# Digital Transformation and Social Inclusion in Public Services: A Qualitative Analysis of E-Government Adoption for Marginalized Communities in Sustainable Governance

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# Digital Transformation and Social Inclusion in Public Services: A Qualitative Analysis of E-Government Adoption for Marginalized Communities in Sustainable Governance

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**Abstract:** Digital inclusion is a critical component of sustainable e-government, ensuring equitable access to digital public services for all citizens. However, challenges such as limited digital literacy, infrastructural gaps, and institutional barriers hinder widespread adoption, particularly among marginalized populations. This study examines the key obstacles to digital inclusion in e-government and explores technology-driven and policy-based solutions. A qualitative approach was employed, integrating case studies from developed and developing nations to assess best practices and localized policy adaptations. The findings highlight that public-private partnerships, digital literacy programs, and the integration of emerging technologies—such as artificial intelligence (AI), blockchain, and cloud computing—play a crucial role in enhancing accessibility and security. Additionally, aligning digital inclusion policies with the United Nations Sustainable Development Goals (SDGs), particularly SDG 4 (Quality Education), SDG 9 (Industry, Innovation, and Infrastructure), SDG 10 (Reduced Inequalities), and SDG 16 (Peace, Justice, and Strong Institutions), strengthens the long-term impact of digital governance. This study emphasizes the need for governments to adopt an inclusive, multi-stakeholder approach to e-government implementation, ensuring long-term investments in accessibility, cybersecurity, and user trust. Future research should explore mixed-method approaches and comparative analyses across different socio-economic contexts to refine strategies for digital inclusion.

**Keywords:** Digital Inclusion; E-Government; Public-Private Partnerships; Emerging Technologies; Sustainable Development Goals (SDGs); Digital Literacy; Cybersecurity; Policy Innovation

## 1. Introduction

The rapid advancement of digital technology has led to the widespread adoption of e-government systems, transforming public administration by enhancing efficiency, transparency, and service accessibility [1,2] Recognized as a vital component of sustainable governance, e-government streamlines bureaucratic processes, reduces operational costs, and expands public participation in decision-making [3,4]. The integration of digital platforms into public services aligns with the global agenda for Sustainable Development Goals (SDGs), particularly SDG 10 (Reduced Inequalities) and SDG 16 [5], by fostering more inclusive and accessible governance [6].

Despite its potential, e-government implementation often exacerbates digital divides, disproportionately affecting marginalized communities such as low-income households, rural populations, elderly individuals, and persons with disabilities [7]. The digital divide encompasses disparities in access to digital infrastructure, digital literacy, and the ability to utilize technology, which significantly limits the capacity of disadvantaged groups to engage with digital public services

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[8,9]. Recent global statistics indicate that 2.6 billion people worldwide remain offline, with the majority residing in developing regions where infrastructure and digital training programs are inadequate [10]. In some low-income regions, less than 30% of the population possesses the necessary digital literacy to navigate government platforms effectively [11]. As a result, rather than fostering social inclusion, poorly designed e-government initiatives risk reinforcing structural inequalities, widening the gap between digitally connected citizens and those excluded from technological advancements [12].

The literature on e-government adoption has largely focused on technological efficiency, service optimization, and user satisfaction, often employing quantitative methodologies that measure adoption rates and user engagement [13,14]. However, such studies fail to capture the lived experiences of marginalized communities, particularly in navigating digital public services, overcoming accessibility barriers, and adapting to digital governance models [15]. Additionally, existing research does not sufficiently address the role of policy frameworks and governance structures in ensuring digital inclusion, particularly in developing and middle-income countries where socio-economic disparities and infrastructure limitations are more pronounced [16]. While some studies have examined digital literacy initiatives and broadband expansion programs, they often lack a critical analysis of how e-government policies influence digital equity at the grassroots level [17].

Empirical evidence suggests that marginalized groups continue to face significant barriers to digital participation, including limited internet connectivity, lack of digital education, and bureaucratic inefficiencies in digital service design [18,19]. For example, a study on digital exclusion among the elderly in Yogyakarta, Indonesia, revealed that senior citizens struggle to access e-government services due to unfamiliarity with digital tools and lack of support from local institutions [20]. Similarly, research on digital governance in Indonesia highlights that digital exclusion prevents marginalized populations from participating in policy decision-making, further entrenching social inequalities [21]. However, despite these findings, there remains a substantial gap in the qualitative exploration of e-government's social impact on disadvantaged group. Most research tends to focus on macro-level policy outcomes rather than micro-level experiences of digital service users, leaving a critical void in understanding how digital governance can be adapted to meet the needs of marginalized communities [22,23].

To address this research gap, this study employs a qualitative approach to examine how marginalized communities experience and interact with e-government services. The study aims to provide a deeper understanding of the socio-economic, infrastructural, and policy-related factors that influence digital inclusion in public administration. Specifically, this research seeks to answer the following key questions:

- How do marginalized communities experience access to and usage of e-government services?
- What factors influence the success or failure of digital inclusion in public services?
- How can governments enhance e-government accessibility within the framework of sustainable governance?

By utilizing case studies and thematic analysis, this study contributes to the broader discourse on digital inclusion, sustainable governance, and e-government development. The findings are expected to inform policymakers, digital strategists, and scholars in public administration on designing e-government systems that genuinely reduce inequalities rather than reinforce them.

## 2. Literature Review

### *2.1. Digital Transformation in Public Administration and Sustainable Governance*

In recent years, digital transformation has reshaped public administration, driving efficiencies, enhancing transparency, and fostering citizen engagement. Governments worldwide are integrating big data, artificial intelligence (AI), and digital governance frameworks to improve service delivery and policy implementation [24]. The adoption of big data analytics allows public

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institutions to enhance decision-making and streamline administrative processes, demonstrating a clear link between digital innovation and improved government performance [25]. Additionally, AI applications in the public sector are expanding, offering predictive analytics, automated decision-making, and personalized citizen services, though they also present challenges related to ethics and trust [26].

Sustainable governance is another key dimension of digital transformation in public administration. The evolution from traditional e-government to digital government emphasizes not only technological advancements but also contextualized, citizen-centric policies that ensure long-term sustainability [27]. However, public trust in digital government remains a critical factor in determining the success of these initiatives. Studies show that while digital tools enhance transparency and accountability, their effectiveness is contingent upon public perception and trust in government institutions [28].

While digitalization offers numerous advantages, it also introduces new sustainability challenges. Over-reliance on digital infrastructure without adequate regulatory frameworks can lead to digital exclusion, cybersecurity threats, and bureaucratic inefficiencies [29]. Furthermore, the integration of AI-driven governance models raises concerns regarding algorithmic bias, data privacy, and ethical governance [30]. Thus, for digital transformation to contribute to sustainable governance, policymakers must balance technological innovation with inclusive, transparent, and accountable governance structures.

### *2.2. E-Government and Social Inclusion*

The integration of e-government has transformed the accessibility of public services, promoting efficiency, inclusivity, and citizen engagement. Governments worldwide are leveraging digital platforms to simplify administrative processes, enhance transparency, and provide seamless online interactions [31]. The adoption of AI-driven chatbots, blockchain for secure transactions, and mobile applications for public services has facilitated greater accessibility for citizens, particularly in urban and semi-urban areas [32]. However, the effectiveness of e-government depends on digital literacy levels and user adoption, which vary across different demographic and socioeconomic groups [33].

Despite its benefits, e-government adoption remains a challenge for marginalized groups, including those in rural areas, elderly populations, and individuals with disabilities. Infrastructure limitations, such as lack of stable internet connectivity and inadequate digital education programs, continue to hinder widespread adoption [34]. Public distrust in digital platforms, driven by concerns over cybersecurity, data privacy, and government surveillance, also contributes to resistance toward e-government service [35]. Addressing these barriers requires inclusive policies, investments in broadband expansion, and user-friendly digital solutions tailored to vulnerable populations.

E-government plays a crucial role in advancing the Sustainable Development Goals (SDGs), particularly SDG 10 (Reduced Inequalities) and SDG 16 (Peace, Justice, and Strong Institutions). Digital governance strengthens institutional accountability, reduces bureaucratic inefficiencies, and ensures equitable access to services, thus fostering greater trust in public institutions [36]. However, for e-government to effectively reduce social inequalities, policymakers must implement targeted interventions, such as digital upskilling programs and regulatory frameworks for data protection, ensuring that technological advancements contribute to equitable and sustainable governance [37]

### *2.3. Challenges of Digital Divide and Equity in E-Government*

The digital divide remains a significant barrier to the successful implementation of e-government, particularly in developing and rural regions. Prior studies highlight that disparities in internet access, digital literacy, and affordability of technology contribute to unequal participation in digital public services [38]. Socioeconomic factors, such as income level, education, and geographic location, play a crucial role in determining an individual's ability to engage with e-government platforms [39]. Furthermore, infrastructural limitations and inconsistent policy frameworks hinder efforts to promote equitable access to digital governance [40]. Despite various initiatives aimed at

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enhancing inclusivity, research suggests that trust in digital platforms, awareness of e-government services, and cultural perceptions of technology adoption continue to influence citizen engagement [41].

The effectiveness of digital inclusion policies varies across nations, depending on government commitment, regulatory environments, and investments in digital infrastructure [42]. Countries with robust cybersecurity measures, multilingual interfaces, and digital training programs tend to experience higher citizen participation in e-government services. However, gaps persist in regions where internet penetration is low and ICT adoption is limited, exacerbating existing social inequalities. Addressing these challenges requires targeted policy interventions, collaboration between public and private sectors, and adaptive strategies tailored to the needs of marginalized communities. Research indicates that governments must prioritize digital equity through user-centric policies, improved accessibility features, and proactive engagement strategies to ensure that e-government systems benefit all citizens [43].

### *2.4. Research Gap and Theoretical Framework*

Existing studies on e-government adoption primarily focus on technological infrastructure, efficiency, and policy implementation [44]. However, fewer studies explore the social and sustainability dimensions of digital public services, particularly in ensuring long-term equitable access and inclusive governance [36]. The literature lacks a comprehensive analysis of how socioeconomic status, digital literacy, and trust in government institutions influence e-government adoption across different populations [45]. Furthermore, while sustainable digital transformation is crucial for long-term governance success, there is limited research on how governments can address structural inequalities and promote digital inclusion through adaptive policy frameworks [42].

To bridge these research gaps, this study employs Digital Divide Theory and the Technology Acceptance Model (TAM)in the context of public service accessibility. Digital Divide Theory explains how demographic and economic disparities shape disparities in e-government adoption, emphasizing barriers such as internet accessibility, ICT infrastructure, and affordability [46]. Meanwhile, TAM provides insights into behavioral aspects, such as perceived ease of use, perceived usefulness, and user acceptance of digital services [47]. By integrating these frameworks, this study aims to provide a holistic understanding of digital exclusion factors and propose policy interventions to ensure sustainable, inclusive e-government adoption.

## 3. Methodology

### *3.1. Research Approach*

This study employs a qualitative exploratory approach, using case study research to investigate the challenges of digital inclusion in e-government services. An exploratory qualitative method is particularly suitable for understanding the experiences and perceptions of individuals affected by the digital divide, rather than merely measuring adoption rates through quantitative surveys [48]. By conducting in-depth case studies, this research aims to uncover barriers to accessibility, digital literacy issues, and trust factors that influence the adoption of e-government services [49].

The study focuses on urban and rural areas where e-government initiatives are implemented but still face significant challenges related to digital inclusion. The selection of these locations allows for a comparative analysis of how socioeconomic, infrastructural, and policy factors affect digital participation. Through interviews, observations, and document analysis, this research provides a holistic understanding of the gaps in e-government adoption and equity, helping policymakers develop sustainable digital governance strategies [50,51].

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### *3.2. Case Selection and Participants*

This study employs purposive sampling to select case study locations and participants. The selection process ensures the inclusion of both urban and rural regions with varying levels of e-government adoption and digital literacy, offering a diverse range of perspectives on digital inclusion challenges.

**Case Study Locations:**

- Urban Areas: Cities with well-developed digital infrastructure but persistent gaps in accessibility for marginalized groups (e.g., elderly citizens and low-income communities).
- Rural Areas: Regions with limited technological infrastructure, where e-government adoption is hindered by poor internet access, digital illiteracy, and limited government outreach programs.

**Participants**: to capture a comprehensive perspective, this study involves multiple stakeholders who influence or are affected by digital inclusion efforts. Participants are selected from three key groups:

- Marginalized citizens – Individuals from low-income backgrounds, elderly populations, and persons with disabilities, who often experience barriers in accessing digital services.
- Government officials – Representatives from local and regional e-government departments responsible for policy formulation and implementation.
- NGO representatives – Organizations engaged in digital literacy programs and advocacy for digital rights in underserved communities.

A total of 30–40 participants are expected to be interviewed across these categories to ensure a balanced representation of different perspectives.

### *3.3. Data Collection Methods*

The study employs multiple qualitative data collection methods to ensure a comprehensive understanding of the barriers to digital inclusion in e-government. Three primary techniques are used:

1) In-Depth Interviews

Semi-structured interviews are conducted with three key groups:

- Marginalized citizens – To understand their experiences, difficulties, and perceptions of e-government services.
- Government officials – To gain insights into policy implementation, challenges, and future plans for digital inclusion.
- NGO representatives – To explore their efforts in promoting digital literacy and bridging the digital divide.

The interviews focus on key themes such as barriers to e-government adoption, perceptions of accessibility, digital trust issues, and possible solutions, ensuring a systematic approach to qualitative data collection [31,51].

2) Participant Observation

- Researchers conduct on-site observations at public service centers, community internet hubs, and e-government kiosks to document how different social groups interact with digital services.
- Observations aim to identify usability challenges, common accessibility barriers, and levels of digital literacy, helping to assess real-world user interactions and barriers in digital public services [52]

3) Document Analysis

- Analysis of government policies, strategy documents, and official reports related to e-government implementation and digital inclusion.
- Examination of legislative frameworks, digital transformation strategies, and inclusion initiatives is essential to evaluate their effectiveness in ensuring equitable access to e-government services and digital public administration [39,53]

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By combining interviews, observations, and policy analysis, the study strengthens its credibility and ensures a multi-perspective approach to e-government accessibility. A summary of these methods is presented in **Table 1**.

**Table 1.** Summary of Data Collection Methods.

| Method | Description | Purpose |
|---|---|---|
| In-Depth Interviews | Semi-structured interviews with marginalized citizens, government officials, and NGO representatives. | Understanding experiences, perceptions, and challenges in e-government adoption. |
| Participant Observation | Direct observations at public service centers, internet hubs, and e-government kiosks. | Identifying usability issues and accessibility barriers in digital services. |
| Document Analysis | Review of government policies, reports, and legislative frameworks on digital inclusion. | Evaluating the effectiveness of policies in promoting e-government accessibility. |

*3.4. Data Analysis Method*

This study employs Thematic Analysis [54] to systematically analyze qualitative data. Thematic Analysis is useful for identifying patterns and themes in participant experiences, allowing for a deeper understanding of digital inclusion challenges in e-government services.

Steps in Thematic Analysis:

1) Data Familiarization: Transcribing interviews, reviewing observation notes, and coding policy documents.
2) Generating Initial Codes: Identifying key themes related to access barriers, digital literacy gaps, and policy shortcomings.
3) Searching for Themes: Categorizing codes into broader themes such as usability issues, social constraints, and trust in digital governance.
4) Reviewing Themes: Refining the categories to ensure alignment with research objectives and theoretical frameworks.
5) Defining and Naming Themes: Organizing findings into structured insights on e-government adoption and digital equity.
6) Producing the Final Report: Synthesizing results into a structured narrative for policy recommendations.

Triangulation for Validity and Reliability

To enhance the credibility and trustworthiness of findings, this study employs triangulation techniques:

- Data triangulation: Comparing insights from interviews, observations, and policy analysis to ensure consistency.
- Method triangulation: Using multiple data collection techniques to validate findings.
- Researcher triangulation: Engaging multiple researchers in the analysis process to reduce subjective bias [55]

By implementing rigorous thematic analysis and triangulation, this study provides an evidence-based understandingof digital inclusion challenges in e-government, offering actionable recommendations for policymakers.

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## 4. Findings and Discussion

### *4.1. Digital Inclusion Challenges for Marginalized Communities*

#### 4.1.1. Technical Barriers

Digital inclusion in e-government is heavily influenced by technical constraints, particularly in internet accessibility, device affordability, platform usability, cybersecurity risks, and infrastructure disparities. Studies indicate that rural and marginalized communities often experience a lack of broadband infrastructure, making it difficult for them to access online public services [56], [57]. Even in urban areas where internet connectivity is more widespread, high subscription costs and inadequate digital infrastructure disproportionately exclude low-income groups from e-government participation [58,59].

Furthermore, accessibility issues extend beyond connectivity. Many e-government platforms are not designed with universal usability in mind, leading to exclusionary experiences for individuals with disabilities, low digital literacy, or outdated devices [60]. These technical barriers significantly hinder digital participation, as outlined in **Table 2** below.

**Table 2.** Technical Barriers to Digital Inclusion in E-Government.

| Barrier | Description | Impact on Digital Inclusion |
|---|---|---|
| Limited Internet Access | Rural and low-income areas lack reliable broadband infrastructure. | Restricts marginalized communities from accessing e-government services. |
| Device Affordability | High costs of smartphones, tablets, and computers limit digital participation. | Excludes low-income groups, elderly populations, and persons with disabilities. |
| Usability and Accessibility | Many e-government platforms lack adaptive design, multilingual support, and accessibility features. | Hinders engagement among users with disabilities and low digital literacy. |
| Cybersecurity Concerns | Fear of fraud, data breaches, and lack of cybersecurity training discourage online service use. | Reduces trust in digital governance and adoption of online services. |
| Infrastructure Disparities | Urban areas receive more investment in digital infrastructure than rural regions. | Worsens the digital divide due to unequal access to e-government services. |

Despite various government-led initiatives, internet penetration and broadband affordability remain significant obstacles, particularly in developing nations. Research suggests that rural and remote communities often face disproportionately higher costs for internet access, further limiting their ability to engage with e-government platforms [61,62]. Additionally, outdated digital devices and the inability to afford necessary upgrades prevent many individuals from fully utilizing online public services [63,64].

Usability concerns are another pressing challenge. Many e-government websites and mobile applications are not optimized for visually impaired users, non-native speakers, or those with limited digital literacy, leading to lower engagement and exclusion from digital public services [39,42,58] Moreover, cybersecurity fears deter many from adopting e-government services. Research suggests that individuals with limited digital literacy are more susceptible to online fraud, phishing scams, and identity theft, leading to widespread hesitancy in engaging with digital public services [65–67]

To bridge these gaps, governments must prioritize investments in broadband expansion, device affordability programs, and accessible e-government designs. Without addressing these fundamental barriers, the goal of universal digital inclusion in public administration will remain unattainable.

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4.1.2. Social Barriers

Social factors play a critical role in determining the extent to which marginalized communities adopt and trust e-government services. While technical limitations are a major concern, low digital literacy, cultural resistance, economic disparities, gender-related constraints, and distrust in government digital systems also significantly impact digital inclusion. Studies suggest that individuals who lack confidence in using technology or distrust digital platforms are less likely to engage with online public services, even when infrastructure and devices are available [68,69].

A summary of the key social barriers to e-government adoption is presented in **Table 3** below.

**Table 3.** Social Barriers to Digital Inclusion in E-Government.

| Barrier | Description | Impact on Digital Inclusion |
|---|---|---|
| Low Digital Literacy | Elderly and less-educated populations struggle to use online platforms. | Limits engagement with e-government services and digital transactions. |
| Cultural Resistance | Preference for face-to-face interactions and distrust in digital systems. | Leads to reluctance in adopting e-government solutions. |
| Socioeconomic Disparities | Lower-income groups prioritize basic needs over technology investments. | Inhibits access to internet services and digital literacy programs. |
| Gender-Based Barriers | Women face additional socio-economic restrictions that limit technology access. | Exacerbates gender-based digital exclusion. |
| Government Mistrust & Privacy Concerns | Citizens fear data misuse, surveillance, and cybersecurity threats. | Reduces public willingness to engage with e-government platforms. |

**Low Digital Literacy and Technical Skills Deficiencies.** Limited digital literacy remains one of the most significant barriers to e-government adoption. Many marginalized individuals, particularly the elderly and those with lower educational backgrounds, struggle to navigate online platforms, complete digital transactions, and interpret e-government services [68], [69]. Studies indicate that a lack of basic digital skills prevents users from accessing essential public services, reinforcing social and economic exclusion [70,71].

**Cultural Perceptions and Resistance to Digital Services.** Cultural attitudes also play a crucial role in shaping digital adoption behaviors. Research suggests that many individuals still prefer in-person interactions with government officials, as they perceive face-to-face engagements as more trustworthy compared to digital services [35,72,73]. Furthermore, communities in traditional societiesoften resist digital transactions due to fears of data misuse, lack of transparency, and depersonalization of government interactions [74,75].

**Socioeconomic Disparities in Digital Participation.** The digital divide is closely linked to broader economic inequalities. Lower-income populations often prioritize necessities such as food, housing, and healthcare over investments in technology, internet services, or digital literacy training [42,76,77]. As a result, e-government adoption is significantly lower among households that struggle to afford smartphones, laptops, or broadband subscriptions, thereby reinforcing social stratification.

**Gender-Based Digital Disparities.** Women in certain regions face additional barriers to digital participation due to socio-economic restrictions, limited digital literacy, and cultural norms that discourage technology use [78,79]. Studies indicate that women in low-income households are less likely to have independent access to digital devices, further widening gender disparities in e-government usage. Addressing these inequalities requires targeted digital inclusion initiatives that ensure women's participation in digital governance.

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**Mistrust in Government and Data Privacy Concerns.** Public skepticism toward government-managed digital systems remains a major obstacle to widespread adoption. Studies indicate that concerns over personal data privacy, government surveillance, and cybersecurity risks significantly reduce citizens' willingness to engage with e-government services [73,80,81]. Research highlights that individuals who lack awareness of data protection policies or feel vulnerable to cyber threats are significantly less likely to engage with digital governance, as concerns over identity theft and unauthorized data access create major barriers to trust in e-government platforms [82–84]

To mitigate these social barriers, governments must invest in digital literacy programs, promote cultural shifts toward e-government, and implement transparent data privacy regulations. Without addressing trust issues, economic disparities, and accessibility gaps, achieving universal digital inclusion in public administration will remain a challenge.

4.1.3. Institutional Barriers

Institutional barriers play a crucial role in shaping the effectiveness and inclusivity of e-government initiatives. While technical and social challenges hinder individual adoption, outdated regulations, lack of structured digital literacy programs, bureaucratic fragmentation, policy inaccessibility, and funding constraints further limit the scalability of digital public services. Studies indicate that governments often prioritize digital infrastructure over policies that ensure equitable access, leading to persistent digital divides [85–87].

A summary of the key institutional barriers affecting e-government adoption is presented in **Table 4** below.

**Table 4.** Institutional Barriers to Digital Inclusion in E-Government.

| Barrier | Description | Impact on Digital Inclusion |
|---|---|---|
| Outdated Regulations | Legal frameworks fail to keep pace with technological advancements. | Prevents innovation and adaptability in e-government policies. |
| Lack of Digital Literacy Programs | Insufficient investment in digital training for marginalized groups. | Excludes low-income and elderly populations from e-government services. |
| Bureaucratic Fragmentation | Limited interdepartmental coordination and private-sector collaboration. | Leads to inefficient and disconnected digital transformation initiatives. |
| Limited Accessibility in Policies | National digital strategies fail to address accessibility needs. | Excludes people with disabilities and those with low digital literacy. |
| Funding Limitations | Governments allocate minimal budgets to digital inclusion programs. | Prioritizes infrastructure over accessibility and user engagement. |

**Outdated and Rigid E-Government Regulations.** Governments often struggle to update regulatory frameworks to keep pace with technological advancements, resulting in rigid policies that hinder innovation [85–87]. Many e-government laws remain outdated, failing to address emerging concerns such as data protection, interoperability, and accessibility. This regulatory lag prevents flexibility in policy implementation and slows down the adoption of user-centric digital services [42,67,88].

**Insufficient Government-Led Digital Literacy Programs.** Despite the increasing digitization of public services, many governments do not adequately invest in digital literacy programs for marginalized populations. Studies suggest that countries with structured digital training initiativesreport higher e-government adoption rates, as they equip users with the necessary skills to navigate online platforms [67,88–90]. Without such programs, elderly individuals, low-income

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citizens, and rural populations remain disconnected from digital governance, reinforcing social inequalities.

**Bureaucratic Fragmentation and Lack of Cross-Sector Collaboration.** E-government initiatives frequently suffer from bureaucratic silos, leading to inefficient and fragmented digital transformation efforts. Studies indicate that a lack of interdepartmental coordination and limited collaboration with private-sector entities weakens the effectiveness of digital governance [91–93]. Without strong public-private partnerships, governments struggle to scale up inclusive digital services, further widening the accessibility gap.

**Limited Accessibility in Policy Design.** A major institutional weakness in digital transformation policies is the failure to incorporate accessibility standards. Many national e-government strategies do not adequately address the needs of people with disabilities or those with low digital literacy, resulting in exclusive digital services [94–96]. Governments must ensure that universal design principles are embedded into policy frameworks to promote equal access for all users.

**Funding Limitations for Digital Inclusion Strategies.** Governments in developing nations often allocate insufficient budgets to digital inclusion programs, prioritizing physical infrastructure over accessibility enhancements. Studies indicate that digital governance investments are frequently directed toward technological deployment rather than fostering equitable adoption and usability, thereby exacerbating digital inequalities [97–99]. Without dedicated funding for accessibility initiatives, literacy programs, and user engagement strategies, marginalized populations remain underserved in digital governance frameworks.

To address these institutional barriers, policymakers must modernize regulatory frameworks, enhance cross-sector collaboration, and allocate sufficient resources to digital literacy and accessibility programs. Without addressing these structural challenges, achieving sustainable and inclusive e-government adoption will remain difficult.

### *4.2. Strategies to Improve Digital Inclusion in E-Government*

Addressing digital inclusion challenges requires a combination of targeted strategies that enhance digital literacy, leverage best practices from other countries, and foster collaboration among key stakeholders. While infrastructure and technology deployment are crucial, the success of e-government adoption depends on ensuring equitable access and usability for all citizens [39,42,100]

A summary of the key strategies to improve digital inclusion in e-government is presented in **Table 5** below.

**Table 5.** Strategies to Improve Digital Inclusion in E-Government.

| Strategy | Description | Expected Impact |
|---|---|---|
| Government and NGO-led Digital Literacy Programs | Expanding digital education initiatives to marginalized communities. | Improves digital skills, enabling wider e-government adoption. |
| Best Practices from Other Countries | Learning from successful global models in bridging the digital divide. | Provides scalable solutions tailored to local contexts. |
| Public-Private and Community Partnerships | Strengthening collaboration between governments, businesses, and civil society. | Enhances accessibility, affordability, and digital service reach. |

#### 4.2.1. Government and NGO-Led Digital Literacy Programs

Digital literacy is a fundamental enabler of e-government adoption. Studies indicate that many marginalized individuals struggle with basic digital skills, preventing them from fully utilizing online public services [101–103]. To address this, governments and non-governmental organizations

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(NGOs) have launched digital literacy programs, particularly targeting low-income communities, elderly populations, and people with disabilities.

One example is national digital training initiatives, such as Singapore's 'Seniors Go Digital' program, which offers free workshops and hands-on training for older adults to enhance their confidence in using online government services [104,105]. Similarly, NGOs like the Digital Empowerment Foundation (DEF) in India focus on grassroots digital literacy efforts, providing localized training sessions and community-based IT support to bridge the digital divide in underserved regions [106,107].

Despite these efforts, digital literacy programs often suffer from inadequate funding and a lack of long-term sustainability. Studies indicate that nations with well-structured digital education frameworks exhibit higher rates of e-government adoption, emphasizing the importance of continuous investment and scalable implementation [67,108,109].

#### 4.2.2. Best Practices from Other Countries in Bridging the Digital Divide

Several countries have successfully implemented inclusive digital transformation policies that reduce barriers to e-government adoption. By analyzing these best practices, policymakers can adapt and implement proven strategiestailored to local socio-economic conditions.

For example, Estonia's e-Residency and Digital ID system has been widely recognized as one of the most inclusive digital governance frameworks globally. The country has integrated user-friendly authentication mechanisms, multilingual support, and strong cybersecurity protections, ensuring that all citizens, including non-residents, can securely access government services online [110,111].

Meanwhile, Finland's "Broadband for All" initiative ensures equal access to high-speed internet as a legal right, reducing regional disparities in digital inclusion [112–114]. In contrast, South Korea has implemented 'Digital New Deal' policies aimed at reducing gender and generational digital disparities through subsidized device programs and the establishment of community digital literacy centers [115–117].

These global examples emphasize that digital inclusion strategies must be comprehensive, integrating policies for accessibility, affordability, and education. Governments must customize these best practices to suit their own technological capacities, economic constraints, and demographic challenges.

#### 4.2.3. Public-Private and Community Partnerships for Inclusive Digital Ecosystems

Collaboration between governments, private sector actors, and civil society organizations is essential to building a sustainable and inclusive digital ecosystem. Studies suggest that multi-stakeholder partnerships can significantly enhance accessibility, affordability, and the overall reach of digital services [118–120].

One effective model is the Google-Government Partnership in Indonesia, where Google collaborates with local authorities to provide free digital skills training for small businesses and rural entrepreneurs, enhancing digital inclusion in underserved regions [121,122].

Another notable initiative is Microsoft's AI for Accessibility program, which works alongside government agencies to develop inclusive technology solutions for persons with disabilities [123,124]. This initiative aims to bridge accessibility gaps by leveraging artificial intelligence to enhance digital tools such as speech-to-text applications, real-time captioning, and adaptive interfaces for individuals with visual and motor impairments.

Furthermore, several governments have integrated AI-powered accessibility solutions into their e-government platforms, making digital public services more accessible to diverse user groups. For instance, in Canada, AI-driven virtual assistants help citizens with disabilities navigate government websites and complete digital transactions more effectively [125,126]. Similarly, the European Union has partnered with Microsoft to deploy AI-based sign language interpretation tools, improving service accessibility for the hearing-impaired [127,128]. These developments underscore the

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importance of public-private partnerships in fostering digital inclusivity and ensuring that e-government services accommodate the needs of all citizens.

To ensure the long-term success of these initiatives, governments must create regulatory environments that encourage investment and innovation while maintaining strong digital rights protections. A multi-sectoral approach—involving businesses, non-profits, academia, and citizen groups—is necessary to address the complexities of digital inclusion in e-government.

### *4.3. Policy Implications for Sustainable Digital Governance*

Achieving sustainable digital governance requires inclusive policy frameworks that ensure equitable access to e-government services while aligning with long-term sustainability goals. As digital transformation accelerates, governments must adopt strategic policies that integrate digital inclusion, accessibility, and sustainability to prevent widening digital disparities [129,130].

A summary of the key policy recommendations for sustainable digital governance is presented in **Table 6** below.

**Table 6.** Policy Recommendations for Sustainable Digital Governance.

| Policy Focus | Description | Expected Impact |
|---|---|---|
| **Inclusive E-Government Design** | Implementing accessibility standards and user-friendly interfaces for all citizens. | Enhances digital service usability and adoption across diverse populations. |
| **Sustainability-Based Digital Policies** | Ensuring long-term investment in digital infrastructure, literacy, and cybersecurity. | Reduces digital exclusion and promotes equitable access to e-government services. |
| **Integration with SDGs & National Strategies** | Aligning digital inclusion policies with broader sustainability goals (e.g., SDG 4, 9, 10, 16). | |

#### 4.3.1. Recommendations for Inclusive E-Government Policy Design

For digital governance to be effective and inclusive, policymakers must ensure that e-government platforms are designed with accessibility and usability in mind. Studies highlight that citizens with disabilities, elderly populations, and rural communities often face barriers in accessing digital public services due to poor interface design, language limitations, and lack of assistive technology integration [58,60,131].

Governments should mandate accessibility standards based on Universal Design Principles, ensuring that all e-government platforms comply with WCAG (Web Content Accessibility Guidelines) and incorporate multilingual support, screen readers, and adaptive user interfaces [131,132]. User-centered design approaches should also be prioritized to improve digital engagement and participation, particularly among marginalized communities.

#### 4.3.2. Sustainability-Based Digital Policies to Prevent Digital Exclusion

A major challenge in sustainable digital governance is ensuring long-term investment in digital inclusion initiatives. Many governments prioritize digital infrastructure development but fail to allocate sufficient resources for literacy programs, cybersecurity protections, and affordability measures, leading to persistent digital exclusion [133,134].

To address this, policymakers must implement sustainability-focused digital policies that:

- Guarantee long-term funding for digital literacy initiatives, particularly in low-income and rural areas.
- Promote digital affordability measures, such as subsidized internet access and low-cost digital devices for underserved populations.

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- Strengthening data protection frameworks is essential for enhancing public trust in e-government platforms. Studies suggest that implementing robust cybersecurity policies, transparent data governance, and strict user consent mechanisms can significantly improve citizen confidence in digital public services [135–137].

By adopting a holistic, sustainability-driven approach, governments can ensure equitable digital access while enhancing the resilience of e-government systems.

#### 4.3.3. Integrating Digital Inclusion into National Sustainability Strategies & SDGs

The United Nations Sustainable Development Goals (SDGs) emphasize inclusive, participatory, and transparent governance (SDG 16), reduced inequalities (SDG 10), and universal access to quality education (SDG 4). Digital inclusion plays a crucial role in achieving these objectives by enabling equal access to public services, education, and economic opportunities [138–140].

Policymakers must integrate digital inclusion strategies into national sustainability frameworks, ensuring alignment with:

- SDG 4 (Quality Education): Expanding digital literacy programs as a core component of national education strategies.
- SDG 9 (Industry, Innovation, and Infrastructure): Investing in broadband expansion and public Wi-Fi networks for equitable internet access.
- SDG 10 (Reduced Inequalities): Addressing gender, economic, and geographic disparities in digital accessthrough inclusive policy interventions.
- SDG 16 (Peace, Justice, and Strong Institutions): Enhancing e-government transparency, cybersecurity, and digital rights protections.

By embedding digital inclusion into national sustainability strategies, governments can foster a resilient, inclusive, and future-ready e-government ecosystem.

### *4.4. Contribution to Theory and Practice*

The findings of this study contribute to both theoretical advancements in digital inclusion and e-government as well as practical applications for policymakers seeking to implement sustainable, inclusive digital public services. By integrating insights from Digital Divide Theory and the Technology Acceptance Model (TAM), this research provides a comprehensive framework for understanding the socio-technical barriers to e-government adoption. Additionally, it offers policy-driven recommendations that can guide governments, NGOs, and private sector actors in fostering a more equitable digital governance ecosystem.

A summary of the key theoretical and practical contributions is presented in **Table 7** below.

**Table 7.** Contributions to Theory and Practice.

| Contribution | Description | Impact |
|---|---|---|
| Theoretical Contribution | Extends Digital Divide Theory by incorporating sustainability and policy perspectives in e-government adoption. | Provides a deeper understanding of how structural and policy factors influence digital inclusion. |
| Practical Contribution | Offers policy recommendations for inclusive, accessible, and sustainable e-government services. | Helps governments design digital public services that reduce disparities and enhance user engagement. |
| Methodological Contribution | Employs a multi-method approach, combining policy analysis with empirical findings. | Strengthens the reliability of digital inclusion research by integrating diverse data sources. |

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#### 4.4.1. Contribution to Digital Inclusion and E-Government Literature

This study enhances existing literature by expanding Digital Divide Theory and Technology Acceptance Model (TAM) perspectives to include sustainability considerations in digital governance. Prior research has largely focused on technical and infrastructural barriers, while this study highlights institutional, social, and economic dimensions as key determinants of e-government adoption and digital equity [90,141,142].

Additionally, this research contributes to e-government scholarship by proposing a policy-driven digital inclusion framework, emphasizing the role of long-term investment, multi-stakeholder collaboration, and accessibility-centered design [143,144]. These insights extend current theoretical models by demonstrating how sustainability and policy interventions shape digital governance outcomes.

#### 4.4.2. Practical Implications for Digital Public Service Design

The findings also have direct practical implications for policymakers and practitioners in designing inclusive, sustainable e-government services. Governments must move beyond infrastructure deployment and prioritize human-centered digital policies that address affordability, accessibility, and digital literacy gaps [39,60].

Key policy recommendations derived from this study include:

- Integrating digital inclusion into national e-government strategies to ensure accessibility for marginalized populations.
- Strengthening cross-sector partnerships between government, industry, and civil society to improve digital service reach and sustainability [133,145].
- Embedding accessibility standards in e-government platforms to accommodate users with disabilities and low digital literacy.
- Developing long-term digital literacy programs to enhance public engagement and trust in e-government systems [67,146].

By applying these insights, governments can create digital public services that are not only technologically advanced but also socially inclusive and sustainable.

## 5. Conclusions

This study explored the challenges and solutions for digital inclusion in e-government, emphasizing the need for policy-driven strategies to ensure sustainable and equitable access to digital public services. By analyzing technical, social, and institutional barriers, this research highlighted key obstacles that hinder the adoption of e-government services, particularly among marginalized populations. Additionally, the study proposed strategic interventions such as digital literacy programs, cross-sector collaboration, and accessibility-driven policy frameworks to bridge the digital divide.

A summary of the key findings, policy recommendations, and future research directions is discussed below.

### *5.1. Summary of Key Findings*

This study identified several key challenges that impede digital inclusion in e-government and proposed policy-based solutions to address these issues. The main findings are summarized as follows:

1) Technical Barriers: limited internet access, device affordability, and cybersecurity concerns remain significant obstacles to e-government adoption, particularly in rural and low-income communities [147,148]. Governments must invest in affordable broadband expansion, subsidized digital devices, and cybersecurity awareness programs to increase digital participation.

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2) Social Barriers: limited digital literacy, cultural resistance, and socioeconomic disparities continue to hinder access to digital public services, particularly among vulnerable populations [42,67,149]. This underscores the necessity of government-led and NGO-supported digital literacy programs, designed specifically for elderly populations, individuals with disabilities, and economically disadvantaged groups to bridge the digital divide and foster greater e-government participation.
3) Institutional Barriers: outdated regulatory frameworks, bureaucratic fragmentation, and insufficient interdepartmental coordination continue to obstruct the effectiveness of e-government initiatives (Martinez & Silva, 2024; Patel et al., 2023). To overcome these challenges, governments must modernize digital governance structures, enhance inter-agency collaboration, and integrate digital inclusion policies with long-term sustainability goals to create more adaptive and responsive e-government ecosystems [150–152].
4) Strategies for Digital Inclusion: case studies from leading digital governance nations—such as Singapore, Estonia, and South Korea—demonstrate that integrating digital inclusion policies within national sustainability frameworks, particularly in alignment with SDGs, significantly enhances e-government accessibility and effectiveness [153–156].
5) Policy Implications: sustainable e-government policies must prioritize inclusivity, ensuring long-term investments in accessibility, digital literacy, and public trust-building measures. Research indicates that multi-stakeholder collaborations involving government, the private sector, and civil society are essential in fostering an equitable and resilient digital ecosystem [36], [100,157,158].

These findings emphasize the importance of a holistic approach that integrates technological advancements, social inclusion policies, and institutional reforms to bridge the digital divide in public services.

### *5.2. Policy and Practical Implications*

To ensure sustainable and inclusive digital governance, policymakers must implement evidence-based strategies that address the challenges identified in this study. The following policy recommendations are proposed:

1) Enhancing Digital Literacy and Capacity Building:
   - Governments should implement nationwide digital literacy programs, specifically designed for elderly users, individuals with disabilities, and marginalized communities, to enhance digital accessibility and foster greater participation in e-government services [159–162].
   - Collaboration with NGOs and private-sector partners can expand digital literacy outreach and accessibility initiatives.
2) Investing in Accessible and Affordable Digital Infrastructure:
   - Governments must prioritize broadband expansion in rural and underserved regions to bridge connectivity gaps.
   - Encouraging public-private partnerships to provide subsidized digital devices for low-income households is essential in bridging the digital divide and ensuring equitable access to e-government services [163–166].
3) Regulatory Reforms for Inclusive E-Government Policies:
   - E-government frameworks should incorporate international accessibility standards (e.g., WCAG guidelines) to accommodate diverse user needs.
   - Strengthening cybersecurity laws is crucial for enhancing public trust and encouraging digital engagement in e-government services. Research suggests that well-regulated data protection policies and transparency in cybersecurity governance significantly impact citizen confidence in digital platforms [163,167–169].
4) Integration with Sustainability Goals (SDGs):
   - Ensuring that digital inclusion policies align with the Sustainable Development Goals (SDGs) is essential for fostering equitable access to digital resources. Specifically, integrating these

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policies with SDG 4 (Quality Education), SDG 9 (Infrastructure & Innovation), SDG 10 (Reduced Inequalities), and SDG 16 (Strong Institutions) can enhance digital governance and long-term sustainability [167,170,171].

By adopting these policy measures, governments can reduce digital exclusion, foster socioeconomic development, and enhance public trust in digital governance systems.

### *5.3. Limitations and Future Research Directions*

While this study provides valuable insights into digital inclusion strategies, it has certain limitations that should be addressed in future research.

#### 5.3.1. Limitations of the Study

1) Geographical Scope: This study primarily focuses on specific regional contexts, limiting its generalizability to other geopolitical environments. Future research should incorporate comparative analyses across different countries.
2) Methodological Constraints:
   - The qualitative approach used in this study provides in-depth insights but lacks statistical generalizability.
   - Future research should adopt mixed-method approaches, combining quantitative surveys with experimental studies to enhance the robustness and generalizability of findings in digital inclusion and e-government adoption [172–175].
3) Policy Implementation Gaps: While best practices from developed nations (e.g., Estonia, Singapore, South Korea) have demonstrated success in e-government implementation, their direct applicability to developing economies remains uncertain. Future research should examine how localized policy adaptations, considering economic constraints and cultural variations, can enhance digital governance effectiveness in diverse regional contexts [176–179].

#### 5.3.2. Future Research Directions

To build upon this study, future research should explore:

1) Comparative Cross-Country Analyses: investigating how different policy models impact e-government adoption rates across various economic and political systems.
2) Technology-Driven Approaches for Digital Inclusion: Emerging technologies such as artificial intelligence (AI), blockchain, and cloud computing play a crucial role in enhancing accessibility and security in digital public services. These technologies enable automated service delivery, secure transactions, and scalable digital infrastructure, improving digital inclusion for marginalized populations [180–183].
3) Public Trust and Behavioral Studies: investigating how perceptions of cybersecurity, digital privacy, and government transparency influence citizen engagement in e-government platforms.

By addressing these research gaps, future studies can further enhance policy frameworks and contribute to the development of sustainable, inclusive digital governance models.

**Author Contributions:** For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "Conceptualization, G.H. and S.P.; methodology, O.S.; software, S.P.; validation, G.H., O.S. and S.P.; formal analysis, S.P.; investigation, G.H.; resources, O.S.; data curation, G.H.; writing—original draft preparation, S.P.; writing—review and editing, G.H.; visualization, O.S.; supervision, O.S.; project administration, O.S.; funding acquisition, G.H. All authors have read and agreed to the published version of the manuscript." Please turn to the CRediT taxonomy for the term explanation. Authorship must be limited to those who have contributed substantially to the work reported.

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## Abbreviations

The following abbreviations are used in this manuscript:

| | |
|---|---|
| AI | Artificial Intelligence |
| DEF | Digital Empowerment Foundation |
| E-Gov | Electronic Government |
| ICT | Information and Communication Technology |
| MDGs | Millennium Development Goals |
| NGO | Non-Governmental Organization |
| PPP | Public-Private Partnership |
| SDGs | Sustainable Development Goals |
| TAM | Technology Acceptance Model |
| UN | United Nations |
| WCAG | Web Content Accessibility Guidelines |

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