Research Article

UDC 004.8:330.341
JEL: O33, Q56, G34, O32, L86

THE ROLE OF ARTIFICIAL INTELLIGENCE IN DIGITAL SUSTAINABILITY AND GOVERNANCE SYSTEMS

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Received: 15/10/2025
Revised: 14/04/2026
Accepted: 21/05/2026
Published: 30/06/2026

DOI: 10.61954/2616-7107/2026.10.2-6

Background. To successfully modernise public governance for the digital era, the strategic adoption of artificial intelligence (AI) is an absolute necessity. The AI, however, cannot deliver sustainable value in a vacuum. Unlocking its true potential depends on institutional readiness, proactive regulatory frameworks, and robust governance capacity to mitigate both operational and societal risks.

Purpose. This study aims to examine how the evolving EU AI Act's governance framework shapes the concept of Sustainable Digital Governance and to evaluate AI literacy and institutional readiness among Croatian civil servants as critical prerequisites for responsible AI deployment.

Findings. This empirical study utilises survey data collected in mid-2025 from Croatian civil servants to evaluate AI literacy, perceptions, and organisational readiness. While these preliminary findings are subject to certain methodological limitations, they reveal a severe implementation gap between regulatory mandates and institutional capacity. 73.6% of surveyed officials reported no prior exposure to AI-related training or professional discourse, and 80.2% could not identify high-risk AI systems within their operational environments. 62.6% noted a lack of organisational guidance on AI software utilities and their associated risks, leaving only 25.3% who felt capable of executing tasks in compliance with AI Act risk-mitigation standards.

Implications. These insights demonstrate that successful public sector AI governance requires moving beyond mere regulatory compliance to embrace targeted capacity-building, institutional learning, and well-defined national implementation strategies. Ultimately, this study synthesises theoretical perspectives with empirical data to introduce a holistic framework for the sustainable governance of AI systems. It concludes with actionable recommendations designed to guide policymakers and organisational leaders through the regulatory and operational complexities of an AI-driven landscape.

Keywords: Artificial Intelligence, AI Governance, AI Literacy, Digital Governance, Sustainability.

1. Introduction.

Sustainable development, far from being an exclusively ecological term, represents a multidimensional paradigm aimed at achieving economic, environmental, social, cultural, and governance objectives in an intertemporal context, with an emphasis on meeting the needs of present and future generations (Keser, 2023). Although numerous definitions exist, its common thread is the recognition of the necessity to align these different dimensions. Haughton (1999) summarises this complexity, stating that sustainable development requires "economic and social systems that foster long-term ecological stewardship of resources, recognising the interdependence of social justice, economic well-being, and ecological management". Kemp et al. (2005) emphasise that the adoption of this holistic approach, which in recent years has been supplemented by cultural and governance dimensions, is a key to understanding the foundations on which modern development policies must be built.

Within this framework, the dimension of sustainable governance is primary in operationalising the sustainability concept. It encompasses the application of the principles of the good governance doctrine, as defined by the Council of Europe (2007). These principles include accountability, transparency, policy coordination, efficiency, effectiveness, the rule of law, innovation and openness to change, sustainability and long-term orientation, and other quality standards. These principles are not abstract ideals but concrete standards that enable the functionality of an integrated approach to governance, which is a prerequisite for sustainable development (Keser et al., 2023).

Sustainable governance plays a central role in digital transition and sustainability, imposing an integrated approach that unifies horizontal and vertical levels of coordination and cooperation. This study aims to apply this framework to highlight the complex interrelationships among technology, sustainability, and governance systems.

Despite the increasing attention to artificial intelligence (AI) governance and regulatory frameworks, existing research has predominantly focused on normative, legal, and policy-oriented analyses of emerging regulatory regimes, particularly the European Union Artificial Intelligence Act (Cancela-Outeda, 2024; Veale & Borgesius, 2021). Much of this literature examines the ethical principles, legal design, and institutional architecture of AI governance, emphasising regulatory instruments, risk-based approaches and the protection of fundamental rights.

Empirical evidence on public institutions' capacity and preparedness for implementation is scarce. As evidenced by several studies in the field of digital government (Wirtz et al., 2019; Jørgensen & Ma, 2025), much emphasis is placed on civil servants' levels of digital literacy and on institutions' organisational capacity to handle digital governance transformation.

Conducted research (Madan & Ashok, 2023; OECD, 2025) indicates that the prerequisites for successful digital (AI) transformation of the public service sector depend not only on the regulatory framework, but, to a great extent, on organisational and human capacity in the digital arena.

Hence, the results indicate that, alongside ensuring regulatory compliance mechanisms, there is an evident need to enhance AI literacy and competence (skills) education to meet the requirements of sustainable digital transformation. Recent research in digital governance (Janssen et al., 2020) emphasises data governance and the responsible use of AI systems when deployed in the public sector.

The study is grounded in the fundamental concepts of integrated governance and policy integration, as well as the primary drivers of digital transformation. Based on the integrated governance principles, governance is perceived as a coordinated and participatory process that promotes cross-sectoral cooperation and aligns institutional with multidimensional sustainability objectives (Keser, 2023; Peters, 2004).

The integrated governance methods include policy integration on both the horizontal and vertical poles, requiring institutional coordination and policy coherence, and require stakeholder collaboration and participation in decision-making across various governance levels (Domorenok et al., 2021).

The study aims to address the noted scarcity by providing preliminary empirical insights from the Croatian public sector. Based on the national AI literacy and governance curricula provided by the State School of Public Administration and Judicial Academy (DSJU, 2026; Duić et al., 2026), the study is based on a questionnaire addressing various segments of AI literacy, such as perception of AI, safety and security of using AI tools, AI literacy levels, regulatory obligations awareness, and similar.

The purpose of the preliminary findings is to point to the level of institutional and regulatory alignment among and within various public institutions in the Republic of Croatia. The main research question segments are divided into three sections. Section 1 analyses how Croatian civil servants perceive the role of AI in public administration. Section 2 analyses to what extent Croatian civil servants understand the fundamental principles of AI literacy and to what extent they are aware of obligations and responsibilities codified in the European Union's Artificial Intelligence Act (AIA). Finally, Section 3 analyses the extent to which the current public sector's capacities are aligned with regulatory requirements regarding AI systems' implementation. The overall aim of both the preliminary and further analyses is to understand the efforts required to ensure successful AI implementation through sustainable digital governance practices.

2. Literature Review.

The overwhelming majority of recent relevant literature points to AI as the central driver of the digital transition. While McCarthy (2007) lays an essential but strictly technical foundation by defining AI as the science and engineering of making intelligent machines, this study deals with what that definition does not cover: the complex system of governance and sustainability necessary for the responsible application of AI systems in society.

Russell and Norvig (2020) modernised the approach by defining AI as a "rational agent" that strives to maximise a given objective, directly connecting with the question of governance. Consequently, it is crucial to analyse how to ensure that the objectives of these AI agents align with complex social, ethical, and environmental sustainability standards. In this sense, the role of AI in the context of sustainability is extremely significant because its value, as pointed out by Nishant et al. (2020), lies not only in optimising resource consumption but also in its ability to improve effective environmental management and act as a powerful technology with the potential to accelerate the green transition and enhance productivity, efficiency and innovation.

AI has the potential of creating numerous environmental and ethical challenges. The core issue within the digital sustainability paradigm revolves over the question to what extent digitalization supports and/or enables sustainability.

As visible through the example of energy- and water-hungry data centres (especially when servicing large language models (LLM) data training and consumption), AI or, rather, digital infrastructure as whole, creates a significant environmental impact (Nishant et al., 2020; Toderas, 2025). This contradicts the general strive towards decarbonisation, and examples such as this one, that indicate significant dichotomy in goals and outcomes has been thoroughly addressed in the relevant literature (Toderas, 2025; van Wynsberghe, 2021).

AI sustainability, hence, requires a holistic approach whereby sustainability through AI reveres to the reduction of negative consequences while, at the same time, focusing on enhancing productivity, efficiency and innovation.

The noted direction requires a multifaceted approach (Nishant et al., 2020) that simultaneously drives technology, sustainability, and governance in a unified, bottom-up approach (individual to state), reducing reductionism and promoting sustainable solutions that encompass the whole.

e-ISSN 2786-8958
ISSN-L 2616-7107

The governance framework that enables noted concepts is driven by regulatory frameworks such as the European Union's (EU) Artificial Intelligence Act (AIA), preceded by the Ethics Guidelines for Trustworthy AI (European Commission, 2019). Simultaneously, an important holistic framework for sustainable governance is visible in the OECD Council Recommendation on Artificial Intelligence (OECD, 2019), which explicitly calls for the development of AI systems that are transparent and accountable, in accordance with sustainable development principles and protection of human rights.

In more general terms, digital transformation requires practical and responsible AI application. This requires new governance models that do not stem from technology itself, but from strategic and ethical consideration of the societal and systemic implications of AI applications. To that end, the present study highlights the triangular interrelationship among governance, sustainability, and technology. It provides indications on how this methodology can be implemented in the Croatian public administration, having in mind the current state of system readiness and human resources capacity to adopt the technology sustainably and responsibly.

3. Methodology.

The research methodology combines the normative framework qualitative analysis (focus on the Artificial Intelligence Act (Regulation (EU) 2024/1689 laying down harmonised rules on artificial intelligence (European Parliament and Council of the European Union, 2024b) (AI Act)), and empirical research by means of an anonymous survey questionnaire for Croatian civil servants (perceived levels of AI literacy, institutional readiness, and regulatory awareness).

The first section provides a comprehensive analysis of the applicable normative framework (as noted, the focus is placed on the AI Act). The section examines and interprets the core legal provisions and principles of sustainable digital governance relevant to future compliance obligations of the public sector.

The subsequent empirical section utilizes preliminary data from an anonymous survey conducted in 2025 among Croatian civil servants enrolled in the State School for Public Administration's AI literacy training program (various specialized educational programmes, from basic AI fundamentals, to advanced AI compliance for local and regional governance). By presenting initial findings from this research, the study identifies emerging trends and critical challenges regarding AI literacy, regulatory awareness, and the institutional readiness required to effectively govern AI systems within daily administrative operations in various levels of public administration.

The analytical sample comprises 91 respondents, whose profile is defined by functional relevance (persons designated by various public administration bodies to enroll into various educational programs) rather than socio-demographic characteristics. All participants are civil servants whose professional responsibilities are utilizing digital systems, database management, information processing, or decision-support tools in their everyday activities. Representing a diverse range of public-sector institutions and administrative levels (over 80 different institutions have participated in the educational programs), this sample provides a focused and functionally pertinent perspective on the preliminary insights within the modern public administration landscape.

The study does not provide a granular breakdown of respondents based on age, gender, seniority, or specific affiliation, primarily to ensure anonymity of the research design by excluding personal or institutional identifiers. Participation in the questionnaire was entirely voluntary and conducted under strict anonymity, ensuring no personal data was collected. All respondents were fully informed of the study's purpose and the fact that their data would be utilized exclusively in an aggregated format for scientific research.

To ensure a comprehensive assessment of both technical competence and regulatory readiness, the survey instrument was designed as a multi-format framework, the details of which are presented in Table 1.

Table 1. Survey Instrument Methodology AIA Awareness.

Section	Focus Areas	Question Formats
AI literacy	Familiarity, competence, operational risks in daily workflows	Dichotomous: training history, IT involvement, and institutional policies
AIA awareness	Regulatory obligations (AI Act) and governance expectations	Likert Scales: perception of AI tool importance, risk impact, and data processing functions
Contextual insights	Identification of specific digital tools and descriptions of high-risk operational scenarios	Open-ended: contextualization of quantitative responses to identify governance gaps

Given the non-probabilistic sampling, the empirical analysis is primarily descriptive. Dichotomous items were evaluated using frequencies and percentages, while Likert-scale responses were examined through measures of central tendency and dispersion to identify dominant patterns. Responses to open-ended questions underwent qualitative content analysis, in which brief textual entries were coded for recurring themes and grouped into categories such as AI usage, governance risks, regulatory awareness, and institutional capacity gaps. This thematic grouping served to complement the quantitative data, providing contextual insight into how respondents perceive high-risk AI scenarios, operational risks, and organisational shortcomings.

The reliance on a non-probabilistic sample from a specific training program precludes generalising the findings to the entire Croatian civil service (the present study aims to provide indications rather than final findings).

Second, the respondents represent a functionally specialised subgroup whose attitudes and digital engagement may differ significantly from those of the broader public administration workforce (despite the wide vertical and horizontal spread of attendees).

Third, the findings are based on self-reported perceptions rather than objective assessments of AI literacy or legal compliance (the educational programme still does not issue certification; only attendance confirmation is provided).

Finally, due to the fact that the present analysis is preliminary and restricted to a single section of the questionnaire, the analysis does not attempt to provide an overall scope of interpretation. Rather, this study is indicative and aimed at identifying emerging trends and governance gaps.

Projected continuation of this analysis aims to expand the sample size (we continue to conduct questionnaires and plan to include semi-structure interview qualitative analysis formats), include a more diverse range of administrative bodies, and incorporate comparative methods to enhance analytical robustness and external validity.

4. The EU AI Act as a Catalyst for Governance Reform.

The evolution of the normative framework, particularly through the AI Act, marks a paradigm shift in sustainable digital governance. Rather than being a mere set of restrictions, AI Act establishes legal foundations and compliance requirements that shape the deployment of AI tools across the public sector. This study provides a general overview of the key provisions of the AI Act, focusing on how regulatory obligations and governance expectations require a structured approach to AI integration.

A central pillar of this new governance model is the management of high-risk AI systems. AI Act mandates rigorous compliance requirements, including implementation of principles that ensure transparency and accountability (Mudrić, 2025). By defining the parameters for legal foundations, AI Act compels public sector institutions to align their technological deployment with broader societal and administrative standards. AI risk management, especially for high-risk AI systems, is a focus of technical standards harmonisation, and relevant international and national organisations, such as ISO and NIST, have already published standards for AI risk management (ISO/IEC 42001:2023, NIST AI RMF). The European Standardization Framework is still under development.

e-ISSN 2786-8958
ISSN-L 2616-7107

The human-centric approach is further reinforced by the requirement to enable meaningful human supervision. To ensure technical competence and regulatory readiness, governance frameworks must prioritise technical robustness and the ability of human operators to intervene in AI-driven processes. This "human-in-the-loop" (HITL) requirement is not just a technical safeguard but a legal necessity designed to mitigate operational risks and organisational shortcomings. This is perhaps the most difficult requirement to meet, given the general constraints on human resources and the emerging challenges of fully understanding the complexities of data training and AI decision-making (Mudrić, 2025).

To be effective, HITL mechanisms must position human judgment, ethical reasoning, and personal accountability at the heart of the decision-making chain. This mandate extends far beyond a simple "emergency stop" function; it necessitates the creation of intuitive interfaces and specialised workflows that empower human supervisors to interpret, challenge, and override AI-generated outputs. As noted by Kapoor (2025), the human role is undergoing a fundamental shift from passive observation to active collaboration, involving a continuous cycle of evaluation, steering, and validation of an AI system's performance. The iterative nature of HITL ensures that AI systems remain resilient, equitable, and ethically sound throughout their operational lifecycle. By adopting this dynamic oversight, organisations can address the critical need to maintain human agency over sophisticated technologies, thereby reinforcing public confidence in their use.

In tandem with oversight, the AI Act enforces strict transparency and explainability standards. Providers of high-risk systems are legally required to provide comprehensive insights into the logic, capabilities, and inherent limitations of a model. This regulatory pressure effectively mandates the implementation of Explainable AI (XAI) techniques to demystify "black box" processes. However, as Clement et al. (2023) emphasise, explainability is not a peripheral technical add-on, but rather a composite ingredient that must be woven into the very fabric of the software development lifecycle.

Such a foundation of responsible governance facilitates internal audits, helps identify algorithmic bias, and provides the clarity needed for stakeholders to contest decisions meaningfully. By institutionalising these requirements, the AI Act transforms AI governance from a discretionary best practice into a mandatory legal standard. This shift elevates AI strategy to a board-level priority, compelling directors and managers to take an active role in managing AI risk and AI compliance. This new regulatory environment is also catalysing the rise of specialised executive leadership, such as the Chief AI Officer (CAIO), dedicated to harmonising these complex governance duties across the entire organisation.

4.1. Sustainable Digital Governance.

The AI Act provides the fundamentals of responsible AI governance. However, in a broader European regulatory ecosystem, the AI Act must be reviewed in light of the impact of organisational activities that incorporate AI digital transformation on society and the environment. In this context, the concept of Corporate Digital Responsibility (CDR) and the legal mandates introduced by by Directive (EU) 2024/1760, known as the Corporate Sustainability Due Diligence (CSDDD) (European Parliament and Council of the European Union, 2024b) are critical. CDR offers a proactive ethical framework that serves as a moral compass (Lobschat et al., 2021), guiding an organisation's digital impact through principles of fairness, societal well-being, and trust (AI Ethics Guidelines). While the AI Act mandates specific technical and procedural safeguards, CDR points to the underlying values and strategic intent behind the deployment of technology (Herden et al., 2021). Hence, evaluating AI Act in synergy with CSDDD reveals a necessary convergence. While the AI Act focuses on safety and fundamental rights related to the technology itself, CSDDD obligates large entities to identify, prevent, and mitigate adverse environmental and human rights impacts across their entire value chain.

When an AI system is integrated into corporate or administrative processes, it becomes a permanent link in the chain.

e-ISSN 2786-8958
ISSN-L 2616-7107

For instance, a biased algorithm utilised in supply chain management could lead to discriminatory practices that fall directly under the CSDDD's obligations.

The noted intersection creates regulatory pressure compelling organisations to adopt the "Sustainable Digital Governance" framework. This approach aligns with the academic call for "Sustainable AI" (van Wynsberghe, 2021), which requires simultaneous consideration of AI's environmental sustainability and its potential to advance sustainability goals. The described mechanism requires a holistic approach in which IT and sustainability departments must collaborate to manage AI Act compliance and CSDDD reporting. Equally, governing bodies must manage the entire socio-technical system, assessing both the intrinsic properties of AI tools and their extrinsic impacts on society through a unified governance lens.

4.2. Fundamental Transformation of the Public Sector.

A participatory approach involving all key stakeholders is necessary to ensure transparency and accountability within the AI ecosystem. The governing structure, civil society, the private sector, and academia must be "at the same table" to jointly discuss governance mechanisms that will minimise risks and harness the full potential of the technology.

Such a governance model requires an integrated approach based on horizontal and vertical cooperation and a high level of participation from formal and informal actors (Tasan-Kok & Vranken, 2011; Schwedler, 2011; Keser et al., 2023) to ensure transparency, accountability, and explainability for the AI ecosystem. AI has the potential to improve the efficiency of public administration.

The adoption of AI in the public sector faces specific challenges that require a special approach, different from that in the private sector. Zuiderwijk et al. (2021) pay attention to the governance and regulatory implications of AI, while highlighting the lack of research addressing this topic.

Nishant et al. (2020) pointed out that AI increases efficiency by automating repetitive tasks, uncovers key insights by analysing vast amounts of unstructured data, and solves the complex problems by integrating resources.

Theoretically, AI can "liberate" public servants from routine tasks, allowing them to focus on high-value work that demands human empathy, perception and critical judgment. Predictive analytics further empowers governance systems to allocate resources more effectively, ranging from traffic flow optimisation in smart cities to energy balancing in electricity markets to forecasting demand for social services. For citizens, AI-powered tools such as chatbots and virtual assistants provide 24/7 access to information, significantly reducing wait times and improving engagement (Androutsopoulou et al., 2019). In this sense, digital transformation provides an opportunity to fundamentally redesign the relationship between the state and its citizens, making it more accessible, transparent, and user-centric.

Simultaneously, the public sector faces a distinct and expansive set of implementation obstacles. This is primarily visible through the noted lack of internal technical expertise and the ethical risks associated with algorithmic bias. A major challenge lies in the management and procurement of AI systems. Public bodies often lack the technical proficiency to evaluate complex tools effectively, creating knowledge asymmetry with private-sector vendors. This can result in vendor lock-in or the acquisition of non-compliant technology. While the AI Act imposes significant obligations on public bodies as "deployers" of high-risk systems, the guidelines for translating these legal mandates into specific procurement requirements remain underdeveloped (or, as preliminary research indicates, non-existent).

Ethical risks are particularly acute in the public sector, where administrative decisions profoundly impact individual rights and societal well-being (Wirtz et al., 2022; Kuziemski & Misuraca, 2020). The use of biased algorithms in sensitive areas, such as social welfare, criminal justice, or employment, can perpetuate existing social inequalities and erode public trust (Zuiderwijk et al., 2021).

The rapid digitalisation of public services risks widening the digital divide, potentially marginalising citizens who lack the necessary skills or access to navigate new platforms. Addressing these challenges requires a commitment to human-centric design, robust ethical oversight, and substantial investment in public-sector capacity building, particularly through education.

5. Results

The synthesis of the normative analysis and preliminary empirical findings reveals a substantial misalignment between the governance mandates of the European regulatory environment and the current operational readiness of the surveyed Croatian civil servants.

Empirical data from 91 respondents indicates a significant deficiency in foundational engagement with artificial intelligence, as 73.6% reported no prior participation in relevant educational programs or professional gatherings (including basic educational programs on the use of standard office tools).

The noted high numbers directly correlate with a narrow perception of institutional risk regarding the use of AI systems and tools. Only 19.8% of respondents identified their organisational activities as involving high-risk AI systems, while the vast majority (80.2%) failed to recognise such systems within their professional scope (or their organisation at large). Despite this low recognition rate, the qualitative justifications provided by the minority suggest that actual operational exposure is far more extensive than subjective awareness indicates. These participants substantiated their claims by citing engagement with state information infrastructure, e-services, legal case analysis, and the management of critical databases (including sensitive personal data such as health records and Personal Identification Numbers (OIB)).

Furthermore, they identified high-risk contexts in financial operations, such as loan approvals and grant allocations, as well as the handling of classified datasets and business secrets.

An analysis of AI literacy and organisational capacity further underscores the implementation gap identified in this study's theoretical framework. Institutional efforts to mitigate digital risks appear insufficient, with 62.6% of respondents stating that their organisations have not provided training on essential software or the associated digital risks. This lack of support manifests in low self-assessed competence regarding the obligations imposed by the AI Act. Specifically, only 25.3% of participants felt capable of performing tasks in compliance with AI Act requirements, such as risk recognition and incident mitigation.

The remaining 74.7% expressed a profound need for targeted education, citing a lack of theoretical and practical knowledge, total unfamiliarity with the EU regulatory framework, and the absence of a clear national legislative roadmap as primary barriers to professional readiness. Table 2 synthesises these quantitative distributions and qualitative insights to provide a comprehensive overview of these findings.

These findings suggest that, while the AI Act conceptualises the public sector as a natural deployer of high-risk systems (given the high-risk determinations in Annexes I and III of the AI Act), the individuals responsible for operationalising this oversight generally lack the necessary AI literacy and institutional support. The data confirms that current perceptions of AI remain largely detached from the rigorous governance expectations established by the EU.

Consequently, a staged research design is required to further refine these measurement instruments and facilitate a more systematic evaluation of reliability and validity in subsequent phases.

Table 2. Distribution of AI Awareness and Literacy Indicators among Croatian Civil Servants (N=91).

Thematic Section	Survey Indicator / Research Question	Response (Yes)	Response (No)	Positive %	Negative %	Contextual Findings
AIA Awareness	Participation in AI-related educational programs or discourse	24	67	26.4%	73.6%	Systematic lack of foundational information and professional engagement with AI terms, concepts, and use-case
	Identification of High-Risk AI systems in professional context	18	73	19.8%	80.2%	State info-infrastructure, e-services, legal case solutions, databases/registries, OIB, health records, loan approvals, financial transactions, guarantees, SME grants, employee data, and business/state secrets, etc.
	Institutional training on software use and associated operational risks	34	57	37.4%	62.6%	Organisational deficit in providing risk-based training for essential digital tools and software systems
AI Literacy	Perceived capability to fulfil AIA regulatory and risk-mitigation obligations	23	68	25.3%	74.7%	Need for training on negative consequences and risk recognition; absence of theoretical/practical knowledge; lack of familiarity with the AIA and national strategic frameworks

6. Discussion.

The empirical findings reveal a substantive "implementation gap" between the EU's normative ambitions and the current operational readiness of the Croatian public administration. Within the context of this study, this gap signifies a misalignment between the governance expectations established by the AI Act (encompassing risk identification, accountability, human oversight, and organisational preparedness) and the low levels of AI literacy, regulatory awareness, and institutional support reported by respondents. From a sustainable governance perspective, this indicates that the principles of accountability, transparency, and innovation have not yet been sufficiently operationalised (Schwedler, 2011; Tasan-Kik & Vranken, 2011). Consequently, the findings reinforce the view that digital transformation is not merely a technical transition, but a strategic and ethical evolution contingent upon the public sector's capacity to critically evaluate the implications of AI deployment (Nishant et al., 2020).

Table 2 further elucidates this discrepancy. Although few respondents explicitly identified high-risk AI systems in their professional environments, their open-ended responses detailed activities involving state information infrastructure, e-services, registries, legal case processing, and financial decision-making. This suggests that the core issue is not an absence of high-risk applications (present in the public sector for a long time already), but rather a limited capacity to recognise them within the regulatory categories introduced by the AI Act (the ability to align the normative framework with the actual operational systems in use). This divide between operational exposure and regulatory awareness means public servants may manage AI systems with significant legal and societal consequences without realising when specific AI governance obligations are triggered. Several drivers of this gap can be inferred from the data. First, there is a foundational educational deficit, as most participants reported no prior exposure to AI-related training or professional discourse.

Second, the results suggest weak organisational integration of AI governance, with a notable absence of institutional training regarding software use and operational risks. Third, the low self-assessed capability to fulfil AI Act obligations indicates that legal requirements have not yet permeated daily administrative workflows.

Research in public administration emphasises that without integrating AI risk management into governance systems and strengthening internal capacity, the systematic identification and mitigation of risks across the AI lifecycle remains unattainable (Wirtz et al., 2020). This limitation similarly hinders the practical application of human oversight and explainability, both of which presuppose that officials can competently question AI systems' outputs (Russell & Norvig, 2020). These findings align with broader research suggesting that insufficient internal knowledge weakens public institutions during procurement and oversight (Zuiderwijk et al., 2021). Ultimately, from the perspective of Sustainable Digital Governance, effective AI risk management requires a holistic approach to the socio-technical system rather than a narrow focus on formal compliance (van Wynsberghe, 2021). Bridging this implementation gap demands both the legal alignment with the AI Act and systematic investment in AI literacy and internal governance capacity to ensure a responsible digital transformation.

7. Conclusions.

Merging the AI Act with the CSDDD establishes the groundwork for what this study defines as Sustainable Digital Governance. The research indicates that for AI to drive digital sustainability, governance mechanisms must transcend bureaucratic limits. They must shift toward an integrated approach that simultaneously manages technical risks and social consequences. By bridging the transparency and safety requirements of the AI Act with the accountability and value chain obligations of the CSDDD, this proposed framework ensures that AI deployment becomes a pillar of the ethical integrity and resilience of digital ecosystems.

The primary takeaway of this research is that modernising governance for the digital era depends entirely on aligning regulatory standards with actual operational capacities. Moving toward a sustainable digital future demands a transition from reactive, "check-the-box" compliance to a proactive, risk-centred strategy.

However, the data reveal that an implementation gap currently hinders this transition. Overcoming this hurdle requires a combination of specialised educational initiatives and a robust national strategic roadmap. The public sector can act only as a competent deployer and guardian of AI technologies by prioritising institutional readiness and widespread AI literacy.

While these findings offer significant insights, several methodological constraints exist. Because the empirical data rely on a non-probabilistic sample of 91 civil servants, potential sampling bias limits the direct generalisability of these results to the broader Croatian administration or other national or international jurisdictions.

Additionally, the study's focus on Croatia reflects a specific institutional and cultural environment that may not be found in other EU Member States. Consequently, future research should expand its geographic reach and employ larger, statistically representative samples to facilitate cross-border comparisons. Upcoming research phases will utilise qualitative interviews to triangulate these findings further and provide a more nuanced understanding of the institutional barriers to advancing AI literacy.

Conflict of Interest Statement.

The authors declare that there is no conflict of interest.

Funding Disclosure.

This research received no external funding.

AI Use Statement.

The authors declare that no generative AI tools were used in the preparation of this work.

REFERENCES

Androutsopoulou, A., Karacapilidis, N., Loukis, E., & Charalabidis, Y. (2019). Transforming the communication between citizens and government through AI-guided chatbots. Government Information Quarterly, 36(2), 358–367. https://doi.org/10.1016/j.giq.2018.10.001

Cancela-Outeda, C. (2024). The EU's AI act: A framework for collaborative governance. Internet of Things, 27, 101291. https://doi.org/10.1016/j.iot.2024.101291

Clement, T., Kemmerzell, N., Abdelaal, M., & Amberg, M. (2023). XAIR: A Systematic Metareview of Explainable AI (XAI) Aligned to the Software Development Process. Machine Learning and Knowledge Extraction, 5(1), 78-108. https://doi.org/10.3390/make5010006

Council of Europe. (2007). Good local and regional governance-The European challenge (the Valencia Declaration); MCL-15(2007)5 final. Valencia: Conference of European Ministers Responsible for Local and Regional Government. https://www.ftr-bg.org/wp-content/uploads/2019/10/Valencia_Declaration_MCL-1520075final_EN.pdf

Domorenok, E., Graziano, P., & Polverari, L. (2021). Introduction: Policy integration and institutional capacity: Theoretical, conceptual and empirical challenges. Policy and Society, 40(1), 1–18. https://doi.org/10.1080/14494035.2021.1902058

DSJU. (2026). Državna škola za javnu upravu. Osnove AI pismenosti: Razumijevanje sustava umjetne inteligencije [Online live seminar]. https://www.dsju.hr/program-kategorije/?courseid=922&td=1&ts=6&catid=49&ucionica=1&online_uzivo=1

Duić, D., Vidaković, I., & Mudrić, M. M. (2026). *Pravni okvir umjetne inteligencije* [Obrazovni materijali]. Pravosudna akademija. https://epak.gov.hr/course/info.php?id=2311&lang=en

European Commission. (2019). Ethics guidelines for trustworthy artificial intelligence. High-Level Expert Group on Artificial Intelligence. https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai

European Parliament and Council of the European Union. (2024a). Directive (EU) 2024/1760 of the European Parliament and of the Council of 13 June 2024 on corporate sustainability due diligence and amending Directive (EU) 2019/1937 and Regulation (EU) 2023/2859. Official Journal of the European Union. https://eur-lex.europa.eu/eli/dir/2024/1760/oj

European Parliament and Council of the European Union. (2024b). Regulation (EU) 2024/1689 laying down harmonised rules on artificial intelligence (Artificial Intelligence Act). Official Journal of the European Union, L 2024/1689. https://eur-lex.europa.eu/eli/reg/2024/1689/oj

Gasser, U., & Almeida, V. A. F. (2017). A layered model for AI governance. IEEE Internet Computing, 21(6), 58–62. https://doi.org/10.1109/MIC.2017.4180835

Haughton, G. (1999). Environmental justice and the sustainable city. Journal of Planning Education and Research, 18, 233–243. https://doi.org/10.1177/0739456X9901800305

Herden, C. J., Alliu, E., Cakici, A., Cormier, T., Deguelle, C., Gambhir, S., Griffiths, C., Gupta, S., Kamani, S. R., Kiratli, Y.-S., Kispataki, M., Lange, G., Moles de Matos, L., Tripero Moreno, L., Betancourt Nunez, H. A., Pilla, V., Raj, B., Roe, J., Skoda, M., Song, Y., Ummadi, P.K., Edinger-Schons, L. M. (2021). "Corporate Digital Responsibility": New corporate responsibilities in the digital age. Sustainability Management Forum, 29(1), 13–29. https://doi.org/10.1007/s00550-020-00509-x

Janssen, M., Brous, P., Estevez, E., Barbosa, L. S., & Janowski, T. (2020). Data governance: Organizing data for trustworthy artificial intelligence. Government Information Quarterly, 37(3), Article 101493. https://doi.org/10.1016/j.giq.2020.101493

Jørgensen, B. N., & Ma, Z. G. (2025). Impact of EU regulations on AI adoption in smart city solutions: A review of regulatory barriers, technological challenges, and societal benefits. Information, 16(7), 568. https://doi.org/10.3390/info16070568

Kapoor, M. (2025). The evolving role of human-in-the-Loop evaluations in advanced AI systems. European Journal of Computer Science and Information Technology, 13(9), 115–126. https://doi.org/10.37745/ejcsit.2013/vol13n9115126

Kemp, R., Parto, S., & Gibson, R. B. (2005). Governance for sustainable development: Moving from theory to practice. International Journal of Sustainable Development, 8 (1-2), 12–30. https://doi.org/10.1504/IJSD.2005.007372

Keser, I. (2023). Interdependence and Complementarity of a Multi-Dimensional Concept of Sustainable Development and the Integrated Approach to Urban Governance—Case Study City of Zagreb. Sustainability, 15(12), 9213. https://doi.org/10.3390/su15129213

Keser, I., Puljiz, J., & Maleković, S. (2023). Potencijal i izazovi integriranog urbanog upravljanja. Hrvatska i komparativna javna uprava, 23 (4), 593–617. https://doi.org/10.31297/hkju.23.4.1

Kuziemski, M., & Misuraca, G. (2020). AI governance in the public sector: Three tales from the frontiers of automated decision-making in democratic settings. Telecommunications Policy, 44, 101976. https://doi.org/10.1016/j.telpol.2020.101976

Lobschat, L., Mueller, B., Eggers, F., Brandimarte, L., Diefenbach, S., Kroschke, M., & Wirtz, J. (2021). Corporate digital responsibility. Journal of Business Research, 122, 875–888. https://doi.org/10.1016/j.jbusres.2019.10.006

Madan, R., & Ashok, M. (2023). AI adoption and diffusion in public administration: A systematic literature review and future research agenda. Government Information Quarterly, 40(1), 101774. https://doi.org/10.1016/j.giq.2022.101774

McCarthy, J. (2007). What is artificial intelligence? Stanford: Stanford University, Computer Science Department. http://jmc.stanford.edu/artificial-intelligence/

Mudrić, M. (2025). Pravni okvir regulacije umjetne inteligencije, drugi dio. Informator. https://informator.hr/strucni-clanci/pravni-okvir-reguliranja-umjetne-inteligencije-ii

Nishant, R., Kennedy, M., & Corbett, J. (2020). Artificial intelligence for sustainability: Challenges, opportunities, and a research agenda. International Journal of Information Management, 53, 102104. https://doi.org/10.1016/j.ijinfomgt.2020.102104

OECD. (2019). Recommendation of the Council on Artificial Intelligence. Paris: OECD Publishing.

OECD. (2025). Governing with Artificial Intelligence: How AI is accelerating the digital government journey. Paris: OECD Publishing.

Russell, S. J., & Norvig, P. (2020). Artificial intelligence: A modern approach (4th ed.). London: Pearson.

Schwedler, H. W. (2011). Integrated urban governance, the way forward. Berlin: Metropolis; Senate Department for Urban Development.

Tasan-Kok, T., & Vranken, J. (2011). Handbook for multilevel urban governance in Europe: Analysing participatory instruments for an integrated urban development. Rotterdam: EUKN.

Toderas, M. (2025). Artificial Intelligence for Sustainability: A Systematic Review and Critical Analysis of AI Applications, Challenges, and Future Directions. Sustainability, 17(17), 8049. https://doi.org/10.3390/su17178049

van Wynsberghe, A. (2021). Sustainable AI: AI for sustainability and the sustainability of AI. AI Ethics, 1, 213–218. https://doi.org/10.1007/s43681-021-00043-6

Veale, M., & Zuiderveen Borgesius, F. (2021). Demystifying the draft EU Artificial Intelligence Act. Computer Law Review International, 22(4), 97–112. https://doi.org/10.9785/cri-2021-220402

Wirtz, B. W., Weyerer, J. C., & Geyer, C. (2019). Artificial intelligence and the public sector—applications and challenges. International Journal of Public Administration, 42(7), 596–615. https://doi.org/10.1080/01900692.2018.1498103

Wirtz, B. W., Weyerer, J. C., & Sturm, B. J. (2020). The dark sides of artificial intelligence: An integrated AI governance framework for public administration. International Journal of Public Administration, 43, 818–829. https://doi.org/10.1080/01900692.2020.1749851

Zuiderwijk, A., Chen, Y., & Salem, F. (2021). Implications of the use of artificial intelligence in public governance: A systematic literature review and a research agenda. Government Information Quarterly, 38, 101577. https://doi.org/10.1016/j.giq.2021.101577