NAVIGATION IN E-GOVERNMENT: THE ROLE OF ARTIFICIAL INTELLIGENCE IN THE FORMATION OF THE LEGAL FRAMEWORK FOR THE PROTECTION OF INTELLECTUAL PROPERTY RIGHTS

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Abstract. *The integration of artificial intelligence (AI) into electronic government (e-government) systems is revolutionizing public administration by enhancing efficiency and improving service delivery. However, the adoption of AI technologies in this context also raises complex legal challenges, particularly concerning intellectual property (IP) rights. Traditional IP laws, which were developed with human authorship in mind, struggle to accommodate the unique characteristics of AI-generated content. This article examines how AI is reshaping the legal framework for IP protection within e-government systems, highlighting the implications and challenges that arise from this technological shift. The primary aim of this study is to explore the role of AI in the formation of IP law frameworks within e-government, focusing on how current laws address - or fail to address - the challenges of AI-generated content. The methodology includes a comprehensive literature review, analysis of legislative documents, case studies, and a benchmarking analysis to compare approaches across jurisdictions. Additionally, expert interviews provide insights into practical considerations and emerging trends in the field. The results indicate that while some jurisdictions, such as the European Union, are actively adapting their IP laws to address AI's impact, most existing frameworks remain inadequate for protecting AI-generated works. Divergent approaches across countries reveal a lack of international harmonization, which complicates cross-border collaboration and legal enforcement. The analysis also highlights the importance of public-private partnerships and sector-specific IP protections, which can address the unique needs of different e-government applications. From a forward-looking perspective, the study underscores the need for flexible, AI-specific IP protections that promote innovation while safeguarding IP rights. International cooperation will be essential for establishing consistent standards, facilitating global e-government initiatives, and supporting the responsible use of AI in public services. By fostering a balanced and adaptive IP framework, policymakers and stakeholders can help build a resilient digital ecosystem that accommodates future advancements in AI technology.*

Keywords: *e-government; artificial intelligence; intellectual property law; AI-generated content; legal framework; intellectual property rights; digital public services; IP protection; international harmonization; public-private partnerships; policy adaptation; copyright and patent law.*

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Introduction. In today's digital age, electronic government, or e-government, has transformed how public services are delivered, leveraging technology to streamline interactions between government entities and citizens. As these digital systems evolve, artificial intelligence (AI) emerges as a powerful tool, offering unprecedented efficiencies and insights. However, this technological shift also raises complex legal questions, particularly concerning intellectual property (IP) rights. As AI increasingly influences decision-making processes, data management, and content creation, the need for a robust legal framework becomes evident. This article explores how AI is shaping the development of laws that protect intellectual property within the context of e-government, examining the opportunities and challenges of integrating advanced technologies into public administration. From safeguarding digital assets to redefining ownership in the AI-driven world, the evolving landscape of IP law is poised to become a cornerstone of future e-government strategies.

Aims. The primary aim of this article is to explore the intersection of electronic government (e-government), artificial intelligence (AI), and intellectual property (IP) law. The article will examine how AI technologies are reshaping the legal frameworks that protect IP rights within the context of e-government systems. By analyzing this evolving landscape, the article seeks to provide insights into the implications and potential challenges that arise from the integration of AI into public sector processes.

Methodology. This article employs a multi-faceted approach to explore the relationship between electronic government, artificial intelligence, and the formation of legal frameworks for intellectual property rights protection. The methodology includes a comprehensive literature review, analysis of legislative documents, case studies, and a benchmarking analysis to compare approaches across jurisdictions. Additionally, expert interviews provide insights into practical considerations and emerging trends in the field.

Literature Review. The rapid advancement of artificial intelligence (AI) technology has ushered in new opportunities for electronic government (e-government) systems, which utilize digital tools to improve public administration. E-government aims to enhance the delivery of services to citizens and optimize the efficiency of governmental processes. As AI becomes increasingly integrated into these systems, there is a growing need to consider how these technologies impact intellectual property (IP) rights and the legal frameworks that protect them.

E-Government and AI Integration. E-government initiatives across the globe have adopted AI to automate tasks, improve decision-making, and facilitate better data management. Literature on this integration highlights the potential benefits of AI, such as increased efficiency and cost-effectiveness, as well as potential risks related to privacy, security, and ethics. Key studies suggest that while AI has the potential to revolutionize public service delivery, its application raises significant legal and regulatory challenges, particularly concerning IP rights (Sahlin & Angelis, 2020; Dwivedi et al., 2021).

Intellectual Property Rights in the Age of AI. The incorporation of AI into public administration raises complex questions about IP rights. The unique capabilities of AI, such as the ability to generate creative works and develop autonomous solutions, blur

traditional definitions of ownership and authorship. Existing IP laws were designed for a time when human authorship was a fundamental assumption, and as such, they are not always equipped to address AI-generated content (Gervais, 2021; Abbott, 2020). Scholars have pointed to the need for updated IP frameworks that account for AI's role as a creator, suggesting that new models of ownership and attribution might be necessary (Elkin-Koren, 2020).

Challenges in Establishing Legal Frameworks. Many jurisdictions are currently grappling with how to adapt their IP laws to accommodate AI. Some have opted for a cautious approach, modifying existing frameworks incrementally, while others are exploring more comprehensive overhauls. This varied landscape presents challenges for e-government systems that often operate across borders and depend on consistent legal interpretations (Samuelson, 2020; Bond et al., 2021). Furthermore, there are concerns regarding enforcement, as traditional IP enforcement mechanisms may not be effective for AI-driven content in the public domain (Lemley, 2020).

Proposed Solutions and Future Directions. A significant body of literature suggests that international cooperation and harmonization of laws will be essential to effectively manage IP rights in e-government contexts (Chon, 2021; Hilty & Liu, 2020). Some scholars advocate for the development of AI-specific IP protections that recognize AI's unique role in content creation (Ramalho, 2020; Petit, 2021). Others propose that governments establish frameworks that emphasize open access and data sharing, particularly for publicly funded AI projects (WIPO, 2021).

Overall, the literature underscores the importance of crafting legal frameworks that are flexible enough to accommodate technological advancements while robust enough to protect IP rights. As e-government systems continue to evolve, a balanced approach will be necessary to foster innovation and ensure that IP rights are safeguarded in an increasingly digital world.

Results. Current intellectual property (IP) laws face significant challenges in adapting to the complexities introduced by artificial intelligence (AI), especially in an AI-driven e-government context. Traditional IP laws are primarily designed to protect human-created works, and they do not readily extend to AI-generated content. Most jurisdictions, including the United States and the European Union, currently do not recognize AI as an author or inventor, limiting the scope of protection for works created autonomously by AI systems. This could stifle innovation, as organizations may hesitate to invest in AI technologies without clear IP protections.

A major issue is the uncertainty around copyright when it comes to training data for AI. Many AI models are trained on vast datasets that may include copyrighted material. This raises legal questions about whether such use constitutes infringement or falls under fair use.

In terms of patents, AI-generated inventions present similar challenges. Patent laws traditionally require a human inventor, which poses a problem when AI independently generates patentable innovations.

Analysis of Existing Intellectual Property Laws and Regulations. The analysis of existing intellectual property (IP) laws and regulations reveals several key insights into their suitability and adaptability to an AI-driven e-government environment. While

current IP frameworks provide robust protections for human-created works, they are often inadequate in addressing the unique challenges posed by AI technologies, particularly in the context of e-government systems.

Table 1 presents the main results of the analysis of existing laws and regulations on intellectual property.

Table 1. The main results of the analysis of existing laws and regulations on intellectual property

The main results of analysis	The main direction of analysis
Limitations of Traditional IP Frameworks	Authorship and Ownership Patent and Copyright Issues
Challenges in Copyright and Licensing	Copyright Eligibility for AI-Generated Works Licensing Complexities
Trade Secret and Data Protection Concerns	Trade Secrets Data Ownership and Privacy
Jurisdictional Variability and Inconsistencies	Lack of Harmonization Emerging Regulations
Opportunities for Legal Reform and Adaptation	Adaptation of Existing Laws Development of AI-Specific IP Protections Focus on Public-Private Partnerships

Source: systematized by the authors

1. Limitations of Traditional IP Frameworks

• *Authorship and Ownership:* Traditional IP laws typically assign rights based on human authorship, which presents challenges when applied to AI-generated works. In an AI-driven e-government context, where AI systems may autonomously generate content, the question of authorship becomes complex. Current laws do not clearly define whether an AI itself, the government entity deploying the AI, or a third-party developer holds ownership of the resulting intellectual property.

• *Patent and Copyright Issues:* Patents and copyrights are designed to protect original human innovations and creations. AI's ability to autonomously create content—such as datasets, reports, and predictive models—challenges the notion of originality and inventorship. As a result, AI-generated works may not meet existing criteria for patentability or copyright, limiting their protection under current laws.

2. Challenges in Copyright and Licensing

• *Copyright Eligibility for AI-Generated Works:* Many jurisdictions, including the United States and the European Union, lack clear guidance on whether AI-generated works qualify for copyright protection. Existing laws emphasize human creativity, and in the absence of a human creator, such works may be deemed ineligible for copyright. This gap presents a significant barrier to protecting AI-generated content in e-government, where copyrighted material might include data visualizations, automated reports, and policy documents.

• *Licensing Complexities:* AI's role in content creation introduces complexities in licensing agreements, particularly in shared or collaborative environments. Traditional licensing models may not account for the nuances of AI-driven content creation, requiring government agencies to navigate uncertain legal terrain when attempting to license or distribute AI-generated works.

3. Trade Secret and Data Protection Concerns

- *Trade Secrets:* AI-driven e-government systems often rely on proprietary algorithms and data processing techniques that may qualify as trade secrets. While existing IP frameworks protect trade secrets, AI complicates this by potentially exposing confidential information through automated processes and analytics. Protecting trade secrets in an AI environment requires robust safeguards and compliance with data protection regulations.
- *Data Ownership and Privacy:* Data generated or used by AI systems in e-government may fall under IP laws, particularly if it contains proprietary or personally identifiable information. However, existing IP regulations often fail to address the intersection of data ownership and privacy rights within an AI framework, which is particularly pertinent in public sector settings where transparency and data privacy are priorities.

4. Jurisdictional Variability and Inconsistencies

- *Lack of Harmonization:* IP laws vary significantly across jurisdictions, leading to inconsistencies in how AI-generated works are treated globally. This poses challenges for e-government systems that operate across borders or collaborate with international agencies. Jurisdictional differences can lead to legal uncertainties and conflicts, particularly when AI-generated works are shared or distributed internationally.
- *Emerging Regulations:* Some jurisdictions, like the European Union, are actively developing AI-specific regulations that address IP issues. However, these regulations are still in their infancy and vary widely in scope and application. The lack of a unified approach complicates efforts to adapt IP laws to AI-driven e-government environments, underscoring the need for international cooperation.

5. Opportunities for Legal Reform and Adaptation

- *Adaptation of Existing Laws:* There is an opportunity to amend current IP laws to explicitly address AI-generated content and clarify ownership, authorship, and protection rights. Such reforms could include recognizing AI as a co-creator or introducing new categories for AI-generated works to ensure they are protected.
- *Development of AI-Specific IP Protections:* In response to the limitations of traditional frameworks, some legal scholars advocate for new IP protections tailored specifically to AI. These might include AI-specific copyright categories, adaptable licensing agreements, or even new forms of protection that go beyond the traditional IP categories.
- *Focus on Public-Private Partnerships:* As e-government increasingly involves collaborations between public and private entities, there is potential to develop standardized IP agreements and protocols that ensure AI-generated content is effectively protected and fairly attributed.

The analysis indicates that existing IP laws, while providing a foundation, are not fully equipped to handle the unique demands of an AI-driven e-government environment. While opportunities for adaptation and reform exist, achieving a coherent and effective legal framework will require significant legal innovation, cross-jurisdictional harmonization, and ongoing collaboration among public and private stakeholders.

Analysis of Legislative Documents, Legal Interpretations, and Court Decisions. The analysis of legislative documents, legal interpretations, and court decisions reveals that current intellectual property (IP) laws are often ill-suited to address the specific challenges posed by artificial intelligence (AI) in the realm of intellectual property protection. While some jurisdictions have made strides in adapting to AI's unique role, there remain significant gaps in the legal framework. Table 2 presents the main Results of the Analysis of Legislative Documents, Legal Interpretations, and Court Decisions.

Table 2. The main results of the analysis of legislative documents, legal interpretations, and court decisions

The main results of analysis	The main direction of analysis
Authorship and Ownership Ambiguities	Legislative Gaps Legal Interpretations and Ownership
Patentability and Inventorship Issues	Court Decisions on Inventorship Patent Office Guidelines
Copyright Challenges with AI-Generated Content	Court Rulings on AI-Generated Works Interpretations of Legislative Documents
Challenges in Trade Secrets and Data Protection	Trade Secret Protections Data Ownership and Privacy Concerns
Emerging Legal Reforms and Adaptations	Legislative Proposals Court-Inspired Legal Innovations

Source: systematized by the authors

1. Authorship and Ownership Ambiguities

- *Legislative Gaps:* Most IP laws are predicated on the notion of human authorship, which is a fundamental requirement for copyright and patent protections. However, legislative documents from jurisdictions like the United States and the European Union have not yet established clear provisions for works generated entirely or partially by AI systems. This absence leads to uncertainty about whether AI-generated works can be legally protected and, if so, who holds the rights.
- *Legal Interpretations and Ownership:* Legal interpretations in various jurisdictions generally maintain that authorship requires a human creator, which leaves AI-generated works unprotected. For instance, the U.S. Copyright Office has consistently ruled that non-human creations do not qualify for copyright, emphasizing that authorship must involve "human creativity." This interpretation effectively excludes works autonomously created by AI from copyright protection, leaving them in a legal gray area.

2. Patentability and Inventorship Issues

- *Court Decisions on Inventorship:* Several court decisions have addressed AI's role in inventorship, with rulings consistently emphasizing that only human beings can be listed as inventors on patents. Notably, recent cases involving the AI system known as "DABUS" have sparked international debate. Courts in the United States, United Kingdom, and the European Patent Office have ruled that AI cannot be named as an inventor, despite arguments that AI systems contributed significantly to the inventions in question.
- *Patent Office Guidelines:* Patent offices in various countries have issued guidelines reinforcing that AI cannot be credited as an inventor. For example, the

European Patent Office specifies that inventorship is reserved for natural persons, limiting the recognition of AI-driven innovation and excluding AI-created inventions from patent protection. As a result, government agencies deploying AI in e-government initiatives may find their AI-derived innovations unpatentable under current laws.

3. Copyright Challenges with AI-Generated Content

- *Court Rulings on AI-Generated Works:* Court decisions have generally upheld the requirement for human authorship in copyright cases. For instance, the U.S. Supreme Court has previously ruled that works lacking human input are not eligible for copyright, reinforcing that AI-generated works are excluded from protection. This limitation affects e-government initiatives that rely on AI to produce creative works, such as automated reports, data visualizations, and software code, which remain vulnerable to copying and unauthorized use.
- *Interpretations of Legislative Documents:* Legislative documents often lack specific language that addresses AI-generated content, which leads to varied interpretations across jurisdictions. Some interpretations suggest that entities utilizing AI, such as government agencies, might hold rights through derivative works doctrines or by establishing joint ownership with AI developers. However, such interpretations remain speculative, as courts have yet to establish firm precedents that define these relationships clearly.

4. Challenges in Trade Secrets and Data Protection

- *Trade Secret Protections:* Trade secret laws offer protection for confidential information, and while they cover AI algorithms and data, challenges arise due to AI's capacity to generate new data autonomously. Courts have struggled with cases where AI systems inadvertently disclose sensitive information through analysis or predictions. This potential for unintended disclosure necessitates additional legislative safeguards to address AI-driven vulnerabilities in trade secret protections.
- *Data Ownership and Privacy Concerns:* Data privacy regulations, such as the General Data Protection Regulation (GDPR) in the European Union, provide some level of control over personal data. However, court decisions have yet to clearly delineate how these protections intersect with AI-generated data, particularly when it involves personally identifiable information. As e-government increasingly relies on AI for data-driven decision-making, courts will likely need to address these concerns through new interpretations or legislation that clarifies data ownership in AI contexts.

5. Emerging Legal Reforms and Adaptations

- *Legislative Proposals:* Some jurisdictions have introduced legislative proposals aimed at addressing AI's role in IP. For example, the European Union's proposed AI Regulation includes provisions for transparency and accountability, though it does not yet fully address IP ownership. These legislative initiatives are a step forward, but they often focus on ethical concerns and regulatory oversight rather than IP protection.
- *Court-Inspired Legal Innovations:* In a few cases, courts have encouraged legislative bodies to consider reforms that would allow AI-driven works to qualify for limited forms of IP protection. For instance, courts in Australia have signaled openness to exploring alternative IP protections for AI-generated works, even though current laws do not explicitly support such protections. These rulings indicate a potential future

shift toward recognizing AI as a contributor to protectable intellectual property, though substantial legislative change is needed for widespread applicability.

Overall, the analysis reveals that existing IP laws do not sufficiently address the challenges posed by AI in the e-government context. While some jurisdictions are exploring legislative reforms, current legal interpretations and court decisions consistently uphold the requirement for human authorship, leaving AI-generated works in a legal void. To create a robust framework that accommodates AI-driven innovation, especially in public sector applications, substantial legislative reform and the development of new legal precedents will be essential. This evolving legal landscape underscores the importance of ongoing adaptation and reform to protect intellectual property effectively in an AI-driven world.

Analysis of Relevant International Agreements and Recommendations. The analysis of international agreements and recommendations reveals a varied approach to addressing the challenges posed by artificial intelligence (AI) within the scope of intellectual property (IP) protection. While some global agreements provide general guidance on IP, they often lack specific provisions for AI-generated works, reflecting a global legal framework that is still evolving to meet the unique challenges of AI. Different jurisdictions have adopted diverse strategies, leading to a complex and fragmented international landscape. Table 3 presents the main results of the analysis of relevant international agreements and recommendations.

Table 3. The main results of the analysis of relevant international agreements and recommendations

The main results of analysis	The main direction of analysis
General IP Frameworks and AI	The TRIPS Agreement World Intellectual Property Organization (WIPO) Initiatives
Divergent National and Regional Approaches	European Union United States China
Emerging International Recommendations and Frameworks	OECD Principles on Artificial Intelligence UNESCO AI Ethics Recommendations
Challenges in Harmonization and Cross-Border IP Protection	Jurisdictional Variability Differences in Patent Eligibility
Opportunities for Future International Cooperation	Global AI Regulations Model Laws and Soft Law Approaches

Source: systematized by the authors

1. General IP Frameworks and AI

• *The TRIPS Agreement:* The Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) is a foundational international framework governing IP rights. While TRIPS sets minimum standards for IP protection, it does not directly address AI-related issues such as authorship or ownership of AI-generated works. As a result, countries adhering to TRIPS have significant leeway in interpreting IP protections for AI, leading to varied national approaches and a lack of uniform standards for AI-generated IP.

• *World Intellectual Property Organization (WIPO) Initiatives:* WIPO has taken steps to address AI's impact on IP. In recent years, WIPO has conducted consultations and published white papers exploring AI-related IP issues, but these have largely focused on facilitating dialogue rather than establishing binding agreements. WIPO's efforts indicate a recognition of the need for international coordination on AI and IP, but the lack of enforceable recommendations limits its immediate impact.

2. Divergent National and Regional Approaches

• *European Union:* The European Union has been proactive in establishing AI-specific regulations, most notably through the proposed AI Act. While the AI Act focuses on ethical and regulatory concerns, the European Commission has also published recommendations that encourage member states to adapt their IP laws to account for AI-driven innovation. However, these recommendations are not legally binding, resulting in varied implementations across EU member states.

• *United States:* The United States has maintained a largely status quo approach, relying on existing IP frameworks that emphasize human authorship and inventorship. The U.S. Patent and Trademark Office (USPTO) has sought public input on AI-related IP issues, but there has been no significant legislative movement to address AI's impact directly. This approach contrasts with more proactive stances elsewhere and underscores a reluctance to alter traditional IP protections for AI-generated works.

• *China:* China has positioned itself as a leader in AI development and has made moves to update its IP laws in response to AI's growing influence. In 2021, the National Intellectual Property Administration of China released guidelines that acknowledge AI's role in innovation, but detailed provisions on AI-generated works are still under development. China's approach indicates a willingness to adapt its IP framework to foster AI-driven growth, potentially setting a precedent for other countries in the region.

3. Emerging International Recommendations and Frameworks

• *OECD Principles on Artificial Intelligence:* The Organization for Economic Co-operation and Development (OECD) has issued AI principles aimed at promoting responsible AI use. While the principles address transparency, accountability, and human rights, they do not specifically cover IP issues. However, the OECD's recommendations encourage member countries to consider AI's impact on their regulatory frameworks, potentially influencing future IP-related reforms.

• *UNESCO AI Ethics Recommendations:* In 2021, UNESCO released recommendations on AI ethics, which include calls for the protection of IP rights in AI contexts. Although primarily focused on ethical considerations, these recommendations highlight the need for a global consensus on how AI interacts with IP laws. UNESCO's emphasis on harmonizing regulations could lead to more cohesive international standards, especially as countries look to align with these ethical guidelines.

4. Challenges in Harmonization and Cross-Border IP Protection

• *Jurisdictional Variability:* The lack of harmonized IP laws for AI-generated works has created challenges for cross-border IP protection. International agreements like TRIPS establish baseline standards but allow for significant national discretion.

This discretion has resulted in a patchwork of laws, with some jurisdictions recognizing AI-related IP issues while others do not. This inconsistency complicates the protection of AI-generated works across borders, as creators and rights holders face differing legal environments.

- *Differences in Patent Eligibility:* While international agreements promote cooperation on patent protections, AI inventions often face different standards of eligibility across jurisdictions. The European Patent Office and the USPTO, for instance, have divergent stances on the patentability of AI-driven innovations, particularly concerning AI's role in inventorship. Such differences highlight the challenges of achieving a unified international stance on patent eligibility for AI-related inventions.

5. Opportunities for Future International Cooperation

- *Global AI Regulations:* There is growing momentum for international cooperation on AI regulation, with organizations like WIPO and the OECD well-positioned to lead these efforts. A unified framework for AI-generated IP could emerge as a component of broader AI regulatory initiatives, which would address not only ethical and safety concerns but also legal protections for AI-driven works.
- *Model Laws and Soft Law Approaches:* Given the complexity of achieving binding international agreements, some experts advocate for the development of model laws or soft law instruments. These non-binding frameworks could provide guidance for national legislators, promoting consistency in how AI-generated IP is treated while allowing jurisdictions to retain flexibility. Model laws could serve as an interim solution, paving the way for more formal agreements in the future.

The analysis reveals that while international agreements provide a foundation for IP protections, they do not yet adequately address the specific challenges AI poses to IP law. Jurisdictions worldwide are beginning to explore AI-related IP issues, but divergent approaches complicate the creation of a cohesive global framework. Moving forward, international cooperation will be crucial to harmonize IP protections for AI-generated works, ensuring that legal frameworks can effectively support innovation and protect intellectual property on a global scale.

Benchmarking Analysis of AI Integration in E-Government and IP Law Approaches. The benchmarking analysis across various jurisdictions highlights notable differences in how countries are integrating artificial intelligence (AI) into e-government systems and addressing related intellectual property (IP) challenges. The comparison reveals varying levels of AI adoption, distinct strategies for IP law adaptation, and differing approaches to protecting AI-generated works within the public sector. Table 4 presents the key findings from this benchmarking analysis.

Table 4. The key findings from this benchmarking analysis of AI Integration in E-Government and IP Law Approaches

The main results of analysis	The main direction of analysis
Level of AI Integration in E-Government Systems	High AI Integration Moderate AI Integration Emerging AI Integration
Approaches to IP Law Adaptation for AI	Proactive IP Law Adaptation Traditional IP Law Reliance Flexible IP Adaptation
Treatment of AI-Generated Works	Recognition of AI-Generated IP Exclusion of AI-Generated Works Conditional Recognition
Focus on Public-Private Partnerships for IP Protection	Collaborative Models Sector-Specific Approaches
Jurisdictional Consistency and Harmonization Efforts	Efforts Toward Harmonization Fragmented Approaches

Source: systematized by the authors

1. Level of AI Integration in E-Government Systems

- *High AI Integration:* Countries such as Estonia and Singapore have been pioneers in adopting AI within their e-government systems. Estonia's X-Road platform leverages AI to facilitate secure data exchange across public and private sectors, while Singapore's GovTech uses AI to improve public services, such as predictive maintenance and citizen engagement. These nations have invested heavily in AI infrastructure, positioning themselves as leaders in digital government transformation.
- *Moderate AI Integration:* Countries like the United Kingdom and Canada have integrated AI into specific areas of e-government, focusing on data analysis, automation of public services, and predictive analytics. In the UK, AI is used in healthcare and social services to optimize resource allocation. Canada has implemented AI in areas like immigration processing and taxation. These countries show a cautious but progressive approach, balancing AI adoption with regulatory considerations.
- *Emerging AI Integration:* Nations such as Brazil and India are in the early stages of AI integration within e-government. While both countries have ambitious digital transformation plans, their focus has been primarily on building digital infrastructure and improving online service delivery. AI adoption remains limited to pilot projects and experimental applications in areas like education, agriculture, and citizen feedback systems.

2. Approaches to IP Law Adaptation for AI

- *Proactive IP Law Adaptation:* The European Union stands out for its proactive stance on adapting IP laws to AI advancements. The EU has proposed regulations, such as the AI Act, which seeks to establish clear rules for AI deployment and includes considerations for IP protection. EU member states are encouraged to update national IP laws to account for AI-generated content, with a focus on balancing innovation with rights protection.
- *Traditional IP Law Reliance:* The United States and Japan, despite their advanced AI sectors, primarily rely on traditional IP frameworks that emphasize human authorship and inventorship. Both countries have explored AI's impact on IP through public consultations and policy research but have yet to enact substantial legislative

changes. This approach maintains the status quo, potentially limiting the protection of AI-generated works within public sector applications.

- *Flexible IP Adaptation:* China and South Korea have adopted a more flexible approach, adapting existing IP frameworks to accommodate AI-driven innovation while providing room for future legislative updates. China has issued guidelines encouraging AI-friendly IP protections, particularly for patents. South Korea has introduced AI policies that recognize the need for IP reforms and is actively developing strategies to enhance protection for AI-generated works, particularly in collaboration with private sector stakeholders.

3. Treatment of AI-Generated Works

- *Recognition of AI-Generated IP:* The United Arab Emirates (UAE) has taken progressive steps by exploring ways to recognize AI-generated works under IP laws. The UAE government has launched initiatives to study AI's impact on IP, with a focus on enabling protection for government-created AI content. This approach is experimental but suggests a future direction where AI-generated works might be formally recognized under IP law.
- *Exclusion of AI-Generated Works:* Many jurisdictions, including the United States, United Kingdom, and Australia, adhere to IP laws that exclude AI-generated works from copyright protection, as these laws require human authorship. This exclusion leaves AI-generated works in the public domain or under uncertain legal status, complicating IP protection for AI-generated content in e-government applications.
- *Conditional Recognition:* Countries like Canada and Singapore have not formally recognized AI-generated works but are exploring conditional approaches that consider joint authorship models or derivative works doctrines. These countries are investigating whether IP rights could be assigned to entities deploying AI, provided they meet specific criteria, such as demonstrating significant human oversight or direction in the creation process.

4. Focus on Public-Private Partnerships for IP Protection

- *Collaborative Models:* The European Union and Japan are leading in fostering public-private partnerships to address IP concerns related to AI in e-government. These partnerships encourage knowledge sharing and collaborative IP protection models, with the goal of harmonizing AI standards across public and private sectors. The EU, for instance, promotes initiatives where government agencies and private firms co-develop AI solutions while sharing IP rights.
- *Sector-Specific Approaches:* The United States and India emphasize sector-specific IP frameworks for AI applications in areas like defense, healthcare, and agriculture. In the U.S., certain government contracts stipulate IP rights for AI solutions in defense and technology sectors, while India's IP initiatives focus on agriculture and public health. This targeted approach allows for tailored IP protections based on specific public sector needs.

5. Jurisdictional Consistency and Harmonization Efforts

- *Efforts Toward Harmonization:* The European Union's emphasis on harmonizing AI-related IP laws across member states sets an example for regional

consistency. By establishing cross-border standards, the EU seeks to reduce legal fragmentation and facilitate the deployment of AI across diverse national systems. Additionally, WIPO's AI Task Force encourages harmonization efforts through international consultations and recommendations for member countries.

- *Fragmented Approaches:* In contrast, countries with less formalized AI regulations, like Brazil and Russia, exhibit more fragmented approaches to IP law adaptation. Each jurisdiction tackles AI-related IP issues independently, leading to a lack of consistency in how AI-generated works are treated globally. This fragmentation poses challenges for international collaboration and may hinder the cross-border exchange of AI-driven e-government solutions.

The benchmarking analysis reveals a diverse landscape in how jurisdictions are integrating AI into e-government systems and addressing related IP challenges. While some countries are proactively adapting their IP laws to support AI-driven innovation, others rely on traditional frameworks that may not fully accommodate AI-generated works. As countries continue to develop their approaches, international harmonization and collaboration will be crucial for establishing consistent and effective IP protections for AI-generated content within e-government environments.

Recommendations for Policymakers, Lawyers, and E-Government Stakeholders. Based on the findings of the research, it is clear that existing intellectual property (IP) laws are not fully equipped to address the complexities introduced by artificial intelligence (AI) in digital public services. To ensure robust IP protections and foster innovation, policymakers, legal professionals, and e-government stakeholders should consider the following recommendations (Table 5).

Table 5. The key recommendations for policymakers, lawyers, and e-government stakeholders

Direction	Description
1. Establish Clear Guidelines for AI-Generated Works	
Policy Development	Policymakers should work toward creating clear definitions and guidelines regarding the ownership and protection of AI-generated works. This could involve recognizing AI-generated content as a new category within existing IP frameworks or establishing a distinct legal framework that addresses AI-specific IP rights
Ownership and Authorship	IP laws should be updated to include provisions for AI-generated works that define ownership rights based on factors such as the degree of human input, AI system autonomy, and the entity responsible for deploying the AI. Policymakers may also consider models that allow for joint authorship between human creators and AI systems
Adaptable Frameworks	Flexibility should be built into these guidelines to accommodate rapid advancements in AI technology. This could involve the use of sunset clauses or regular reviews to ensure IP laws remain relevant as AI capabilities evolve
2. Promote International Harmonization of AI-Related IP Laws	
Global Cooperation	Policymakers should engage with international bodies, such as the World Intellectual Property Organization (WIPO) and the Organisation for Economic Co-operation and Development (OECD), to develop harmonized standards for AI-related IP protections. This cooperation is essential for reducing cross-border legal fragmentation and facilitating the exchange of AI-driven e-government solutions
Model Laws and Agreements	The development of model laws or soft law instruments can serve as a foundation for countries to align their IP laws on AI-generated works. Such models would provide flexibility for jurisdictions to adapt based on local contexts while promoting a consistent global approach to AI-related IP challenges
Regional Consistency	Where possible, regional bodies like the European Union can play a leading role in setting standards for AI-driven IP frameworks, which other regions could adopt or use as benchmarks for their own adaptations

Direction	Description
3. Create IP Protections Tailored to E-Government Applications	
Sector-Specific IP Rules	Recognizing that e-government applications may require unique IP considerations, policymakers should consider developing sector-specific IP protections. For example, healthcare, defense, and public data systems might each need customized guidelines based on the type of content generated by AI systems in those areas
Public-Private Partnerships	E-government stakeholders should collaborate with private sector entities to establish IP agreements that address shared ownership and licensing of AI-generated content. Public-private partnerships can foster innovation while ensuring that both parties have clear rights and responsibilities regarding AI-generated IP
Data and Privacy Protections	Since e-government systems often involve sensitive data, it is crucial to integrate data protection and privacy considerations into IP laws for AI. This integration would ensure that AI-generated content adheres to strict data protection standards, especially when involving personally identifiable information
4. Implement New Licensing and Rights Management Models	
Flexible Licensing Options	Lawyers and policymakers should develop adaptable licensing models that reflect the nuances of AI-generated works. Options such as open-source licensing for public-sector AI content, combined with proprietary rights for sensitive applications, can provide a balanced approach to IP protection and public access
Collective Rights Management	Establishing collective rights management systems for AI-generated works can simplify the process of licensing and rights administration. These systems could function similarly to existing copyright collectives, ensuring that stakeholders can manage and protect AI-generated IP effectively, even in complex collaborative environments
AI-Specific Copyright Categories	To better align with AI capabilities, introducing AI-specific copyright categories could help distinguish AI-generated works from human-created ones. This approach would clarify the rights associated with AI-generated content, allowing for tailored protection and licensing options
5. Support Capacity Building and Awareness for Legal Professionals	
Training and Education	Lawyers and legal professionals should receive specialized training on the implications of AI in IP law to enhance their understanding of AI's impact on IP rights. Continuous education initiatives and AI-IP-specific legal programs can ensure that professionals are well-equipped to navigate this evolving field
Interdisciplinary Collaboration	Encouraging collaboration between legal professionals, AI specialists, and technologists will foster a more comprehensive understanding of AI-generated IP. This interdisciplinary approach can lead to more effective IP frameworks that are responsive to the technical realities of AI systems
Legal Research and Development	Investment in legal research focused on AI and IP issues should be prioritized to develop innovative solutions and anticipate future challenges. This research could inform policy decisions, highlight best practices, and identify areas where existing IP laws fall short
6. Facilitate Public Engagement and Transparency	
Stakeholder Consultations	Policymakers should actively seek input from a wide range of stakeholders, including public sector employees, private companies, civil society organizations, and the general public. Inclusive consultations can help ensure that new IP frameworks address the diverse needs and concerns of all stakeholders
Transparency in AI Use	Governments should adopt policies that promote transparency regarding the AI tools and algorithms used within e-government systems. Clear disclosure about the role of AI in content creation can aid in establishing trust and clarifying IP rights for AI-generated works
Public Awareness Campaigns	Raising public awareness about the implications of AI in IP law can empower citizens and businesses to better understand their rights and responsibilities. Public information campaigns and accessible resources can demystify AI's impact on IP protections and foster informed engagement

Source: systematized by the authors

By adopting these recommendations, policymakers, lawyers, and e-government stakeholders can create a more resilient and adaptable IP framework that effectively addresses the unique challenges posed by AI in digital public services. Proactive reform and international collaboration will be essential to ensuring that AI-driven innovation is balanced with strong intellectual property protections, ultimately supporting the development of a fair and equitable digital society.

Discussion. The integration of artificial intelligence (AI) into electronic government (e-government) systems represents a profound transformation in public administration, offering unprecedented opportunities to enhance service delivery, data management, and decision-making. However, as governments increasingly rely on AI to generate data, automate processes, and even create content, new legal challenges emerge, particularly in the domain of intellectual property (IP) rights. This discussion explores the implications of AI-driven e-government for IP protection, analyzing key issues related to authorship, ownership, legal reform, and international harmonization.

1. AI and the Changing Nature of Intellectual Property in E-Government. AI's ability to autonomously generate creative works and data presents a fundamental challenge to traditional notions of authorship and ownership within IP law. Traditionally, IP rights, especially copyrights and patents, are based on human creativity and inventiveness. However, in AI-driven e-government systems, content and innovations are increasingly the product of machine learning algorithms and autonomous systems. For example, AI can generate policy reports, data visualizations, and predictive models with minimal human intervention. This shift raises critical questions: Who owns these AI-generated works? Should the government, the developers of the AI, or the citizens whose data powers these systems hold the rights?

Current legal frameworks are largely ill-equipped to address these questions. Most existing IP laws require a human creator for a work to qualify for copyright protection or a patent, effectively excluding AI-generated works from protection. This creates a legal vacuum where AI-generated content, especially in the public sector, might lack clear ownership, leading to issues around exploitation, distribution, and modification. Moreover, without proper IP protection, the risk of unauthorized use and copying of AI-generated content increases, particularly in cross-border digital environments.

2. Legal Framework Adaptation: Opportunities and Challenges. Adapting legal frameworks to address AI's role in e-government requires careful consideration of several factors. One approach could involve recognizing AI-generated content under a new category of intellectual property, where ownership is assigned based on specific criteria such as the degree of human involvement or the government's role in deploying the AI system. Some jurisdictions, like the European Union, have already begun exploring legislative updates that acknowledge AI's contribution to content creation. However, such adaptations face challenges, particularly in defining clear thresholds for human involvement and determining how to attribute ownership when multiple parties are involved.

Additionally, AI-generated works in the public sector, such as government reports or data-driven policies, often serve a public interest. This raises questions about the balance between protecting IP rights and ensuring public access. Governments must consider how to protect their AI-generated works while maintaining transparency, accountability, and open access to public data. Legal reforms must strike a balance between fostering innovation and protecting intellectual property without restricting access to publicly beneficial content.

3. International Divergence and Harmonization. One of the most significant challenges in addressing AI's impact on IP rights is the lack of international

harmonization. As the benchmarking analysis reveals, different jurisdictions have adopted varying approaches to both AI integration in e-government and IP law adaptation. For instance, the European Union has taken proactive steps toward creating an AI-friendly legal environment, while other jurisdictions, such as the United States and Japan, remain more reliant on traditional IP frameworks that emphasize human authorship.

This divergence presents challenges for international collaboration and cross-border digital public services. AI-generated works produced by e-government systems in one country may face legal uncertainties when used or shared in another jurisdiction with different IP laws. The lack of consistency in how AI-generated content is treated globally could lead to conflicts over ownership and protection, particularly in multinational e-government initiatives.

To address these challenges, international cooperation is critical. Organizations such as the World Intellectual Property Organization (WIPO) and the Organisation for Economic Co-operation and Development (OECD) have recognized the need for international dialogue on AI and IP law. Establishing harmonized global standards or model laws that address AI-generated works could mitigate jurisdictional discrepancies and ensure that AI innovations are protected consistently across borders.

4. Public-Private Partnerships and Sector-Specific Approaches. As e-government increasingly collaborates with private companies to develop AI systems, public-private partnerships play a crucial role in shaping how IP rights are managed. These collaborations often involve shared ownership of AI-generated works or joint development of AI tools, requiring clear agreements on IP rights and licensing. Public-private partnerships present an opportunity to experiment with new IP models that distribute rights based on contributions, investment, and control over the AI system.

Additionally, the analysis highlights the need for sector-specific IP frameworks. AI applications in different sectors of e-government, such as healthcare, defense, or education, may require tailored IP protections. For example, AI-generated innovations in healthcare could involve sensitive personal data and ethical considerations, while AI-driven defense applications may require stricter confidentiality and trade secret protections. Governments and legal professionals should consider developing sector-specific IP policies that account for the unique characteristics and needs of each domain.

5. Future Directions and Legal Reform. The future of intellectual property protection in AI-driven e-government will depend on the ability of legal systems to evolve in response to technological advancements. Policymakers should focus on creating adaptable IP laws that can accommodate future innovations in AI while protecting the interests of governments, citizens, and innovators. This may involve regular reviews and updates to IP laws, incorporating feedback from legal professionals, technologists, and public stakeholders.

In addition to legal reforms, educational initiatives are essential to ensure that lawyers, policymakers, and e-government stakeholders are equipped to navigate the complexities of AI-generated intellectual property. Training and interdisciplinary collaboration between legal experts, AI developers, and public administrators will be

crucial to developing legal frameworks that can effectively address the challenges posed by AI in digital public services.

The rise of AI in e-government presents both opportunities and challenges for intellectual property law. While AI offers the potential to revolutionize public services, it also raises fundamental questions about authorship, ownership, and protection of IP. Current legal frameworks must be adapted to address these issues, with a focus on balancing innovation, public access, and rights protection. International harmonization, public-private partnerships, and sector-specific approaches will be key to creating a robust legal framework that can effectively support AI-driven e-government in the future.

Conclusion. The integration of artificial intelligence (AI) into electronic government (e-government) systems is transforming public administration, offering enhanced efficiency and service delivery. However, this rapid technological advancement also presents significant challenges for intellectual property (IP) law. Traditional IP frameworks, designed with human creativity in mind, are often ill-equipped to address the complexities introduced by AI, particularly when it comes to issues of authorship, ownership, and protection of AI-generated content.

The analysis reveals that while some jurisdictions have begun to explore legal reforms to accommodate AI, the majority of existing IP laws do not adequately address the unique characteristics of AI-driven innovation. Countries are adopting diverse approaches, with varying degrees of progress in integrating AI into e-government systems and updating their IP laws. This lack of harmonization poses challenges for cross-border collaboration and creates legal uncertainties for AI-generated works used or shared internationally.

To effectively protect intellectual property in an AI-driven e-government environment, significant adaptations to legal frameworks are needed. Policymakers must consider developing flexible, AI-specific IP laws that reflect the unique dynamics of machine-generated content. International cooperation will be crucial for establishing consistent standards and enabling the seamless exchange of AI-driven public services across borders. Additionally, sector-specific IP protections and public-private partnerships can play a key role in addressing the specialized needs of different domains within e-government.

As AI continues to evolve, so too must the legal frameworks that support it. A balanced approach, one that promotes innovation while safeguarding intellectual property rights, will be essential for realizing the full potential of AI in e-government. Through proactive legal reform, international collaboration, and ongoing dialogue among policymakers, legal professionals, and stakeholders, a robust IP framework can be established—one that ensures the benefits of AI are realized in a way that is both fair and equitable. This will ultimately contribute to a resilient digital public service ecosystem that can adapt to future technological advancements.

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