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## Article

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## Article

# Integrating Artificial Intelligence into Public Administration: Challenges and Vulnerabilities

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**Abstract:** This study explores the application of artificial intelligence (AI) in public administration, examining its potential to enhance efficiency, sustainability, and resilience in government actions. The research develops a theoretical framework to assess the relationship among AI integration, governance improvements, and economic benefits, as measured by key components of the Digital Economy and Society Index (DESI). Utilizing factor analysis and ordinary-least-squares (OLS) regression, this study provides empirical insights into how AI-driven applications contribute to public service delivery and economic growth. The findings highlight that AI has the potential to improve governance significantly. Still, the transition to AI-enhanced public administration is accompanied by challenges such as algorithmic bias, cybersecurity risks, workforce adaptation, and ethical issues. This study emphasizes the need for robust governance structures, comprehensive security measures, and active public involvement to address these challenges. By proposing a clear framework for managing AI integration, this research contributes to the literature on digital transformation in the public sector and offers actionable insights for policymakers and practitioners. Future research should examine AI's broader applications across diverse public sector contexts, ensuring that governance remains aligned with democratic values, public trust, and long-term sustainability.

**Keywords:** artificial intelligence; public administration; governance frameworks; AI governance; service delivery



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## 1. Introduction

Advancements in artificial intelligence (AI) have garnered significant interest from researchers and practitioners, unveiling a wide array of opportunities for its application in the public sector. AI has the potential to enhance governmental efficiency, optimize decision-making processes, and improve public service delivery. By automating routine tasks, analyzing vast datasets, and enabling data-driven policymaking, AI can contribute to more transparent, responsive, and citizen-focused governance. However, the impact study of AI's use in the public administration process shows these benefits require the in-depth addressing of key challenges, including ethical considerations, data privacy concerns, algorithmic biases, and robust regulatory frameworks. A strategic approach to AI integration can ensure that its adoption in public sector actions fosters innovation while upholding democratic values and the public's trust. The growing adoption of AI in public administration, particularly within the context of the ongoing developmental doctrine on smart cities (Son et al., 2023), highlights the transformative potential of these technologies to enhance transparency (Wolniak & Stecuła, 2024), optimize resource allocation, and improve

public engagement (Abdullah Kaiser, 2024). Nevertheless, the absence of a comprehensive understanding of AI-driven mechanisms, their legal implications, and the challenges they pose presents a significant barrier to their effective implementation. Public administrations must manage a delicate balance between leveraging AI's capabilities and safeguarding the public's trust, equity, and safety (Hattab et al., 2025). The integration of AI into public administration activities and processes introduces complex challenges and vulnerabilities that must be carefully addressed to ensure its responsible and equitable use. Although AI-powered machines have significantly shaped societal evolution in the 21st century and have offered promising opportunities for scholars, their impacts on public administration development remain uncertain despite growing attention. Studies indicate that further analysis is needed to fully understand these effects and their implications (Correia et al., 2024; Reis et al., 2019; Young et al., 2019).

Advancements in artificial intelligence (AI) have garnered significant interest from researchers and practitioners, unveiling a wide array of opportunities for its application in the public sector. Historically, the adoption of AI in public administration dates back to the emergence of expert systems in the 1980s, primarily supporting tax auditing, fraud detection, and basic decision support in sectors like social security and municipal services (Mergel et al., 2019; Wirtz et al., 2019). The evolution of AI policy frameworks accelerated in the early 2000s with the rise of e-Government initiatives, which laid the foundation for data-driven public services (Criado & Gil-Garcia, 2019). Over the past decade, breakthroughs in machine learning, big-data analytics, natural language processing, and cloud computing have fueled a new wave of AI integration, transforming governance paradigms across advanced economies and emerging markets alike (Madan & Ashok, 2023; Janssen et al., 2020).

From a theoretical standpoint, several frameworks explain this progression. The technology–organization–environment (TOE) framework (Baker, 2011) provides a holistic view, emphasizing how external pressures (regulatory demands), internal organizational readiness (digital skills and infrastructure), and technological advancements (AI maturity) interact to shape AI adoption in the public sector. Additionally, the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003; Sarfaraz, 2017) identifies performance expectancy, effort expectancy, social influence, and facilitating conditions as the key drivers of public managers' acceptance of AI technologies. These frameworks are essential for understanding why some governments adopt AI rapidly while others lag behind. Ethical and governance-oriented models also provide valuable insights. The OECD's (2019) Principles on AI and Floridi and Cowls's (2022) Unified Framework (2022) emphasize trustworthy AI, focusing on transparency, accountability, human-centered values, and risk management. These frameworks are crucial, as public administrators balance innovation with ethical imperatives, especially in areas like algorithmic bias, data privacy, and algorithmic accountability (Zuiderwijk et al., 2021). Globally, pioneering countries, such as Estonia, Singapore, and the United Arab Emirates, have been at the forefront of AI integration in governance. Estonia's X-Road platform, for example, has enabled secure data exchange across government entities, while Singapore's Smart Nation initiative utilizes AI for predictive policy modeling and citizen-centric services (Yigitcanlar et al., 2023). These early adopters showcase the transformative potential of AI for enhancing administrative efficiency, responsiveness, and public engagement while also illuminating risks related to transparency, data security, and the erosion of the public's trust.

The integration of artificial intelligence (AI) into public administration presents a transformative potential that could enhance service delivery and operational efficiency (Trajkovski, 2025). By leveraging AI technologies, governmental institutions can analyze vast amounts of data to inform decision-making actors, streamline processes, and improve

citizen engagement. For instance, AI-driven analytics can assist in policy formulation by predicting outcomes based on historical data and current trends. Moreover, tools such as chatbots and virtual assistants have begun to revolutionize how public services interact with citizens, providing timely information and improving accessibility (Cortés-Cediel et al., 2023). However, this rapid advancement does not occur without challenges. Concerns regarding data security, ethical considerations, and possible biases embedded in AI algorithms pose significant questions on the potential vulnerabilities of the public's trust and public service efficacy. Scholars worldwide emphasize the need for in-depth research and new key focus areas in public administration, highlighting that like many innovations, the adoption of AI in the public sector presents considerable risks. These include job displacement, constraints on decision-makers' discretion, reduced transparency in decision making, unclear accountability, and potential threats to privacy and anti-discrimination protections (Yarovoy (2023); Longo (2022); Sobrino-García (2021); Wirtz et al. (2020)).

As AI continues to be integrated into public administration processes, several critical challenges must be addressed to ensure its effective, safe, and ethical implementation. One major concern is the potential for biases embedded within AI algorithms, which can result in inequitable outcomes in the delivery of public services. These biases often arise from training data that inadequately represent diverse populations, thereby reinforcing existing social disparities (Roberto et al., 2018). Furthermore, the increasing dependence on AI-driven decision-making processes raises concerns about transparency and accountability, as algorithmic processes may obscure the rationale behind key policy decisions (Veale & Binns, 2017). Without robust cybersecurity frameworks, AI-driven public administration systems may become susceptible to cyberattacks, potentially undermining the public's trust in digital governance (Brundage et al., 2018). Resistance to change within organizations, particularly in public administration, is frequently rooted in deeply ingrained cultural norms and practices (Rehman et al., 2021). To reflect on this issue, at least with a view to the human resource impact, we note that the integration of AI requires a cultural transformation, which may be met with resistance from employees concerned about job displacement or about having their role diminished in decision-making processes (Golgeci et al., 2025). This underscores the need to cultivate a workplace culture that values continuous improvement and innovation. Implementing AI is not merely a technological shift but a profound organizational change that impacts culture, processes, and the workforce as a whole (Madan & Ashok, 2023; Yigitcanlar et al., 2023; Agarwal, 2018; Ashok et al., 2016). Moreover, understanding the various factors influencing organizational change can aid in mitigating resistance by aligning AI initiatives with the overarching values and objectives of the institution. Ultimately, cultivating an adaptive organizational culture is essential for successfully leveraging AI technologies in public administration, ensuring both improved efficiency and enhanced service delivery (Asmaa & Yasmina, 2024). To navigate these challenges, policymakers and scholars must prioritize research into ethical AI governance, algorithmic transparency, and cybersecurity resilience. The AI multidisciplinary approach that integrates legal, technological, and social considerations is essential for fostering an AI-enhanced public sector that is transparent, accountable, and inclusive while safeguarding citizens' rights and data integrity (Rodrigues, 2020; Chester, 2024).

This paper addresses a critical gap in the existing literature by providing both a retrospective analysis and a forward-looking view on the application of AI in public administration processes. Although prior research has explored AI's potential in governance, a comprehensive examination of its long-term impacts on service efficiency, transparency, and decision making remains lacking. By analyzing past implementations and emerging trends, this study not only assesses the benefits, challenges, ethical considerations, and policy implications of AI use but also establishes a clear connection between AI-driven

governance improvements and economic growth through measurable Digital Economy and Society Index (DESI) components. In light of these objectives, the following research hypotheses are proposed:

**H1.** *There is a positive and statistically significant relationship between the level of digital public services (measured by DESI components) and the quality of governance in EU countries.*

**H0(1).** *There is no statistically significant relationship between digital public services and governance quality in EU countries.*

**H2.** *The development of digital public services and higher degrees of digitalization (measured by DESI indicators) positively influence economic growth in EU countries, controlling for governance quality.*

**H0(2).** *Digitalization and the development of public services have no significant effect on economic growth in EU countries.*

By exploring past implementations and future possibilities, our research constructs a comprehensive framework for understanding the complex interplay among AI, governance, and economic growth. A key focus is the roles of DESI variables (human capital, connectivity, digital technology integration, and digital public services) as fundamental drivers of AI use in the public sector. These components not only enable AI-driven transformation but also serve as measurable indicators of governance improvements and economic benefits. This paper highlights how AI can enhance governmental efficiency, transparency, and decision making while fostering economic competitiveness by linking AI integration to DESI metrics. At the core of this analysis is the necessity of strong legal and ethical frameworks, governance structures, and public engagement strategies to ensure that AI-driven innovations contribute to a sustainable, inclusive, and resilient public administration. Addressing challenges such as algorithmic biases, cybersecurity risks, and workforce adaptation is essential for maximizing AI's potential beneficial use while safeguarding democratic values and the public's trust. Through this analysis, we argue that achieving sustainability and resilience in public administration processes requires a comprehensive strategy that integrates robust governance frameworks, stringent security measures, and proactive public engagement. By addressing these challenges, public administrations can manage the transformative power of AI to deliver efficient, transparent, and equitable services while maintaining the public's trust and ensuring fair outcomes for all stakeholders.

This article is organized as follows: The first section introduces the study's background and context, followed by a review of the relevant literature and the development of research hypotheses. Next, the methodology section outlines the data collection and analysis approaches. The subsequent section presents the results of the hypothesis testing, along with a discussion of their theoretical and practical implications. Finally, the article concludes with an overview of the key findings, limitations, and directions for future research.

## 2. Literature Review

Advancements in AI use have profoundly influenced the public sector's operations, unlocking transformative possibilities across various domains, including service delivery, governance, and financial management. The integration of AI technologies has introduced numerous opportunities to enhance efficiency, transparency, and data-driven decision making. However, this evolution also brings forth a series of challenges, notably in areas concerning ethics, data privacy, bias in decision making, and the shifting dynamics of the workforce. [Wirtz et al. \(2019\)](#) provide a comprehensive framework by identifying ten



key areas where AI applications create value within the public sector. These applications encompass a wide spectrum of activities, including process automation, advanced data analytics, and tools for upgrading citizens' engagement. The versatility of AI allows its use for addressing complex administrative tasks, optimizing public services, and enhancing the overall responsiveness of governmental institutions.

Mishra et al. (2024) further emphasize the increasing adoption of AI in public administration to streamline operations and improve service delivery. For instance, AI-powered chatbots automate routine citizen interactions, enabling public servants to focus on more strategic and complex issues. Additionally, AI-driven decision support systems enhance the accuracy and timeliness of government decisions by processing large datasets, recognizing patterns, and providing actionable insights (Khosravi et al., 2024). These tools not only contribute to efficiency but also promote greater transparency and accountability in governance. However, the authors also caution toward the ethical implications of AI deployment, particularly concerning algorithmic biases in sensitive areas, like criminal justice and social welfare, as well as the potential pressure on job displacement because of automation.

Bouchetara et al. (2024) explore AI's transformative role in public financial management, particularly in enhancing risk management practices. Their study highlights how AI-driven predictive analytics can improve public budget forecasting, detect financial fraud, and optimize resource allocation. By leveraging machine-learning algorithms, governments can identify patterns of financial mismanagement, mitigate fiscal risks, and enhance transparency in public expenditures. Additionally, the research underscores the importance of integrating AI with traditional financial oversight mechanisms to ensure its accountability, minimize biases, and strengthen decision-making processes in the public sector's finance. As financial markets grow more complex, traditional risk mitigation strategies often prove to be inadequate. In the area of public finance management, AI technologies, particularly machine-learning algorithms, provide advanced tools for identifying and addressing risks related to credit, market fluctuations, liquidity, and operations. By leveraging predictive modeling and scenario analysis, governments can enhance fiscal planning, improve debt management, and detect potential financial instabilities before they escalate. Furthermore, AI-driven resource optimization enables more efficient allocation of public funds, ensuring that financial policies are data-driven, proactive, and aligned with long-term economic sustainability and fiscal responsibility. Nevertheless, the integration of AI into financial systems also raises concerns about data privacy, the need for skilled personnel, and the establishment of robust regulatory frameworks to ensure ethical and transparent use.

Complementing these perspectives, other literature highlights the broader implications of AI in the public sector. According to Janssen et al. (2020), AI can play a pivotal role in fostering smart governance, where real-time data and predictive analytics are leveraged to proactively address societal issues. The authors propose a comprehensive data governance framework for trustworthy big-data algorithmic systems (BDASs), emphasizing the stewardship of data and algorithms, controlled transparency, trusted information sharing, risk-based governance, and system-level controls. Sun and Medaglia (2019) emphasize that AI adoption within the public healthcare sector is a multifaceted process influenced by a range of stakeholder concerns encompassing ethical, technical, and organizational dimensions. This complexity highlights the necessity for ongoing research to deepen the understanding of these challenges and to devise strategies that promote the effective and responsible integration of AI into the public sector's operations. Moreover, the accelerated deployment of AI technologies calls for a critical reassessment of workforce dynamics in the public sector.

Recent scholarship has increasingly emphasized the transformative potential of artificial intelligence (AI) in public administration, highlighting both opportunities and challenges. Babšek et al. (2025) offer a comprehensive overview of highly cited research and practical applications, demonstrating a growing interest in how AI can enhance efficiency, decision making, and service delivery within the public sector. Their findings suggest that although adoption is accelerating, it remains uneven across contexts, often limited by organizational inertia and regulatory uncertainty. Complementing this perspective, Cantens (2024) critically explores the epistemological and institutional implications of generative AI, such as ChatGPT, for state governance. He raises important questions about how the state might “think” with such tools, warning that although generative AI holds promise for streamlining administrative tasks and policy formulation, it also introduces new risks related to transparency, accountability, and ethical governance. Together, these studies underscore the need for a balanced, reflective approach to AI integration, one that not only embraces innovation but also remains critically attentive to the implications for democratic oversight and institutional legitimacy.

The accelerated development and deployment of generative AI technologies have outpaced traditional regulatory mechanisms, creating an urgent need for comprehensive governance frameworks. Established AI governance models, such as the OECD’s Principles on Artificial Intelligence (OECD, 2019) and Floridi and Cowls’ (2022) ethical framework, emphasize the importance of transparency, accountability, human-centric values, and risk management in guiding AI innovation responsibly. These principles provide a normative foundation to align AI development with societal expectations and ethical imperatives. At the same time, understanding the adoption and diffusion of generative AI tools within organizations requires insights from established technology adoption theories. The Unified Theory of the Acceptance and Use of Technology (UTAUT) elucidates the roles of performance expectancy, social influence, and facilitating conditions in shaping users’ acceptance, while the technology–organization–environment (TOE) framework highlights how external pressures, organizational readiness, and technological characteristics collectively influence adoption decisions (Sarfaraz, 2017; Baker, 2011). Integrating these frameworks not only deepens the theoretical grounding of AI governance discourse but also offers a multidimensional lens to examine how policy, organizational behavior, and technological factors converge to shape the responsible implementation of generative AI.

Mergel et al. (2019) highlight that the digital transformation in the public sector is a complex and multifaceted process that demands a strategic approach to address evolving citizen expectations and achieve critical objectives, such as enhanced efficiency, transparency, and citizen satisfaction. This study underscores the necessity for public administrators to implement clearly defined processes and frameworks while navigating the challenges inherent in the implementation phase to effectively achieve the intended outcomes of the digital transformation. This ongoing challenge is further emphasized by the OECD’s Framework for Digital Talent and Skills in the Public Sector, which stresses the need for cultivating digital competencies among public sector employees to facilitate the transition from e-Government to digital government. This report outlines strategies for developing a digitally skilled workforce capable of navigating and adapting to the rapidly evolving technological landscape.

The existing research highlights that integrating AI into public administration activities introduces multiple vulnerabilities that must be carefully managed to ensure both efficiency and security (Habbal et al., 2024; Ahmad et al., 2022; Khan & Parkinson, 2018). A primary concern is the susceptibility of AI systems to cyberthreats, which can compromise the integrity of administrative decision-making processes. Contemporary studies emphasize that cyberdefense strategies should address both infrastructure and control

mechanisms to mitigate these evolving risks (Febiandini & Sony, 2023). Consequently, public administrators must proactively identify and address these vulnerabilities, implementing strategic measures to protect the public's trust in AI-driven systems. Although AI has the potential to enhance efficiency, transparency, and decision making in the public sector, its adoption also raises ethical, regulatory, and workforce-related challenges. A comprehensive approach that balances technological innovation with risk mitigation is essential for sustainable AI integration. The success of AI use in public administration depends on the development of robust governance frameworks that mitigate risks while maximizing the technological potential (Febiandini & Sony, 2023).

Some studies reveal that the “integration of digital technology” dimension of DESI evaluates the adoption of digital technologies, including the use of AI (Csiszár, 2023; Almeida de Figueiredo, 2024; Kovács et al., 2022). This dimension focuses on how businesses and public institutions leverage digital tools to enhance productivity, streamline operations, and foster innovation. The increasing use of AI-driven automation, big-data analytics, and cloud computing underscores the significance of the digital transformation in economic and governance contexts. The DESI framework provides valuable insights into how the AI-driven digital transformation impacts governance and economic development. Numerous studies have examined the influences of digitalization and AI adoption on economic growth. Research indicates that investing in digital infrastructure and AI technologies boosts productivity, stimulates innovation, and enhances economic competitiveness (Chu et al., 2024; Habibi & Zabardast, 2020). Furthermore, other scholars highlight that countries with higher levels of digital adoption often experience accelerated economic growth, driven by improved labor efficiency, increased entrepreneurship, and technological advancements (Magoutas et al., 2024; Salas-Guerra, 2021). Overall, the literature indicates that advancements in governance are strongly connected to AI adoption and the digital transformation. AI has the potential to enhance the public sector's transparency, mitigate corruption, and improve service efficiency through data analytics and automation (Grimmelikhuijsen & Tangi, 2024; Straub et al., 2023).

Although there has been substantial research on AI adoption in the private sector (Selten & Klievink, 2024; Wiesmüller et al., 2023), empirical studies examining its role in public administration remain sparse. Specifically, the existing literature on AI adoption in governance focuses primarily on private sector efficiencies and lacks an understanding of the institutional, organizational, and cultural challenges unique to the public sector (Kumar et al., 2021). Additionally, although technology adoption frameworks, like the TOE and UTAUT, have been widely used to examine digital technologies, their application to AI in public governance is underexplored. Furthermore, AI governance models, which emphasize accountability, transparency, and ethical implications, have yet to be adequately applied to the public sector context. This study addresses these gaps by applying these theoretical frameworks to explore the adoption of AI in public administration and developing a conceptual model for its integration into governance structures.

### 3. Samples and Data and Methodology

#### 3.1. Samples and Data

Given that DESI variables, such as human capital, connectivity, the integration of digital technology, and digital public services, act as critical enablers for AI adoption in public administration, this paper establishes connections among AI integration and measurable DESI components, governance enhancements, and economic advantages. It provides a comprehensive framework to discuss the integration of AI into public administration activities, focusing on the associated challenges and vulnerabilities.



The manuscript employs DESI indicators as a proxy for AI adoption in public administration because of their comprehensive measurements of the digital infrastructure, e-Government services, and citizens' and public servants' digital skills—the key enablers of the AI-driven transformation. DESI's specific focuses on e-Government services and the digitalization of the public sector's functions make it an appropriate tool for assessing AI's role in governance. Furthermore, as AI adoption requires a foundation of digital readiness across governmental institutions, businesses, and citizens, DESI's multidimensional approach to the digital transformation offers a robust framework for evaluating AI integration. Its focus on digital capabilities aligned with the foundational requirements for AI to be effectively implemented in public governance, making it a relevant and validated proxy for understanding AI's impacts on governance and economic benefits. AI is not just a tool but also a transformative force that can address governance challenges, improve service delivery, and enhance the public sector's efficiency.

The variables *desi\_hc*, *desi\_conn*, *desi\_idt*, and *desi\_dps* are related to DESI, a tool developed by the European Commission to assess digital competitiveness among EU countries. The first variable, *desi\_hc* (human capital), measures digital skills and individuals' abilities to engage in the digital economy and society. This encompasses both basic digital literacy, such as the percentage of individuals with fundamental digital skills and their use of the internet for communication, information retrieval, and social networking, and advanced skills, including the number of ICT (information and communications technology) specialists in the workforce and the number of graduates in science, technology, engineering, and mathematics (STEM) fields. A robust human capital foundation is critical for ensuring that both the workforce and public administration are prepared for the digital transformation. Conversely, low scores in this area may signal significant obstacles to economic growth because of insufficient digital literacy or advanced skills.

The second variable, *desi\_conn* (connectivity), evaluates the deployment and adoption of broadband infrastructure as well as the quality of internet connections. It focuses on the availability, quality, and affordability of broadband services, which are critical for a robust digital infrastructure. This variable is structured into three key subcategories: fixed broadband coverage, which includes the availability of broadband at basic speeds and the coverage of ultra-fast broadband, mobile broadband, which examines the penetrations of 4G and 5G networks and the adoption of mobile broadband services by users, and affordability, which assesses the cost of broadband subscriptions relative to income. High-quality connectivity is indispensable for enabling digital services, supporting remote work, and driving economic competitiveness. However, inadequate connectivity can deepen the digital gap, especially in rural or underserved areas.

The third variable, *desi\_idt* (integration of digital technology), assesses the extent to which businesses incorporate digital technologies into their operations, including e-commerce and cloud services. This variable highlights two key areas: digital transformation in businesses, which focuses on the adoption of advanced technologies, such as cloud computing, big data, AI, and the use of enterprise resource planning (ERP) software to enhance operational efficiency and decision making. It also includes e-commerce, which measures the proportion of small and medium-sized enterprises (SMEs) engaging in online sales, including cross-border transactions, and the revenue generated from these activities. In the context of the public administration, the integration of AI and other digital technologies offers transformative potential. For instance, AI can streamline administrative processes, improve service delivery, and enable data-driven decision making. The adoption of cloud computing and big-data analytics can enhance operational efficiency and scalability in government services, while the principles of e-commerce, such as seamless online transactions, can be applied to improve citizen engagement and access to public services.

This synergy underscores the importance of the digital transformation in both the private and public sectors.

The final component of DESI is *desi\_dps* (digital public services), which emphasizes the digitization of public services, including e-Government and e-Health systems. This component is divided into two subcategories: e-Government and e-Health. The first one assesses the availability of online public services for citizens and businesses, as well as the ease in accessing these services digitally (e.g., tax filing and document requests). The second one evaluates the availability of e-Health services, such as online consultations and electronic health records, and it tracks the use of these services by citizens. The digitization of public services plays a critical role in integrating AI into public administration because digitized public services, powered by AI, enhance operational efficiency, minimize bureaucracy, and improve accessibility, making government services more effective and citizen centric.

All the variables included in the analysis are presented in Table 1. Table 2 presents the summary of the statistics and provides an overview of the distribution of these variables, including measures of the mean, standard deviation, minimum and maximum values, allowing for a better understanding of their dynamics and overall trends in governance performance.

**Table 1.** Variables employed in the analysis.

Name	Code	Source	Definition
Variables employed in the regression analysis			
Good Governance Status	GGOV	World Bank Database	Using the World Bank database, it is calculated through a factor analysis methodology and evaluates the quality of governance across various domains, including democracy, the rule of law, public service delivery, and citizen participation.
Long-term Economic Growth	ECGR	World Bank Database	GDP per capita, measured in purchasing power parity (PPP) (constant 2011 international currencies).
Human Capital	desi_hc	Eurostat—European Commission Database	Measures digital skills, including basic and advanced digital competencies.
Connectivity	desi_conn	Eurostat—European Commission Database	Measures the availability, quality, and affordability of broadband and 5G networks.
Integration of Digital Technology	desi_idt	Eurostat—European Commission Database	Evaluates how businesses adopt digital technologies, including cloud computing, big data, and e-commerce.
Digital Public Services	desi_dps	Eurostat—European Commission Database	Measures the availability and quality of e-Government services, such as online public services and open data.
Education	educ	Eurostat—European Commission Database	Graduates in tertiary education, science, math, computing, engineering, manufacturing, and construction, by sex—per 1000 of the population aged 20–29.
Foreign Direct Investment, Net Inflows (Percentage of GDP)	fdini	World Bank Database	Direct investment equity flows in the reporting economy as a percentage of the GDP (%).

**Table 1.** *Cont.*

Name	Code	Source	Definition
Variables employed in the factor analysis (GGOV)			
Name	Code	Source	Definition
Control of Corruption	CCOR	World Bank Database	Measures the extent to which public power is exercised for private gain, including petty and grand corruption, as well as the effectiveness of policies and institutions in preventing and addressing corruption in government, the judiciary, and public services.
Rule of Law	RLW	World Bank Database	Measures the extent to which legal frameworks are enforced, property rights are protected, courts are independent, contracts are upheld, and crime and corruption are controlled.
Government Effectiveness	GEF	World Bank Database	Measures the quality of public services, policy formulation and implementation, the competence of civil servants, and the government's commitment to policies that support development.
Political Stability and the Absence of Violence/Terrorism	PSAV	World Bank Database	Captures the likelihood of political instability, government overthrow by unconstitutional means, and the presence of violence or terrorism.
Regulatory Quality	RQ	World Bank Database	Measures the government's ability to formulate and enforce sound policies and regulations that promote private sector development, market efficiency, and economic growth.
Voice and Accountability	VA	World Bank Database	Measures the extent to which citizens can participate in selecting their government; enjoy freedoms of expression, association, and media; and have access to transparent and accountable governance.

**Table 2.** Descriptive statistics for variables employed in the analysis.

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
desi_hc	162	45.64667	9.417707	27.47616	71.39063
desi_conn	162	37.61553	12.82175	12.67195	77.08926
desi_idt	162	29.49816	10.40716	10.11913	59.08657
desi_dps	162	57.30215	16.74399	7.412362	91.17917
educ	162	18.49383	6.499935	3.8	40.3
fdini	162	7.466063	24.42403	−40.08106	163.0436
GGOV	162	8.023109	1.132001	−2.013542	1.679326
ECGR	162	52,226.03	22,313.18	25,874.21	137,947.3

Our results show that the good governance status (GGOV) appears to have a negative minimum value (−2.013542), suggesting governance challenges in Bulgaria in 2022 and highlighting that governance in this country faced significant difficulties in this year, potentially because of political instability, corruption, weak institutional effectiveness, and challenges in upholding democratic principles and the rule of law (Bulgaria held its third parliamentary election in less than two years on 2 October 2022). In contrast, in 2021, France recorded the highest good governance status (GGOV) value at 1.679326, indicating strong

institutional effectiveness, political stability, adherence to the rule of law, and low levels of corruption. A high level was also recorded in 2020 (1.651972), indicating that France's strong governance performance during that year, despite the pandemic, was driven by effective crisis management, stable political leadership, economic recovery measures, and a commitment to the rule of law. This view is further supported by the literature, including (Hill et al., 2020).

The *fdini* variable exhibits a broad range (from  $-40.08106$  to  $163.0436$ ) and a high standard deviation ( $24.42403$ ), indicating substantial variation across countries. The lowest level of foreign direct investment (FDI) net inflows (percentage of GDP) was recorded in Hungary in 2018 ( $-40.08106$ ), while the highest level was observed in Cyprus in 2019 ( $163.0436$ ). The DESI variables (*desi\_hc*, *desi\_conn*, *desi\_idt*, and *desi\_dps*) appear to measure different aspects of digital governance, with varying means and standard deviations. The *educ* variable has a mean of 18.49, indicating an average level of education in the dataset, but with a wide range (from 3.8 to 40.3), suggesting disparities in education levels.

In terms of the good governance status, the variables employed in the analysis are the six dimensions of governance identified by the World Bank, which include voice and accountability, political stability and the absence of violence/terrorism, government effectiveness, regulatory quality, the rule of law, and the control of corruption. According to the literature, AI enhances public administration by improving efficiency, transparency, and service delivery, but its integration requires ethical governance to address bias, accountability, and privacy concerns (Ansell & Torfing, 2022; Zuiderwijk et al., 2021). AI in public administration presents several legal and ethical issues that directly impact good governance. These issues influence transparency, accountability, fairness, and trust in government institutions. In terms of the key concerns related to data privacy and protection, AI systems rely on vast amounts of personal data, raising concerns about compliance with privacy laws. The GDPR in the EU represents an example in this regard, meaning that AI-driven public administration must adhere to strict regulations ensuring data security, user consent, transparency, and the right to be forgotten. This means that governments and AI developers must implement robust data governance frameworks to prevent unauthorized data collection, minimize risks of data breaches, and uphold citizens' fundamental rights to privacy and personal data protection. Governments must ensure that AI does not unlawfully collect or misuse citizens' data. Moreover, legal frameworks must require fairness audits and anti-discrimination measures to prevent AI algorithms from reinforcing existing biases, which could lead to discriminatory outcomes in the management of public services, such as welfare distribution. Additionally, AI implementation in public administration raises cybersecurity risks, as these systems are vulnerable to cyberattacks that could compromise sensitive data and disrupt essential services. Other critical concerns are accountability and liability—if an AI system makes a harmful decision, such as wrongfully denying social benefits, determining responsibility can be complex, whether it lies with the AI developer, the government agency, or a third party. On the other hand, in terms of ethical issues, AI should not reinforce social inequalities. Ethical governance ensures that AI systems promote inclusivity and fairness in the decision-making process, the public's trust, and acceptability, and it must balance security with respect for civil liberties.

### 3.2. Empirical Framework and Methodology

To achieve the objectives of a robust governance framework and effectively manage crises, it is essential to empower individuals, governments, and policymakers with precise decision competences. However, the primary focus must be on identifying the key factors that mitigate challenges in public administration. A review of the theoretical background reveals that although most studies propose comprehensive frameworks for integrating AI

into public administration processes, few address the associated challenges and vulnerabilities. AI is not merely a tool but also a transformative force capable of addressing governance challenges, enhancing service delivery, and improving the public sector's efficiency.

This study develops a theoretical framework to assess the relationships among AI integration and governance improvements and economic benefits, measurable by DESI components. By analyzing both the challenges and opportunities of AI integration into public administration processes, while carefully considering legal and ethical implications, we propose a comprehensive decision-making framework. This framework examines the interplay between digital competitiveness and good governance, as well as the link between digital competitiveness and economic growth.

The model incorporates the key explanatory variables that influence digital competitiveness and economic growth. To address issues of skewed distribution, eliminate orthogonality among components, and generate independent factors, the GGOV variable was derived using exploratory factor analysis (EFA). The dependent variables in the model are GGOV and economic growth (ECGR), both expressed as functions of DESI components, including human capital (*desi\_hc*), connectivity (*desi\_conn*), the integration of digital technology (*desi\_idt*), and digital public services (*desi\_dps*). Additionally, the education level (*educ*) and foreign direct investment inflows (*fdini*) are included as key determinants, reflecting their impacts on governance and economic performance.

The selection of the control variables in our analysis is grounded in their established relevance to the digital transformation and governance outcomes. Specifically, foreign direct investment (FDI) inflows are included, as they play pivotal roles in facilitating technological diffusion, enhancing institutional quality, and introducing innovative business practices. Prior research has indicated that FDI serves as a conduit for advanced technologies and managerial knowhow, which can accelerate the adoption of digital tools and AI within both the private and public sectors (Habibi & Zabardast, 2020; Magoutas et al., 2024). By controlling for FDI, we account for external economic influences that may affect both governance performance and economic growth independently of domestic digitalization efforts.

The timeframe of 2017–2022 was purposefully selected to reflect a period marked by significant digital transformation initiatives within the European Union. This period captures the implementation of critical EU-level strategies, including the Digital Single Market framework, and coincides with the early phases of the Digital Decade Policy Programme 2030. Moreover, it encompasses the unprecedented acceleration of digitalization prompted by the COVID-19 pandemic, which necessitated rapid adaptation in public administration through remote service delivery and expanded e-Government solutions (Alkhawaldah et al., 2024; Rodrigues, 2020). Focusing on the EU context is particularly valuable, given the region's strong regulatory environment for AI, commitment to ethical digital governance, and the availability of robust, harmonized data through the DESI indicators. The diversity of the digital readiness across EU member states further enables a nuanced analysis of how varying levels of digital maturity interact with governance outcomes and economic performance.

We employ the ordinary-least-squares (OLS) regression and factor analysis methodology using the following specification:

$$Y_{it} = c_0 + c_1 \times \text{desi\_hc}_{i,t} + c_2 \times \text{desi\_conn}_{i,t} + c_3 \times \text{desi\_idt}_{i,t} + c_4 \times \text{desi\_dps}_{i,t} + c_5 \times \text{educ}_{i,t} + c_6 \times \text{fdini}_{i,t} + c_i + \varepsilon_{i,t} \quad (1)$$

where



- $Y_{it}$  represents the dependent variable for country  $i$  at time  $t$ . Specifically, we focus on two dependent variables: GGOV, which measures the efficiency of public services, the corruption perception index, and citizens' satisfaction, and ECGR, which is measured by GDP per capita and assesses the standard of living and the overall economic performance of a nation;
- $desi\_hc_{i,t}$  is the DESI human capital score for country  $i$  at time  $t$ ;
- $desi\_conn_{i,t}$  represents the DESI connectivity score for country  $i$  at time  $t$ ;
- $desi\_idt_{i,t}$  measures the DESI integration-of-digital-technology score for country  $i$  at time  $t$ ;
- $desi\_dps_{i,t}$  is the DESI digital-public-service score for country  $i$  at time  $t$ ;
- $educ_{i,t}$  represents the status of graduates in tertiary education for country  $i$  at time  $t$ ;
- $fdini_{i,t}$  is foreign direct investment equity flows in the reporting economy.

The **GGOV** variable was derived using **EFA**, a statistical technique that identifies underlying latent factors from observed variables. This approach mitigates issues related to skewed distribution, eliminates orthogonality among components, and generates independent factors, ensuring a more robust and interpretable measure of governance quality. Factor analysis works by identifying a smaller set of common factors ( $q$ ) that can effectively represent the variance in a more extensive set of original variables ( $p$ ). By reducing the dimensionality, it enhances the model's efficiency while preserving the essential information. This method is particularly useful in governance studies, where multiple interrelated indicators, such as the public service's efficiency, corruption perception, and citizens' satisfaction, in our case, can be condensed into a single composite measure, improving both analytical clarity and statistical reliability.

$$Y_{ij} = Z_{i1}b_{1j} + Z_{i2}b_{2j} + Z_{i3}b_{3j} + \dots Z_{iq}b_{qj} + e_{ij} \quad (2)$$

In this context,  $Y_{ij}$  represents the value of the  $i$ th observation for the  $j$ th variable, while  $Z_{ik}$  denotes the  $i$ th observation for the  $k$ th common factor. The term  $b_{qj}$  refers to the set of linear coefficients, known as factor loadings, which indicate the strength and direction of the relationship between the observed variables and the underlying latent factors. Finally,  $e_{ij}$  represents the unique factor associated with the  $j$ th variable, capturing the variance that is not explained by the common factors. Factor analysis assumes that each observed variable can be expressed as a linear combination of a smaller number of latent factors plus an error term. This technique is particularly useful for reducing dimensionality and identifying hidden structures within the data, making it a valuable tool in governance and economic studies.

The independent variables used in the analysis are summarized in Table 1. To estimate the relationships among the governance quality, economic growth, and digital competitiveness, we employ a fixed-effect model, which controls for unobserved heterogeneity across countries and over time. The general specification of the model is described by the following equation:

$$Y_{i,t} = \alpha_i + X_{i,t}\beta + \varepsilon_{i,t} \quad (3)$$

where  $Y_{i,t}$  represents the dependent variable for country  $i$  at time  $t$ , capturing either **GGOV** or **ECGR**. The term  $\alpha_i$  denotes an unobserved country-specific constant, accounting for time-invariant heterogeneity across countries.  $X_{i,t}$  is the matrix of time-variant explanatory variables, including DESI components, education level, and foreign direct investment inflows. Finally,  $\varepsilon_{i,t}$  is the error term, capturing unobserved factors and random shocks. Using a panel data model, we assess whether a fixed- or a random-effect approach is appropriate. Fixed effects remain constant across individuals, while random effects vary. To ensure the suitability of the fixed-effect model, we conducted the Hausman test, which

confirmed the model's validity. To ensure comparability and robustness in governance assessments, **GGOV** was computed following the **normalization** procedure (Equation (4)) validated by [Eck and Waltman \(2009\)](#). This method standardizes indicators, allowing for meaningful cross-country comparisons while mitigating scale distortions. Similar approaches have been widely used in institutional quality research ([Kaufmann et al., 2010](#)) and digital competitiveness studies ([Desai et al., 2002](#)). By employing this methodology, we ensure that the governance performance is measured in a consistent and statistically sound manner.

$$M = \frac{\sum_{t=1}^n W_t \times V_t}{\sum_{t=1}^n W_t} \quad (4)$$

M = average value;

V = actual value;

W = weighting factor;

N = number of periods in the weighting group.

$$Z_{ij} = \frac{x_{ij} - \bar{x}_j}{s_j} \quad (5)$$

$X_{ij}$  = data for variable  $j$  in sample unit  $i$ ;

$\bar{x}_j$  = sample mean for variable  $j$ ;

$s_j$  = sample standard deviation for variable  $j$ .

The normalization procedure plays a crucial role in ensuring that governance indicators are comparable and statistically robust across different countries and periods. By standardizing the data, this method eliminates distortions caused by differences in measurement scales, allowing for a more accurate assessment of governance performance. Equation (4) represents a weighted mean computation, where individual values ( $V_t$ ) are weighted by a factor ( $W_t$ ), ensuring that more relevant or reliable indicators contribute proportionally to the final governance score. By applying these formulae, we obtain a comprehensive and statistically sound governance index, which enhances the comparability, consistency, and robustness of governance assessments across EU countries. Although the selected statistical techniques are well suited for our research objectives, we acknowledge several inherent limitations. Ordinary-least-squares (OLS) regression, used as an initial estimation method, assumes no endogeneity or omitted variable bias, which may be challenging in studies of the digital transformation where policy feedback loops exist. To address this, we prioritize fixed-effect models, which control unobserved, time-invariant heterogeneity across countries. However, fixed-effect estimations cannot capture time-variant omitted variables and reduce efficiency when between-country variations predominate. Additionally, in constructing the composite governance index (GGOV), we employ factor analysis to synthesize multiple governance dimensions. Although this approach effectively reduces the dimensionality, it assumes linear relationships between indicators and requires subjective judgment in factor interpretation. Despite these limitations, combining these methods offers a robust analytical framework aligned with the structure of our dataset and research questions.

#### 4. Results

The main results of our paper are presented in Table 3. We present the results of the fixed-effect regression, showcasing two models: Model 1 (GGOV-DESI) and Model 2 (ECGR-DESI). These models examine the impacts of various digital and economic indicators on good governance (GGOV) and economic growth (ECGR) using pooled OLS, random-effect, and fixed-effect estimations. We emphasize the importance of evaluating the impacts of digital and economic factors on governance and growth, as these indicators offer valuable

insights into AI's roles in public administration. In this regard, AI acts as a crucial link between the digital transformation and governance efficiency, influencing policies and decision-making processes that shape institutional quality and economic performance. Using a dataset of 27 European countries from 2017 to 2022, we document that digital public services and digital technology integration play crucial roles in governance and economic growth.

**Table 3.** Fixed-effect regression results.

Variable	Model 1 (GGOV-DESI)			Model 2 (ECGR-DESI)		
	Pooled OLS	Random Effect	Fixed Effect	Pooled OLS	Random Effect	Fixed Effect
desi_hc	0.025 (1.59)	0.001 (0.07)	−0.005 (0.46)	1.696 (5.86) **	369.2 (1.53)	83.52 (0.32)
desi_conn	0.004 (0.53)	−0.001 (0.10)	0.002 (0.04)	207.0 (1.41)	83.49 (1.65)	88.50 (1.74)
desi_idt	0.026 (1.85)	0.012 (2.11) *	0.012 (2.12) *	238.1 (0.91)	372.6 (2.74) **	366.7 (2.66) **
desi_dps	0.011 (1.37) ***	0.009 (1.78) **	0.008 (1.60) **	−88.28 (0.57)	276.8 (2.28) *	327.3 (2.60) *
educ	−0.014 (1.08)	−0.013 (1.87)	−0.013 (1.90)	−346.5 (1.46)	119.3 (0.72)	136.9 (0.81)
fdini	−0.002 (0.47)	0.000 (0.35)	0.001 (0.46)	107.5 (1.78)	−8.082 (0.67)	−7.106 (0.59)
Cons	−1.124 (2.51) *	0.376 (0.93)	0.589 (1.56)	−15.39 (1.83)	25.13 (2.75) **	34.59 (3.79) **
N	162	162	162	162	162	162
R2	0.21	0.76	0.78	0.38	0.33	0.34

Note: This table presents the results of the fixed-effect panel model. All the variables are defined in Table 1. Standard errors are shown in parentheses, and \*\*\*, \*\*, and \* indicate statistical significances at the 1%, 5%, and 10% levels, respectively.

Digital public services (desi\_dps) are significant factors in both models, indicating that enhanced digital public services contribute positively to governance and economic growth in EU countries. In Model 1, they demonstrate strongly positive effects across all the estimations, while in Model 2, they remain significant, with positive coefficients in both the random- and fixed-effect models. The impacts of desi\_dps can be further understood through its subcomponents, such as e-Government services, digital healthcare, online public service accessibility, and open data initiatives. These elements collectively enhance institutional efficiency, transparency, and citizen engagement, reinforcing the link between digitalization and economic performance. The relationships among the desi\_dps components, such as e-Government services, digital healthcare, online public service accessibility, open data initiatives, and economic growth, have been widely explored in the literature. Studies suggest that well-developed e-Government services enhance administrative efficiency, reduce bureaucratic costs, and foster business competitiveness by streamlining the public sector's interactions ([Alkhawaldah et al., 2024](#); [Rodriguez, 2022](#)). Furthermore, the availabilities of online public services and open data foster transparency, strengthen institutional trust, and support innovation-driven economic activities. Empirical research supports these claims, demonstrating that countries with advanced digital public services tend to experience higher economic growth rates because of increased efficiency in service delivery, reduced transaction costs, and improved public-sector performance ([Zhao](#)

[et al., 2015](#)). These findings validate the crucial roles of digital public services in shaping governance efficiency and economic development across EU nations.

The integration of digital technology (*desi\_idt*) is significant and positive in Model 1, indicating that adopting and utilizing digital technologies contribute to governance improvements by enhancing administrative efficiency, transparency, and service delivery. The first model confirms the first hypothesis and reveals a positive and statistically significant relationship between the level of digital public services (measured by DESI components) and the quality of governance in EU countries. In Model 2, *desi\_idt* also remains positive and significant, confirming the second hypothesis of our study and suggesting that higher levels of digital technology integration may positively influence economic growth by fostering innovation, improving productivity, and enabling digital business transformation. The literature supports these findings, emphasizing that increased adoption of digital technology, such as cloud computing, big-data analytics, and artificial intelligence, enhances the public and private sectors' performances ([Criado & Gil-Garcia, 2019](#)). In governance, digital technology streamlines decision making, reduces corruption risks, and strengthens institutional responsiveness ([Das, 2024](#)). From an economic perspective, widespread digital adoption lowers transaction costs, facilitates market expansion, and boosts competitiveness by enabling firms to leverage automation and data-driven strategies ([Suoniemi et al., 2020](#)). Additionally, digital technology integration is crucial in bridging regional disparities within the EU, as more digitally advanced economies tend to experience stronger economic growth, higher employment rates, and improved resilience against economic shocks. These insights highlight the dual roles of *desi\_idt* in shaping both governance efficiency and economic development across EU countries.

Our results support the agenda of the European Commission, notably the Digital Decade Policy Programme 2030, which emphasizes the crucial role of the digital transformation in modernizing public administration. This program sets ambitious targets for digitalizing key sectors, including e-Government, digital public services, and AI-driven governance, to enhance efficiency, transparency, and citizens' engagement across EU member states. By highlighting the positive impacts of digital technology and digital public services on governance and economic growth, our findings align with Europe's 2030 objectives and targets, focusing on four key pillars: digital skills, digital infrastructure, the digitalization of businesses, and digital public services. EU countries with higher levels of digital technology integration, such as Denmark, Estonia, and Finland, have successfully implemented advanced e-Government services, leading to greater administrative efficiency, reduced bureaucratic burdens, and increased citizen engagement. This demonstrates that the digital transformation is crucial in strengthening institutional capacity, improving the public sector's performance, and fostering economic resilience. Moreover, the success of these countries suggests that wider adoption of digital governance strategies across the EU could drive similar benefits, including enhanced transparency, better public service accessibility, and more efficient policy implementation. As a result, investing in digital infrastructure and promoting digital skill development will be essential for all EU nations to fully leverage the potential of digitalization in governance and economic growth.

Although this discussion has emphasized the potential benefits of AI adoption in public governance, such as enhanced efficiency, improved decision making, and greater transparency, it is equally important to acknowledge the significant challenges and risks accompanying these advancements. Algorithmic bias poses a serious concern, particularly in public service delivery, where opaque decision-making processes can unintentionally reinforce social inequalities ([O'Neil, 2017](#)). Additionally, AI adoption brings about substantial workforce implications, including job displacement and the need to rapidly reskill public sector employees to manage and supervise AI-driven processes ([Acemoglu & Restrepo,](#)

2020). Ethical and regulatory shortcomings further complicate AI integration, as existing legal frameworks often lag behind technological innovations, creating gaps in accountability and oversight (Cath, 2018). These challenges highlight the necessity of a balanced approach to AI governance—one that not only leverages the transformative potential of AI but also proactively addresses its ethical, social, and regulatory risks. Incorporating comprehensive risk management strategies and fostering a culture of algorithmic transparency will be essential for sustainable and equitable AI deployment in the public sector. For instance, in the United Kingdom, implementing AI and automated systems in administering Universal Credit (a welfare benefit system) has faced significant challenges. AI tools used to process claims and assess eligibility have been criticized for creating errors that disproportionately impact vulnerable populations. For example, in 2018, reports of AI-driven errors in assessing claims led to payment delays, causing hardship for many claimants. Some individuals were wrongly categorized as ineligible, while others faced incorrect sanctions for failing to meet requirements. These failures highlight the risks of relying on AI systems without adequate human oversight, especially when dealing with individuals' welfare and financial stability. The lack of transparency in the algorithmic decision making further fueled public concern over the system's fairness.

Digital tools, including open data portals and AI-powered analytics, play vital roles in enhancing government accountability by increasing transparency in financial transactions, procurement processes, and policy decisions. These technologies enable real-time monitoring, fraud detection, and data-driven decision making, reducing corruption risks and improving the public's trust in institutions. In line with this, the EU's Open Data Directive promotes the reuse of public sector data, facilitating greater accessibility, interoperability, and innovation in governance. By making high-value datasets available, the directive supports data-driven policymaking, public-sector efficiency, and private-sector innovation, fostering a more open and participatory digital economy. Additionally, initiatives such as the European Data Strategy and the Common European Data Spaces further strengthen the EU's commitment to leveraging data for better governance, economic growth, and societal progress.

However, although the integration of digital technology (*desi\_idt*) positively and significantly impacts governance and economic growth, it introduces ethical dilemmas, legal complexities, and security risks. First, governments must adhere to the General Data Protection Regulation (GDPR) when handling citizens' data, ensuring lawful processing, consent mechanisms, and data security. Second, increased digitalization exposes public administration to cyberattacks, ransomware threats, and data breaches, meaning that legal frameworks must continuously evolve to address emerging cybersecurity and digital sovereignty threats. Third, even if the EU's Open Data Directive promotes transparency, ensuring fair usage of public sector data while protecting sensitive information remains a challenge, it is required for balancing open access and intellectual property rights and for avoiding the exploitation or misuse of public data. Addressing these challenges requires strong regulatory frameworks, robust cybersecurity measures, ethical AI governance, and policies prioritizing digital inclusivity and human rights. A well-balanced approach will ensure the digital transformation benefits all citizens while upholding fundamental legal and ethical standards. The overall results align with the existing literature, underscoring the importance of DESI components, such as human capital (*desi\_hc*) and digital public services (*desi\_dps*), in driving AI adoption. A well-trained workforce with strong digital skills (*desi\_hc*) is crucial for the development and management of AI technologies. In contrast, the availability of AI-powered digital public services (*desi\_dps*) signals the government's commitment to incorporating AI into administrative functions (Kovács et al., 2022). Additionally, a solid digital infrastructure empowers businesses and public institutions to



effectively utilize AI applications, thereby improving governance and boosting economic competitiveness (Almeida de Figueiredo, 2024).

## 5. Conclusions

Integrating AI into public administration processes presents an excellent opportunity to boost government efficiency, transparency, and service delivery. As AI-driven advancements reshape bureaucratic processes and decision making, they hold the potential to enhance productivity and drive economic growth. By optimizing resource allocation, reducing administrative burdens, and improving policy implementation, AI can contribute to a more dynamic and responsive government. However, this technological shift also introduces challenges that require careful management. Issues such as data privacy, algorithmic bias, and ethical concerns raise critical questions about the reliability and fairness of AI in governance. Establishing strong regulatory frameworks and equipping public officials with the necessary skills are crucial for mitigating these risks. Moreover, AI serves as both a catalyst for progress and a potential source of complexity, making it essential for governments to balance innovation with responsibility.

The rationale behind this study is based on the growing importance of the digital transformation in shaping governance efficiency and economic performance. As countries' governments increasingly integrate digital technologies, improve connectivity, and develop digital public services, the ways institutions function and economies grow are significantly influenced. Our findings underscore the critical roles of digital public services and digital technology integration in enhancing governance and economic growth across EU countries. The significance of Digital Public Services (*desi\_dps*) in both our models highlights the positive impacts of e-Government services, digital healthcare, online public service accessibility, and open data initiatives on fostering institutional efficiency, transparency, and economic resilience. Additionally, the positive effect of Digital Technology Integration (*desi\_idt*) reinforces the transformative potential of digital tools in streamlining administrative processes, promoting innovation, and improving the public sector's performance. These results align with the European Commission's Digital Decade Policy Programme 2030, emphasizing the necessity of digital transformation in modernizing public administration. However, although digitalization offers substantial advantages, challenges such as cybersecurity threats, data privacy concerns, and regulatory complexities must be addressed through robust governance frameworks and ethical AI policies. Overall, our study highlights the dual roles of digitalization in governance and economic development, reinforcing the need for EU nations to invest in digital infrastructure, enhance digital skills, and adopt AI-driven governance strategies. By leveraging digital technologies effectively, policymakers can strengthen institutional quality, improve public service delivery, and foster sustainable economic growth in an increasingly digital world.

Importantly, these results matter for several reasons. First, they provide empirical support for the political and financial investments that EU institutions and member states are directing toward the digital transformation. By showing a measurable link between digital public services and governance quality, this study validates current policy directions to modernize public administration. Second, the positive association with economic growth highlights that investments in digital public services yield administrative efficiencies and concrete macroeconomic gains, making a strong case for prioritizing digital infrastructure in post-pandemic recovery plans and future EU budget allocations. Furthermore, our findings suggest that digitalization may help to close governance and economic performance gaps among EU countries by offering scalable and replicable solutions for public service delivery. This is particularly relevant for less digitally advanced member states, where targeted investments could accelerate convergence with more developed peers.

Although we recognize that GDPR compliance, cybersecurity risks, and AI ethics were discussed qualitatively, our use of DESI subcomponents, such as “Digital Public Services” and “Connectivity”, is an effective proxy that encapsulates these dimensions, as validated by the existing literature. Nonetheless, future research should incorporate more granular indicators, such as AI-specific adoption rates or cybersecurity readiness scores, to deepen the understanding of these critical aspects. Finally, this research contributes to academic debates by bridging the gap between theoretical expectations and empirical evidence, confirming that digitalization is not merely a technological shift but also a transformational force for governance and economic development. Policymakers are, thus, encouraged to continue supporting digitalization strategies, not only for their direct administrative benefits but also for their broader roles in driving inclusive growth and democratic resilience across the EU.

Strengthening cybersecurity measures and ensuring strict compliance with data protection regulations, such as GDPR, are essential for addressing the growing risks associated with digitalization. As digital services expand, governments must tackle challenges related to data security, cyberthreats, and privacy concerns to maintain the public’s trust and institutional integrity. Additionally, bridging the digital divide through broadband expansion, digital skills training, and inclusive policies remains a critical issue, as disparities in digital access can exacerbate social and economic inequalities. Although the digital transformation presents significant opportunities, it also introduces vulnerabilities, including the risk of cyberattacks, increased reliance on digital infrastructure, and ethical dilemmas related to AI governance. To mitigate these risks and maximize the benefits of digitalization, national strategies should align with the European Commission’s Digital Decade Policy Programme 2030, fostering cross-border digital cooperation, strengthening regulatory frameworks, and ensuring strategic investments in digital infrastructure. By adopting a balanced approach that addresses opportunities and challenges, EU countries can enhance institutional capacity, improve public service delivery, and drive long-term economic resilience in an increasingly digital world. This study contributes to the growing body of literature by empirically validating the theoretical claims about the governance-enhancing and growth-inducing effects of the digital transformation in public administration. For policymakers, our findings advocate sustained investment in digitalization initiatives. At the same time, researchers are encouraged to explore further causal dynamics and the roles of emerging technologies, such as AI, in governance frameworks. Policymakers should prioritize expanding and enhancing digital public services to improve governance efficiency and economic growth. Governments must invest in e-Government services, digital healthcare, and open data initiatives to streamline public administration, enhance transparency, and foster innovation. Additionally, the integration of digital technology should be encouraged to boost economic competitiveness by promoting AI adoption, cloud computing, and data analytics in both the public and private sectors.

Despite these contributions, our study has several limitations. First, although the dataset covers 27 EU countries from 2017 to 2022, future research could better capture long-term digitalization trends and the impacts of external shocks, such as economic crises and geopolitical disruptions, by incorporating extended timeseries data and additional variables related to political stability, cybersecurity threats, and technological advancements. Second, although this study relies on the Digital Economy and Society Index (DESI) as a key measure of digitalization, future studies could integrate alternative indicators or qualitative assessments to provide a more comprehensive understanding of digital governance. Finally, exploring the differential effects of digitalization at various administrative levels, such as national versus regional governments, would offer more profound insights into policy effectiveness and digital transformation strategies across diverse governance structures.

Further studies could assess the efficacy of specific digital policies, such as AI governance frameworks, cybersecurity regulations, and digital literacy programs, in enhancing the public sector's performance. Comparative analyses between EU and non-EU countries could provide further insights into best practices and potential challenges in digital governance. Finally, future research should also examine the ethical and societal implications of increased AI-driven decision-making processes in governance, ensuring that the digital transformation aligns with transparency, accountability, and inclusivity principles.

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