SMART GREEN GOVERNMENT IN TECHNOLOGY BASED GOVERNANCE

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Abstract

The growing urgency of environmental challenges and rapid digital transformation has encouraged governments to rethink conventional governance models. This study examines the concept and implementation of *smart green government* within the framework of technology-based governance. Adopting a qualitative research approach with a descriptive analytical design, the study explores how digital technologies are integrated with green government principles to support environmentally sustainable public administration. Data were collected through in-depth interviews with key policy actors and complemented by document analysis and limited observation of digital governance practices. The findings reveal that smart green government is primarily understood as an integrative approach that combines digital innovation with environmental sustainability objectives. However, its implementation remains uneven and largely implicit, as digital governance initiatives tend to prioritize administrative efficiency and service delivery over environmental outcomes. Institutional capacity, leadership commitment, inter-agency coordination, and policy coherence emerge as critical factors shaping implementation effectiveness. The study also identifies key challenges, including fragmented governance structures, limited resources, and the environmental footprint of digital infrastructure. Despite these constraints, significant opportunities exist to advance smart green government through integrated digital platforms, data-driven environmental monitoring, and capacity building. This study contributes to public administration literature by offering a holistic governance perspective that bridges digital transformation and environmental sustainability, while providing policy-relevant insights for governments pursuing sustainable governance reforms.

Keywords: Digital Governance, Environmental Sustainability, Governance Reform, Public Administration, Smart Green Government

1. Introduction

The development of global environmental issues over the past two decades has driven a paradigm shift in governance. Governments are no longer positioned solely as regulators and providers of public services, but rather as key actors in ensuring environmental sustainability through environmentally friendly policies and governance practices. Global pressures from climate change, environmental degradation, massive urbanization, and limited natural resources require governments to adopt a development approach that is oriented not only toward economic growth but also toward ecological balance and long-term sustainability (UNEP, 2019). In this context, the concept of green government emerged as a normative and operational response to the failures of conventional, exploitative development approaches.

Green government refers to a government's commitment to integrating environmental

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sustainability principles into the entire public policy cycle, from planning and implementation to policy evaluation (OECD, 2020). These principles include energy efficiency, carbon emission reduction, sustainable waste management, and responsible resource use. However, in practice, the implementation of green government often faces various structural obstacles, such as weak inter-agency coordination, limited bureaucratic capacity, low environmental accountability, and minimal public participation in environmental decision-making (Meadowcroft, 2018). This situation indicates that green government cannot stand alone as a normative policy agenda but requires supporting instruments capable of increasing the effectiveness of its implementation.

Along with the rapid development of information and communication technology, governments in various countries have begun adopting a smart government approach as part of the digital transformation of the public sector. Smart government emphasizes the use of digital technology, big data, the Internet of Things (IoT), and integrated information systems to improve bureaucratic efficiency, the quality of public services, and government transparency and accountability. This transformation aims not only to accelerate administrative processes but also to encourage data-driven decision-making (evidence-based policy). In the context of modern governance, technology is seen as a key enabler in creating adaptive, responsive, and inclusive governance.

Recent studies in public administration emphasize that the success of environmentally oriented governance reforms depends not only on technological innovation, but also on the capacity of human resources to internalize and operationalize sustainability values. Research on Green Human Resource Management (GHRM) in the Indonesian public sector demonstrates that the strategic alignment of human resource policies, organizational culture, and sustainability objectives strongly influences environmental performance (Adini Rakhma et al., n.d.). This finding highlights a critical dimension often overlooked in smart government discourse, namely the role of human capital as a strategic governance resource.

From a governance perspective, the integration of digital technology without corresponding investments in green-oriented human resource management risks producing superficial sustainability outcomes. As shown by Rakhma et al. (2025), green recruitment, green training, and green performance management are essential mechanisms for embedding environmental values within public organizations. Without these mechanisms, digital governance initiatives tend to prioritize efficiency and administrative performance while neglecting long-term environmental impacts.

This insight is highly relevant to the concept of smart green government advanced in this study. Smart green government requires not only smart technologies, but also green administrative capacities that enable public officials to interpret data, design environmentally informed policies, and coordinate sustainability-oriented governance practices. By linking digital governance with GHRM, smart green government can be understood as a holistic governance framework in which technology, institutions, and human resources jointly contribute to environmental sustainability.

Therefore, this study extends the smart green government discourse by incorporating the human resource dimension as a critical enabler of technology-based environmental governance. In line with the Resource-Based View (RBV), environmentally competent public officials represent valuable, rare, and difficult-to-imitate resources that strengthen the

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government's capacity to achieve sustainable governance outcomes (Adini Rakhma et al., n.d.).

The integration of the concepts of green government and smart government has given rise to a new approach known as smart green government. This concept emphasizes the use of digital technology as a strategic instrument to support the environmental sustainability agenda in government administration. Smart green government focuses not only on technology-based administrative efficiency but also on how technology can be used to monitor environmental quality, sustainably manage natural resources, reduce the bureaucratic carbon footprint, and increase public participation in environmental management (Bibri & Krogstie, 2020). Thus, smart green government represents a synthesis between the digitalization agenda of government and a commitment to sustainable development.

In the context of technology-based governance, the implementation of smart green government is becoming increasingly relevant, particularly in developing countries that face simultaneous environmental and governance challenges. Government digitalization opens up opportunities for governments to optimize environmental management through sensor-based monitoring systems, online environmental reporting platforms, and cross-sector data integration for more accurate environmental policy formulation. However, the implementation of technology without a clear green governance framework has the potential to create a paradox, where digitalization actually increases energy consumption and e-waste if not managed sustainably. Therefore, a smart green government approach demands a balance between technological innovation and sustainability principles.

In contemporary public administration literature, governance is increasingly conceptualized as a dynamic interaction between institutional structures, technological infrastructures, and public values. Digital transformation in government is no longer understood merely as an administrative modernization effort, but as a structural force that reshapes decision-making processes, accountability mechanisms, and policy coordination (Dunleavy, 2005). This shift has prompted scholars to critically assess whether digital governance reforms genuinely contribute to broader public values, including environmental sustainability, or whether they primarily reinforce efficiency-driven bureaucratic logics.

International empirical studies demonstrate that although digital government initiatives have expanded rapidly, their integration with environmental sustainability objectives remains uneven. Comparative analyses show that many governments prioritize service delivery efficiency, cost reduction, and performance measurement, while environmental considerations are often treated as secondary or symbolic policy goals (Janowski, 2015). This pattern suggests a structural misalignment between digital transformation agendas and sustainability imperatives, particularly in public sector organizations characterized by sectoral silos and fragmented policy responsibilities (Howlett & Ramesh, 2020).

At the same time, environmental governance challenges such as climate change, urban pollution, and resource scarcity increasingly demand integrative governance approaches that transcend traditional regulatory instruments. Scholars argue that complex and cross-cutting environmental problems require governance innovation, including the strategic use of digital technologies to enhance coordination, monitoring, and policy learning(Duit et al., 2016). However, the effectiveness of digital governance in supporting environmental sustainability depends heavily on institutional design, leadership commitment, and policy coherence rather

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than technological sophistication alone (Dwivedi, 2021).

Within this context, smart green government emerges as a conceptual response to the limitations of both smart government and green government when implemented in isolation. Rather than positioning technology as a neutral or purely instrumental tool, the smart green government perspective recognizes digital systems as governance infrastructures that shape policy priorities, organizational behavior, and accountability relations. Understanding smart green government therefore requires an explicit governance-oriented analysis that moves beyond technological determinism and examines the institutional conditions under which digital transformation can generate environmentally sustainable outcomes (Bibri & Krogstie, 2020).

At the local government level, the issue of smart green government is becoming increasingly strategic as public demand for quality urban environments increases. Local governments are in a crucial position because they have direct authority over environmental management, spatial planning, public transportation, and basic services. Rapid urbanization has increased pressures on the urban environment, such as air pollution, congestion, and a decline in the quality of people's living spaces. In this situation, implementing smart green government at the local level can be an effective policy instrument to address these challenges through the use of technology integrated with environmental policies.

Technology-based government transformation has become a key agenda for public administration reform in various countries, including Indonesia. Government digitalization through the implementation of e-government, smart government, and the use of information technology is seen as capable of improving bureaucratic efficiency, transparency, and the quality of public services. However, in practice, this digital transformation agenda is often not fully integrated with environmental sustainability goals. As a result, government digitalization tends to be solely oriented toward administrative efficiency and public services, without being balanced by a strong commitment to sustainable environmental management.

On the other hand, green government, as an environmentally sound governance approach, faces significant implementation challenges. Limited bureaucratic capacity, weak inter-agency coordination, low utilization of environmental data, and minimal public participation often hamper the effectiveness of environmental policies. In this context, digital technology actually has significant potential to strengthen the implementation of green government through environmental monitoring systems, technology-based data management, and increased transparency and accountability in environmental policies.

However, the integration of government digitalization and green government agendas has not been fully understood conceptually or empirically in public administration studies. The concept of smart green government is still relatively new. It lacks a well-established analytical framework, particularly in the context of technology-based governance at the national and regional levels. Most studies tend to discuss smart government and green government separately, thus failing to explain how digital technology can be strategically utilized to support sustainable environmental governance.

Furthermore, the implementation of smart green government is also influenced by structural and institutional factors, such as regulatory support, leadership, human resource capacity of civil servants, and technological infrastructure readiness. Without a comprehensive

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understanding of these factors, the implementation of smart green government risks becoming merely policy jargon that has no real impact on improving environmental quality and governance.

Based on these conditions, the main problem in this research is the suboptimal integration between the use of digital technology and green government principles in technology-based governance, resulting in technology's potential as an instrument for strengthening environmental governance not being fully utilized. Based on the problem formulation above, the research questions in this article are formulated as follows: How is the concept of smart green government understood within the framework of technology-based governance? This question aims to explore a conceptual understanding of smart green government as a synthesis of smart government and green government from a public administration perspective. What is the role of digital technology in supporting the implementation of green government principles in governance? This question aims to analyze the function of technology as a policy instrument in environmental management, data-driven decision-making, and increasing environmental accountability. What factors influence the implementation of smart green government within technology-based governance? This question covers institutional aspects, regulations, apparatus capacity, leadership, and technological infrastructure readiness. What are the main challenges in implementing smart green government, and what are the opportunities for its future development? This question aims to identify structural and technical barriers while formulating strategic opportunities for strengthening smart green government. What are the implications of implementing smart green government for strengthening governance and environmental sustainability? This question focuses on the contribution of smart green government to improving the quality of governance and achieving sustainable development goals.

Although the concepts of smart government and green government have been extensively discussed in the literature, existing studies predominantly treat them as separate governance agendas. Research on smart government mainly emphasizes administrative efficiency, digital service delivery, and data-driven decision-making, while studies on green government focus on environmental regulation, sustainability policies, and ecological accountability. Only a limited number of studies attempt to connect digital transformation with environmental sustainability, and these are largely situated within the smart city or ICT-for-sustainability discourse, rather than within a public administration and governance framework.

This separation has resulted in a significant research gap. First, there is a lack of conceptual clarity regarding how digital technologies function not merely as administrative tools, but as governance mechanisms that actively shape environmental policy integration, institutional coordination, and accountability structures. Second, existing international literature rarely examines the institutional and governance dimensions of integrating digitalization with green government principles, particularly in developing country contexts. Third, the environmental implications of digital governance itself, such as energy consumption, data center expansion, and electronic waste, remain underexplored within public administration studies.

This study addresses these gaps by introducing smart green government as a governance paradigm, rather than a technological or sectoral initiative. It conceptualizes smart green

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government as an integrative framework in which digital infrastructures, institutional arrangements, and environmental sustainability objectives are deliberately aligned within technology-based governance systems. The novelty of this study lies in its governance-oriented perspective, which moves beyond the instrumental use of technology and emphasizes policy coherence, institutional capacity, and cross-sector coordination as core determinants of sustainable digital governance. By doing so, this study contributes to international public administration literature by bridging the theoretical divide between digital governance and green government, while providing empirical insights into how technology-based governance can be strategically leveraged to advance environmental sustainability.

2. Methods

This study adopts a qualitative research approach with a descriptive analytical design. The qualitative approach is considered appropriate because the study aims to explore in depth the concept, processes, and dynamics of smart green government implementation within a technology-based governance framework. Qualitative research enables a comprehensive understanding of policy meanings, institutional practices, and governance interactions that cannot be adequately captured through quantitative measurement, particularly in relation to the integration of digital technology and environmental sustainability in public administration (Creswell, 2018).

The descriptive-analytical design is employed to systematically describe how the concept of smart green government is translated into governmental policies and practices, while simultaneously analyzing the institutional, technological, and governance factors influencing its implementation. This design allows the study to go beyond mere description by examining relationships among actors, policies, and institutional contexts that shape smart green government practices (miles, M., Huberman, A. M., Saldana, 2019).

The primary focus of this research is the implementation of smart green government in technology-based governance**,** with particular emphasis on the integration of digitalization initiatives and green government principles. The scope of the study includes:

1. Policies and regulations supporting digital governance and environmental management,
2. The utilization of digital technologies to support environmentally sustainable governance,
3. Institutional roles and bureaucratic capacity in implementing smart green government, and
4. Challenges and opportunities in advancing smart green government practices.

This scope limitation is intended to maintain analytical depth and ensure alignment with the research objectives. Accordingly, the study does not examine smart government and green government as separate agendas, but rather focuses on their convergence within the smart green government framework.

This study utilizes qualitative data derived from both primary and secondary sources. Primary data are collected through in-depth interviews with key informants who are directly involved in the formulation and implementation of digital governance and environmental policies. Informants include government officials, policymakers, and stakeholders engaged in technological management and environmental governance. Informant selection is conducted using purposive sampling, based on relevance, expertise, and strategic roles in policy

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implementation.

Secondary data are obtained from official documents, including laws and regulations, development planning documents, government performance reports, digitalization policies, and environmental management reports. In addition, secondary data are collected from academic journal articles, policy reports, and publications issued by national and international institutions related to smart green government. The use of secondary data serves to contextualize findings and strengthen analytical rigor (Bowen, 2009).

The use of secondary data in this study serves not only as contextual support but also as an analytical instrument to strengthen the credibility and depth of qualitative findings. In governance research, secondary data are essential for situating empirical insights within broader institutional and policy environments, particularly when examining complex and cross-sectoral phenomena such as smart green government (Bowen, 2009). Policy documents, strategic plans, and international governance reports provide important evidence regarding formal commitments, regulatory coherence, and implementation priorities.

Moreover, secondary data enable analytical comparison between stated policy objectives and observed governance practices. This comparison is particularly relevant in sustainability-oriented digital governance, where environmental commitments are frequently articulated at a rhetorical level but weakly operationalized in digital systems(OECD, 2020). Through systematic document analysis, this study identifies patterns of policy alignment and fragmentation that help explain variations in smart green government implementation.

The analytical process follows an iterative and reflexive approach, moving continuously between empirical data and theoretical concepts. Such an approach allows the refinement of analytical categories, including institutional capacity, policy integration, and governance coordination (miles, M., Huberman, A. M., Saldana, 2019). By integrating multiple data sources and analytical perspectives, the study enhances methodological rigor and reduces the risk of descriptive bias, thereby strengthening the validity of its conclusions (Lincoln & Guba, 1985).

Data collection is conducted using three main techniques: interviews, document analysis, and limited observation. First, semi-structured in-depth interviews are conducted to capture informants' perspectives, experiences, and interpretations regarding smart green government implementation. The semi-structured format allows flexibility to explore emerging issues while maintaining alignment with research objectives. This technique is particularly effective in uncovering policy implementation dynamics that may not be formally documented. Second, document analysis is undertaken to examine policy frameworks, regulatory commitments, and implementation consistency related to digital governance and environmental sustainability. This technique also serves as a means of data triangulation to validate information obtained from interviews. Third, limited non-participant observation is conducted to examine the practical use of digital systems, platforms, or technological tools related to governance and environmental management, where feasible. Observation focuses on understanding how technology supports or constrains smart green government practices in real administrative settings.

Data analysis is conducted through an interactive and iterative process, following the qualitative data analysis model proposed by Miles, Huberman, and Saldaña (2019), which consists of data reduction, data display, and conclusion drawing and verification. Data

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reduction involves selecting, coding, and categorizing interview transcripts, documents, and observational notes to identify key themes relevant to smart green government, such as digital technology utilization, environmental governance policies, institutional capacity, and implementation challenges. Data display is carried out through thematic matrices and descriptive narratives, enabling systematic comparison across data sources and facilitating pattern recognition. This stage supports analytical clarity and enhances the interpretability of complex qualitative data. The final stage involves drawing and verifying conclusions through critical interpretation of the data and linking empirical findings with relevant theoretical frameworks. Conclusions are continuously refined throughout the analysis process to ensure consistency, credibility, and analytical validity.

To ensure data trustworthiness, this study applies several qualitative validity strategies, including source triangulation, method triangulation, and peer debriefing. Source triangulation is achieved by comparing information from different informants and documents, while method triangulation is conducted by integrating interviews, document analysis, and observation. Peer debriefing involves discussion with academic colleagues to critically assess analytical processes and interpretations, thereby enhancing research credibility (Lincoln & Guba, 1985). This study adheres to ethical principles in qualitative research, including informed consent, confidentiality of informants, and responsible data use. All data are collected and analyzed solely for academic purposes, and informant identities are protected to ensure privacy and ethical integrity throughout the research process.

3. Results and Discussion

a. Conceptualization of Smart Green Government in Technology Based Governance

The findings reveal a notable divergence in how smart green government is conceptualized across institutional actors. Actors from information technology units predominantly frame smart green government in terms of efficiency gains, system integration, and service optimization. In contrast, actors from environmental agencies emphasize monitoring capacity, regulatory compliance, and environmental data availability. This divergence indicates that smart green government is not yet internalized as a unified governance framework, but rather interpreted through sector-specific institutional logics.

This fragmentation suggests that smart green government currently operates more as an implicit convergence of practices than as an explicit policy paradigm. While digital initiatives indirectly support environmental objectives such as reducing paper-based administration or improving reporting efficiency, these outcomes are often incidental rather than strategically designed. Compared to smart government literature that emphasizes performance and innovation, and green government studies that stress environmental accountability, the findings demonstrate a missing governance layer that integrates both agendas through coherent policy design.

From a governance perspective, this condition reflects an early-stage institutionalization of smart green government, where technological adoption precedes conceptual and regulatory alignment. This supports the argument that smart green government represents an evolutionary governance phase rather than a fully

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consolidated model.

b. Role of Digital Technology in Supporting Green Government Principles

The study finds that digital technologies play a crucial role in operationalizing green government principles, particularly in enhancing efficiency, transparency, and environmental monitoring. Digital platforms are utilized to reduce paper-based administration, improve coordination across agencies, and streamline public services. These practices contribute to reducing the environmental footprint of bureaucratic processes, consistent with the principles of green public administration (OECD, 2020). Several informants highlighted the use of integrated information systems and online service platforms as key instruments for minimizing resource consumption and improving service delivery. The transition toward electronic documentation and digital workflows has significantly reduced paper usage and administrative redundancy. This finding reinforces previous studies that emphasize the environmental benefits of e-government and digital public services when aligned with sustainability objectives.

In addition, digital technologies facilitate data-driven environmental governance through real-time data collection, environmental reporting systems, and performance dashboards. These tools enhance the government's capacity to monitor environmental indicators and support evidence-based policy decisions. However, the findings also reveal that technological utilization is uneven across sectors, with environmental applications often receiving less institutional priority compared to service delivery and administrative efficiency. This imbalance suggests that while technology provides substantial potential to strengthen green government, its effectiveness depends on policy alignment and institutional commitment. Without explicit environmental objectives embedded in digital strategies, technology risks reinforcing efficiency-driven governance rather than sustainability-oriented governance.

c. Institutional Capacity and Governance Dynamics

Institutional capacity emerges as a decisive factor influencing the implementation of smart green government. The findings indicate that organizational readiness, bureaucratic competence, and inter-agency coordination significantly shape the extent to which digital technologies can be leveraged for environmental governance. Institutions with stronger leadership commitment and clearer regulatory mandates demonstrate greater progress in integrating digital innovation with green objectives. Informants consistently pointed to human resource capacity as a critical challenge. While technical skills related to digital systems are gradually improving, environmental governance competencies remain uneven. This gap limits the ability of public organizations to translate technological potential into substantive environmental outcomes. The findings corroborate governance literature emphasizing that digital transformation requires parallel investments in institutional learning and capacity building (Dwivedi, 2021).

Coordination across government units also presents a persistent challenge. Smart green government initiatives often involve multiple sectors, including information technology, environmental management, planning, and public services. However,

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fragmented institutional arrangements and sectoral silos hinder integrated implementation. This fragmentation reflects a broader governance issue in public administration, where cross-sectoral sustainability initiatives struggle within traditional bureaucratic structures (Howlett & Ramesh, 2020). Despite these challenges, the study identifies emerging governance practices that support integration, such as inter-departmental coordination mechanisms and cross-sector digital platforms. These practices indicate incremental progress toward more integrated governance, although they remain largely project-based rather than institutionalized.

Institutional capacity in the context of smart green government extends beyond technical proficiency in operating digital systems. It encompasses organizational learning, adaptive leadership, and the ability to integrate cross-sectoral policy objectives into routine administrative processes (Peters, 2015). The findings indicate that while investments in digital infrastructure have increased, investments in environmental governance capacity remain uneven, limiting the transformative potential of technology-based governance.

Leadership framing plays a critical role in shaping institutional responses to smart green government. Leaders who conceptualize digital transformation as a governance reform rather than a technical upgrade are more likely to promote cross-sector collaboration and sustainability integration. Conversely, leadership approaches that prioritize short-term efficiency gains tend to marginalize environmental objectives (Meijer & Bekkers, 2015). This finding aligns with governance literature emphasizing the role of leadership narratives in enabling policy integration. Institutional path dependency further influences smart green government implementation. Organizations with prior experience in environmental management or innovation-oriented reforms demonstrate greater readiness to integrate sustainability objectives into digital governance initiatives. In contrast, institutions characterized by rigid hierarchical structures and narrowly defined performance indicators face greater difficulty in adopting integrative governance approaches (Pierson, 2004). These patterns suggest that smart green government outcomes are shaped not only by current policy choices but also by historical institutional trajectories. Similar challenges have been identified in international studies of sustainability-oriented governance reform, which consistently show that cross-cutting agendas such as environmental sustainability struggle to gain traction within sectorally organized bureaucracies (Jordan & Lenschow, 2010). The findings of this study, therefore, reinforce broader theoretical arguments that institutional reform is a prerequisite for effective smart green government implementation.

d. Challenges in Implementing Smart Green Government

The findings reveal several interrelated challenges that constrain the implementation of smart green government. First, policy incoherence remains a significant obstacle. Digital governance policies and environmental policies are often developed independently, resulting in limited strategic alignment. This separation reduces the potential for technology-driven environmental innovation and reinforces siloed governance practices. Second, resource constraints, particularly financial and

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technical resources, limit the scalability of smart green initiatives. While pilot projects demonstrate the feasibility of integrating technology and sustainability, long-term implementation requires sustained investment and institutional support. This finding aligns with previous research highlighting the importance of fiscal capacity and policy continuity in sustainability-oriented reforms (Meadowcroft, 2018).

Third, the environmental impact of digital infrastructure itself presents a paradox. Informants expressed concern that increased reliance on digital systems may lead to higher energy consumption and electronic waste if not managed responsibly. This issue underscores the importance of adopting environmentally sustainable digital infrastructure, including energy-efficient systems and green procurement practices. Finally, limited public participation in digital environmental governance constrains accountability and inclusiveness. Although digital platforms provide opportunities for citizen engagement, their use in environmental decision-making remains underdeveloped. This finding suggests that smart green government requires not only technological innovation but also participatory governance mechanisms to enhance legitimacy and accountability.

An additional challenge relates to the governance of data generated through digital systems. While digital technologies enable the collection of large volumes of environmental and administrative data, the absence of clear data governance frameworks constrains their effective use. Issues of data ownership, interoperability, and data quality management limit the capacity of public organizations to utilize digital information for environmental decision-making (Kitchin, 2014). Furthermore, the reliance on project-based digital initiatives poses a sustainability risk. Many smart green government efforts are implemented as pilot projects supported by temporary funding or external partnerships. Although these initiatives demonstrate innovation potential, they often lack institutional continuity once project funding ends, undermining long-term learning and scalability (Mergel et al., 2019). Accountability mechanisms also remain weak. While digital platforms theoretically enhance transparency, performance reporting systems tend to prioritize outputs and service metrics rather than long-term environmental impacts. This misalignment reduces incentives for public organizations to internalize sustainability objectives within digital governance reforms (Bovens, 2007).

e. Opportunities and Strategic Directions

Despite the challenges identified, the findings highlight significant opportunities for advancing smart green government. Digital technologies offer a scalable and adaptable platform for integrating environmental considerations into routine administrative processes. When supported by clear policy direction and institutional commitment, technology can enhance environmental monitoring, transparency, and public engagement. One key opportunity lies in the integration of environmental indicators into digital governance performance systems. Embedding sustainability metrics within administrative dashboards and reporting frameworks can institutionalize environmental accountability and align organizational incentives with green objectives. This approach resonates with the broader shift toward performance-based governance in public

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administration (OECD, 2020).

Another strategic opportunity involves strengthening cross-sector collaboration through integrated digital platforms. Such platforms can facilitate data sharing, policy coordination, and joint decision-making across environmental and non-environmental sectors. The findings suggest that integrated governance mechanisms are essential for overcoming institutional fragmentation and achieving holistic sustainability outcomes. Capacity building also emerges as a critical strategic priority. Investing in both digital and environmental competencies among public officials can enhance the effectiveness of smart green government initiatives. This investment should extend beyond technical training to include governance skills, policy analysis, and sustainability leadership.

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f. Implications for Governance and Sustainability

The implementation of smart green government has important implications for public governance and environmental sustainability. The findings suggest that smart green government can strengthen governance quality by improving transparency, accountability, and policy coherence. Digital technologies enable governments to track environmental performance more systematically and communicate policy outcomes more effectively to stakeholders. From a sustainability perspective, smart green government contributes to the integration of environmental objectives into mainstream governance processes. Rather than treating sustainability as a separate policy domain, this approach embeds environmental considerations into everyday administrative practices. This integration is essential for achieving long-term sustainability goals, particularly in complex and resource-constrained governance contexts. However, the findings also underscore that technology alone is insufficient to deliver sustainable governance outcomes. Smart green government requires supportive institutional frameworks, coherent policies, and inclusive governance practices. Without these enabling conditions, digital innovation risks reinforcing existing governance limitations rather than transforming them.

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Secondary data further support these findings. International assessments such as the OECD Digital Government Index indicate that environmental sustainability indicators remain marginal in most national digital governance frameworks. Similarly, reports on e-government development show that while digital service maturity has increased significantly, integration with environmental performance measurement remains limited. These patterns reinforce the empirical findings of this study, which demonstrate that digital governance initiatives are predominantly efficiency-driven rather than sustainability-oriented.

The absence of standardized environmental metrics within digital governance systems limits the potential of technology-based governance to function as a transformative instrument for green government. This highlights the need to embed environmental indicators within digital performance dashboards and reporting mechanisms.

4. Conclusion

This study offers several theoretical implications for public administration and governance research. First, it challenges technologically deterministic assumptions that digital transformation inherently leads to sustainability outcomes. Instead, the findings demonstrate that governance arrangements mediate the relationship between technology and environmental performance, reinforcing calls for governance-centered analytical frameworks in digital government research. Second, the study contributes to policy integration theory by illustrating how digital governance can function either as an integrative or fragmenting force, depending on institutional design and leadership commitment. Finally, the concept of smart green government provides a mid-range governance framework that bridges macro-level sustainability goals and micro-level administrative practices.

This study concludes that smart green government constitutes an emerging governance paradigm that seeks to align digital transformation with environmental sustainability within technology-based governance systems. While digital technologies provide significant opportunities to enhance environmental monitoring, efficiency, and accountability, their potential remains underutilized due to fragmented policies, uneven institutional capacity, and weak cross-sector coordination. The findings demonstrate that technology alone is insufficient to achieve sustainable governance outcomes without supportive institutional frameworks and policy coherence. By conceptualizing smart green government as a governance-oriented framework, this study advances public administration scholarship and highlights the critical role of institutional integration in sustainability-oriented digital reform.

The policy implications of the findings of this study are: First, governments need to institutionalize smart green government through explicit regulatory frameworks that mandate the integration of environmental objectives into digital governance strategies. Without formal policy alignment, digital initiatives risk reinforcing efficiency-driven governance rather than sustainability-oriented reform. Second, environmental performance indicators should be embedded within digital governance systems, including administrative dashboards, monitoring platforms, and performance evaluation mechanisms. This integration would enable systematic tracking of environmental outcomes alongside service efficiency.

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Third, institutional capacity-building programs should be redesigned to simultaneously strengthen digital competencies and environmental governance skills among public officials. Training initiatives must move beyond technical system operation toward policy analysis, cross-sector coordination, and sustainability leadership. Fourth, cross-sector coordination mechanisms should be formalized through interoperable digital platforms that connect information technology units, environmental agencies, and planning bodies. Such mechanisms are essential to overcome institutional silos and ensure coherent implementation of smart green government. Finally, governments must address the environmental footprint of digital infrastructure itself by adopting green procurement policies, energy-efficient systems, and responsible e-waste management practices. This step is crucial to ensuring that digital transformation does not generate unintended environmental externalities.

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