AI technologies is also essential. These standards should include guidelines for developing, implementing, and evaluating AI systems to ensure they are used ethically and effectively. By adopting this approach, governments can support a secure and sustainable AI ecosystem that benefits society as a whole.

4. Discussion and Conclusion

The findings of this study highlight the multifaceted influence of artificial intelligence (AI) on governance processes, shedding light on both the opportunities and challenges that arise with the integration of AI in governmental operations. Despite a broad consensus among political science scholars about AI's impact, as emphasized in this research, the comprehensive scope and implications of such influence remain insufficiently explored. This is consistent with Williams (2021), who underscored the need for a more in-depth, multidisciplinary examination of AI’s role in shaping policy and governance frameworks [13]. Moreover, the necessity for further empirical studies to understand the nuances of AI governance has been echoed by several scholars [14, 15].

One of the key outcomes of this research is the identification of the need for global collaboration in AI governance. The idea of forming international coalitions for AI governance, which ensure public benefit and institutional mechanisms to prevent threats, aligns with Babbari Gonbad (2023), who explored China's strategic approach to AI governance and stressed the importance of regional cooperation in West Asia [10]. Similarly, Bianchi, Nasi, and Rivenbark (2021) discussed the complexities and challenges in implementing collaborative governance models and emphasized the role of shared governance structures in

achieving efficient outcomes [16]. The emphasis on global alliances is also supported by Fabregue (2024), who advocated for European regulatory perspectives that foster collaboration and harmonization across borders [17].

The findings also suggest that integrating advanced technologies can increase accessibility and reduce costs, a crucial strategy for improving governance efficiency. This is consistent with research by Firman, Supangkat, and Supangkat (2018), who identified smart governance as a critical success factor for smart cities, highlighting the importance of technology-driven accessibility [18]. The notion of using AI to streamline processes and make governance more responsive has been examined by Guenduez, Mettler, and Schedler (2019), who discussed the role of the Internet of Things (IoT) and AI in enhancing government responsiveness [19]. Furthermore, Bianchini, Müller, and Pelletier (2022) explored AI as a general method of invention, emphasizing its potential to revolutionize governance systems [20].

The study emphasizes the critical role of transparency and information sharing in AI governance. This is in line with Cepiku and Mastrodascio (2021), who argued that transparent leadership behaviors are fundamental in local government networks, ensuring trust and collaboration [21]. Additionally, enhancing knowledge-sharing mechanisms among government agencies, as well as between the government, citizens, and businesses, aligns with Fadda and Rotondo (2020), who examined high-performance governance networks and highlighted the significance of transparent information exchange [11]. Al-Nafjan (2022) also provided insights into the potential of AI-driven technologies, such as EEG signal analysis in neuromarketing, emphasizing the necessity of data transparency and ethical considerations in AI applications.

The results further point to the importance of continuously updating policies and regulations to address the rapid advancements in AI technology. This finding is supported by Babaeian, Safdari Ranjbar, and Hakim (2023), who emphasized that adaptive policy frameworks are essential for integrating AI into the public policy cycle effectively. The dynamic nature of AI necessitates frequent policy revisions to ensure that regulations remain relevant and protective of public interests [12]. Bharathi, Pramod, and Raman (2022) also underscored the role of predictive models in the financial sector, highlighting how AI's evolving nature requires constant regulatory updates [7].

Moreover, the emphasis on creating a conducive environment for knowledge sharing and collaboration through various platforms, including mobile technology, reflects the findings of Guenduez et al. (2018), who identified the critical success factors for smart government [19]. The call for improved openness and citizen engagement resonates with Heydari, Sajanian, and Nabizadeh (2021), who demonstrated how AI can diversify financial services and improve accessibility [22]. Lastly, the study's recommendations align with Hashmdar and Kurdi (2022), who explored the effectiveness of AI systems in human resources and stressed the importance of utilizing AI to optimize organizational functions [3].

To date, there has not been a comprehensive scientific examination of the impacts of artificial intelligence (AI) on governance processes worldwide. While most political science scholars, particularly those in comparative politics, agree on AI's influence on governance processes, the scope, dimensions, and outcomes of this impact have yet to be fully explored. This report has been written in response to the need for research in this area. It serves only as a preliminary introduction to the issue of AI governance, and further research is required. In the section on optimal AI governance, possible structures for the transition to AI management have been analyzed. In this context, emphasis has been placed on expanding effective tools for fostering collaboration and exploring the potential benefits of joint efforts. Additionally, the necessity of a global AI coalition has been highlighted—an ideal commitment to public welfare, incorporating institutional mechanisms to uphold principles such as the non-threat to others.

Based on the results obtained, the following recommendations are presented:

Utilizing modern technologies for operations by increasing accessibility and reducing the costs associated with these technologies.

Enhancing information transparency through the adoption of appropriate policies, monitoring their implementation, and providing the necessary infrastructure for effectively executing previous policies in this domain within the country.

Increasing the sharing of knowledge and information among government agencies and between the government, citizens, and businesses by establishing the necessary infrastructure for information exchange through various channels, such as mobile phones, to promote openness.

Authors' Contributions

Authors equally contributed to this article.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

All procedures performed in this study were under the ethical standards.

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