Journal of Infrastructure, Policy and Development 2024, 8(10), 7707.
https://doi.org/10.24294/jipd.v8i10.7707

Review

Toward a theory of e-government: Challenges and opportunities, a literature review

Mengzhong Zhang*, **Manpreet Kaur**

Education and Social Sciences, College of Humanities, Gannon University, PA 16541, USA
*** Corresponding author:** Mengzhong Zhang, zhang038@gannon.edu

CITATION

Zhang M, Kaur M. (2024). Toward a theory of e-government: Challenges and opportunities, a literature review. Journal of Infrastructure, Policy and Development. 8(10): 7707. https://doi.org/10.24294/jipd.v8i10.7707

ARTICLE INFO

Received: 1 July 2024
Accepted: 30 July 2024
Available online: 20 September 2024

Abstract: This paper examines the transformative potential of e-government in public administration, focusing on its capacity to enhance service delivery, transparency, accessibility, cost efficiency, and civic engagement. The study identifies key challenges, including inadequate technological infrastructure, cybersecurity vulnerabilities, resistance to change within public institutions, and a lack of public awareness about e-government services. These barriers hinder the seamless operation and adoption of digital government initiatives. Conversely, the study highlights significant opportunities such as streamlined service delivery, enhanced transparency through real-time access to government data, increased accessibility for marginalized and remote communities, substantial cost savings, and greater civic engagement via digital platforms. Addressing these challenges through targeted strategies—enhancing technological infrastructure, bolstering cybersecurity, managing organizational change, and raising public awareness—can help policymakers and public administrators implement more effective and inclusive e-government initiatives. Additionally, the integration of these digital solutions can drive sustainable development and digital inclusion, fostering social equity and economic growth. By leveraging these opportunities, governments can achieve more efficient, transparent, and accountable governance. Ultimately, the successful implementation of e-government can transform the relationship between citizens and the state, building trust and fostering a more participatory democratic process.

Keywords: e-government; service delivery; transparency; accessibility; cost efficiency; civic engagement; e-government theory

1. Introduction

1.1. Problem statement

E-government refers to the use of digital technologies, particularly the internet, to provide government services and information to the public, and it has the potential to transform public administration by enhancing efficiency, transparency, and accessibility. The efficiency gains from e-government include streamlined administrative processes, reduced time and resources for service delivery, and examples like online tax filing systems that simplify paperwork for citizens and reduce administrative overhead. Transparency is improved as digital platforms offer easy access to information, including public records, real-time government updates, and avenues for public feedback, thereby building trust between the government and citizens. Accessibility is expanded as e-government services reach broader populations, including those in remote or underserved areas, through online portals that eliminate the need for physical visits to government offices. Despite these benefits, several challenges hinder the effective implementation of e-government.

Inadequate technological infrastructure, particularly in developing regions, includes insufficient internet coverage, outdated hardware and software systems, and unreliable power supplies, all of which impede the delivery and access to e-government services. Cybersecurity threats pose significant risks as online services become targets for cyberattacks, necessitating robust cybersecurity measures to protect sensitive information and maintain public trust. Additionally, there is often resistance to change within public institutions due to a lack of digital literacy, fear of job displacement, and reluctance to alter established procedures, which requires comprehensive training programs and change management strategies to overcome. Nevertheless, e-government presents numerous opportunities to enhance governance, such as improved service delivery through automated processes and online services that lead to higher citizen satisfaction and reduced bureaucratic delays and enhanced civic engagement via digital platforms that enable citizens to participate in decision-making processes, making governance more inclusive and responsive. E-government also offers cost savings by reducing the need for paper, postage, and in-person consultations, and allows for innovation and flexibility with solutions like mobile applications and cloud computing that enable more adaptable and scalable services. This study aims to provide a comprehensive analysis of these challenges and opportunities, offering actionable recommendations for policymakers and public administrators by examining case studies and existing literature to highlight best practices and propose strategies to overcome the identified barriers, ultimately enhancing the effectiveness of e-government initiatives.

1.2. Purpose of the study

The purpose of this study is to conduct an in-depth examination of the multifaceted challenges and opportunities that come with the implementation of e-government. This involves meticulously analysing case studies from various regions and contexts to understand the real-world applications and hurdles faced by different governments. Additionally, the study will review a wide range of existing literature to gather insights from previous research and theoretical frameworks. Through this comprehensive approach, the study aims to identify specific barriers that impede the successful adoption of e-government, such as the lack of adequate technological infrastructure, which includes issues like insufficient internet coverage and outdated systems; cybersecurity threats, which involve risks of data breaches and cyberattacks; and resistance to change within public institutions, stemming from factors like a lack of digital literacy among staff and fear of job displacement. Concurrently, the study seeks to highlight the numerous benefits and opportunities that e-government can provide, such as significantly improved service delivery through streamlined and automated processes, increased transparency and accountability via easy access to government information, enhanced accessibility to services for citizens in remote or underserved areas, greater civic engagement through online platforms that allow for public participation in decision-making, cost savings from reduced reliance on paper and in-person transactions, and the potential for innovative solutions like mobile apps and cloud computing that make public administration more adaptable and scalable. By integrating these analyses, the study aims to offer practical and

actionable recommendations that can assist policymakers and public administrators in overcoming the identified challenges. These recommendations will be designed to leverage the opportunities presented by e-government to create more efficient, transparent, and responsive governance systems. Ultimately, the study aspires to contribute to the advancement of e-government initiatives by providing a well-rounded understanding of both its obstacles and its potential, thereby helping to drive more effective and widespread adoption of digital technologies in public administration.

1.3. Significance of the study

The significance of this study is multifaceted and pivotal for several reasons. Firstly, it addresses a crucial element of contemporary governance by delving into how digital technologies can fundamentally transform public service delivery, making it more efficient, transparent, and accessible. This exploration is particularly relevant as governments worldwide seek to modernize their operations and improve interactions with citizens. By examining the implementation of e-government, the study sheds light on practical ways in which digital solutions can streamline administrative processes, reduce bureaucratic delays, and enhance overall service quality. Secondly, this study makes a valuable contribution to the academic discourse on e-government by identifying and filling existing gaps in the literature. While much has been written about the potential benefits of e-government, there is still a need for comprehensive analyses that integrate theoretical insights with empirical evidence from diverse contexts. By reviewing case studies and existing research, this study provides a more nuanced understanding of the challenges and opportunities associated with e-government, thereby advancing scholarly knowledge in this field. Lastly, the study is significant for its practical implications, offering actionable recommendations for policymakers and public administrators. These recommendations are designed to help them navigate the complexities of e-government implementation, address barriers such as technological infrastructure deficiencies and cybersecurity risks and capitalize on opportunities to improve governance. By providing these insights, the study aims to support the development of more effective, inclusive, and responsive government services, ultimately contributing to better governance outcomes and increased public trust in government institutions.

2. Literature review

2.1. Theoretical background

2.1.1. Technology acceptance model (TAM)

The technology acceptance model (TAM), developed by Davis in 1989, is a theoretical framework that helps explain how users come to accept and use a technology. According to TAM, two primary factors influence individuals' decisions about whether to adopt a new technology: perceived ease of use and perceived usefulness. Perceived ease of use refers to the degree to which a person believes that using a particular system would be free of effort, while perceived usefulness refers to

the degree to which a person believes that using a system would enhance their job performance. Studies have expanded TAM to include factors like perceived trust and social influence, acknowledging their role in technology adoption. The model has also been applied to various domains such as mobile banking and e-learning, demonstrating its versatility in understanding technology acceptance. Researchers continue to refine TAM to address emerging technologies, ensuring its relevance in the digital age. Recent research in 2023 has explored TAM's application in the adoption of artificial intelligence tools in healthcare, highlighting its adaptability to cutting-edge technologies. Additionally, a 2022 study examined the role of TAM in the acceptance of remote work technologies during the COVID-19 pandemic, emphasizing its importance in understanding technology use in evolving work environments (Panagoulias et al., 2024).

2.1.2. Diffusion of innovations (DOI)

Theory: Rogers' diffusion of innovations (DOI) theory, introduced in 1962, describes how new ideas, practices, or products spread within a society or from one society to another. The theory emphasizes several key elements in the adoption process: the innovation itself, communication channels, time, and the social system. It highlights how the characteristics of an innovation (such as its relative advantage, compatibility, complexity, trialability, and observability) influence its adoption. Communication channels are vital for spreading information about innovations, while the social system and time influence adoption rates. This theory is crucial for understanding e-government adoption, highlighting the importance of effective communication, social context, and the time needed for new technologies to gain public and institutional acceptance.

2.2. Empirical studies

2.2.1. Technological infrastructure and user trust

Research highlights the critical role of robust technological infrastructure and user trust in successful e-government initiatives. Reliable internet connectivity, secure systems, and user-friendly interfaces are essential for effective e-government services. Without a strong technological foundation, even well-designed initiatives can falter (Shareef et al., 2009). Additionally, trust in the security and privacy of online government services is paramount for user adoption. If users do not trust that their personal information is safe, they are unlikely to engage with e-government platforms (Crowder et al., 2013).

2.2.2. Case studies

Case studies from various countries, including Estonia, South Korea, and India highlight successful e-government implementation. Estonia is a leader with comprehensive e-services and a secure digital identity system. South Korea offers a wide range of online public services, and India's Aadhaar system showcases large-scale digital inclusion. These examples emphasize best practices like user-centric design and robust cybersecurity, while also addressing challenges such as the digital divide and cybersecurity concerns (Dias, 2020). Recent studies in 2022 and 2023 further illustrate the progress and challenges in e-government. For example, a 2022 study on Finland's digital transformation highlighted the importance of continuous

user feedback in enhancing public services. Additionally, a 2023 report on Singapore's Smart Nation initiative emphasized the role of public-private partnerships in advancing digital infrastructure and services. These findings reinforce the need for adaptive strategies and collaboration to address evolving digital governance challenges (Aigner et al., 2022).

2.3. E-government and digital divide

Access disparities: Inequities in access to digital technologies contribute to a digital division among individuals, wherein certain demographics encounter hurdles in accessing e-government services. This exclusion disproportionately affects marginalized groups, depriving them of the benefits associated with such services. Closing these access disparities is essential for promoting equal participation in the digital sphere and nurturing inclusivity in governance. Initiatives aimed at bridging this digital gap should prioritize ensuring uniform opportunities for all citizens to engage with e-government endeavours (Patergiannaki and Pollalis, 2023). Addressing access disparities promotes social equity and democratic principles by ensuring all voices are heard in digital governance. Investing in digital infrastructure and literacy programs empowers marginalized communities to benefit from e-government services and participate in civic affairs (Donald and Christopher, 2012).

2.4. E-government in security and privacy concerns

2.4.1. Cybersecurity

Ensuring cybersecurity is imperative for governments to protect sensitive data from cyber threats. The growing complexity of cyberattacks presents a formidable obstacle to safeguarding e-government systems (Zhang et al., 2004). It is crucial for authorities to implement robust measures to mitigate these risks and uphold the integrity of digital platforms. Proactive efforts in enhancing cybersecurity protocols are essential to fortifying e-government infrastructures against evolving threats. By prioritizing cybersecurity initiatives, governments can bolster public trust and maintain the confidentiality of critical information (Palanisamy and Mukerji, 2016). Recent efforts highlight the continuous advancement and challenges in cybersecurity for e-government. For instance, the U.S. National Cybersecurity Strategy, launched in 2023, focuses on defending critical infrastructure, disrupting threat actors, and forging international partnerships. Additionally, the World Economic Forum's Global Cybersecurity Outlook 2023 emphasizes the need for robust cybersecurity measures and international collaboration to combat these risks. These developments underscore the importance of adaptive strategies and collaborative efforts to ensure the resilience and security of digital governance (Radanliev, 2024).

2.4.2. Privacy issues

Guaranteeing cybersecurity is essential for governments to shield sensitive data from cyber threats. The increasing sophistication of cyberattacks poses a significant challenge to safeguarding e-government systems. It is imperative for authorities to deploy robust measures to counter these risks and safeguard the integrity of digital platforms. Taking proactive steps to enhance cybersecurity protocols is crucial for reinforcing e-government infrastructures against evolving threats (Telo, 2021). By

placing a premium on cybersecurity initiatives, governments can enhance public confidence and uphold the confidentiality of vital information (Dixon et al., 2014). Investing in cybersecurity not only protects government systems but also safeguards citizens' privacy and fosters a sense of security in digital interactions with government services. Additionally, promoting cybersecurity awareness and education initiatives can empower individuals to adopt safer online practices, contributing to a more resilient and secure e-government ecosystem (Belanger and Hiller, 2006).

2.5. E-government infrastructure and technical issues

2.5.1. Limited infrastructure

In regions with insufficient technological infrastructure, poor internet connectivity and a lack of hardware can hinder the rollout of e-government services, leading to uneven access and involvement. Addressing these disparities is vital for ensuring fair access and fostering inclusivity. Initiatives to bridge the digital gap should prioritize strengthening infrastructure to enable broader and more equitable access to e-government services (Krishnan and Thompson, 2012). Addressing infrastructure limitations promotes digital inclusion and stimulates economic growth by fostering technology-driven innovation and entrepreneurship. Investing in infrastructure also enhances community resilience and supports sustainable development in the digital age (Zhang and Batjargal, 2022).

2.5.2. Interoperability

The issue of interoperability emerges when government agencies employ disparate systems that struggle to communicate seamlessly. This lack of integration presents a significant challenge to the coherent delivery of e-government services, impeding the objective of offering unified services to citizens (Gottschalk and Saether, 2009). Addressing this obstacle necessitates concerted endeavours to standardize systems and protocols across departments, facilitating seamless information exchange. By promoting interoperability, governments can streamline processes and enhance the efficiency and efficacy of e-government initiatives, ultimately advancing citizen-centric governance (Theresa et al., 2011). Efforts to improve interoperability in e-government are ongoing. For example, the European Union has been working on the European Interoperability Framework (EIF) to guide member states in creating interoperable digital public services. The EIF emphasizes the importance of technical, semantic, organizational, and legal interoperability, encouraging the adoption of shared standards and protocols. Similarly, in 2022, the Indian government launched the National Data Governance Framework Policy, which aims to standardize data management practices across government departments, promoting better data sharing and integration (Campmus et al., 2022).

2.6. E-government and resistance to change

Bureaucratic Inertia: Resistance to adopting new technologies is common within government agencies due to bureaucratic inertia. Existing organizational structures and entrenched procedures can cultivate a reluctance to embrace change, resulting in delays in adopting and implementing e-government initiative (Eyob, 2004). Overcoming this inertia necessitates proactive measures to tackle institutional

barriers, including offering training and incentives for staff to adapt to new technologies. By cultivating a culture of innovation and flexibility, governments can surmount bureaucratic inertia and expedite the integration of e-government solutions, thereby improving service delivery to citizens. Additionally, fostering collaboration and communication channels within government agencies can facilitate smoother transitions towards e-government implementation (Choi and Chandler, 2020).

2.7. E-government in legal and regulatory hurdles

2.7.1. Data protection laws

Ensuring adherence to data protection and privacy regulations poses a significant hurdle for e-government endeavours. Governments are tasked with managing sensitive citizen data while ensuring that data collection and processing practices align with legal frameworks aimed at preserving individuals' privacy (Wu, 2014). This involves implementing robust policies and protocols for the secure handling and storage of data, along with establishing mechanisms to obtain informed consent from citizens. By prioritizing adherence to data protection laws, governments can maintain the trust and confidence of citizens while responsibly and ethically leveraging the benefits of e-government services. Additionally, investing in data protection measures not only safeguards individuals' privacy but also strengthens the overall integrity and reliability of e-government systems, fostering greater public trust and participation in digital governance initiatives (González et al., 2016).

2.7.2. Regulatory frameworks

Establishing appropriate legal and regulatory frameworks to govern e-government activities is crucial yet complex. Clear guidelines are essential to ensure the responsible and ethical use of technology while safeguarding the rights and interests of citizens. Additionally, robust regulatory frameworks provide a framework for accountability and oversight, ensuring that e-government initiatives are conducted transparently and in accordance with established legal standards (Basu, 2011). By developing comprehensive regulatory frameworks, governments can foster public trust and confidence in e-government initiatives, ultimately promoting a more secure and inclusive digital governance environment (Sharma and Gupta, 2003). Establishing clear legal and regulatory frameworks for e-government is crucial to ensure responsible and ethical technology use while protecting citizens' rights. Robust regulations provide accountability and transparency, fostering public trust and confidence in e-government. Comprehensive frameworks promote a secure and inclusive digital governance environment (Sun et al., 2015).

2.8. E-government, citizen trust, and adoption

2.8.1. Trust issues

Cultivating trust among citizens regarding the security and reliability of e-government services is paramount. Addressing data security and privacy concerns is crucial to instil confidence in digital government services. Transparent communication and proactive measures to tackle vulnerabilities can build trust, enhancing public acceptance and participation in e-government initiatives

(Mpinganjira, 2015). This involves implementing robust cybersecurity measures, adhering to stringent data protection protocols, and enhancing transparency in the handling of citizen information (Sharma and Gupta, 2003). By prioritizing these efforts, governments can bolster trust, encourage broader adoption of e-government services, and ultimately improve the efficiency and effectiveness of public service delivery. Promoting accountability and continuous improvement in e-government can strengthen trust and ensure the success of digital governance initiatives (Berdykhanova et al., 2010).

2.8.2. Digital literacy

Digital literacy is crucial in empowering citizens to effectively utilize e-government services. However, inadequate digital skills, especially among older or less technologically proficient individuals, can present a significant obstacle. Therefore, prioritizing efforts to improve digital literacy through education and training initiatives is essential (Chohan and Hu., 2020). By investing in programs that equip citizens with the necessary skills to navigate digital platforms and engage with e-government services confidently, governments can promote greater inclusivity and participation in digital governance processes. Moreover, fostering partnerships with educational institutions and community organizations can help expand the reach of digital literacy initiatives, ensuring that all members of society could benefit from e-government services (Abdulkareem and Ramli, 2021).

2.9. E-government and financial constraints

Budgetary constraints: Budgetary constraints present significant hurdles to the implementation and upkeep of e-government infrastructure. The considerable financial resources needed for these initiatives can hinder progress and restrict their extent, influencing the quality and accessibility of services extended to citizens (Schwester, 2009). Additionally, fostering partnerships with the private sector and exploring alternative funding sources can help mitigate budgetary limitations, enabling governments to expand and enhance e-government services while maximizing value for taxpayers (Yang and Rho, 2007). By investing strategically and efficiently, policymakers can optimize the impact of e-government initiatives within the confines of existing budgets, thereby improving public service delivery and fostering citizen engagement in the digital era (Yang and Rho, 2007).

2.10. E-government, political, and cultural factors

2.10.1. Political will

Robust political support and commitment are essential for the success of e-government initiatives. Politics will play a pivotal role in overcoming obstacles, allocating resources effectively, and implementing the requisite changes in policy and infrastructure (Zhang and Batjargal, 2022). It is imperative for policymakers to prioritize e-government as a strategic imperative, showcasing leadership and steadfast dedication to advancing digital transformation agendas (Curtin et al., 2008). By cultivating a supportive political environment, governments can drive the development and implementation of e-government initiatives, ultimately improving public service delivery and fostering citizen engagement in governance processes.

This entails fostering collaboration across political parties and governmental departments, promoting transparency and accountability, and championing policies that prioritize digital transformation (Ahn and Stuart, 2011).

2.10.2. Cultural resistance

Cultural resistance, originating from both citizens and officials, can present a formidable obstacle to e-government initiatives. Long-standing bureaucratic procedures and deeply ingrained norms may foster apprehension towards embracing change and adopting new practices. Overcoming this resistance necessitates addressing cultural factors through educational initiatives, effective communication strategies, and the cultivation of an organizational culture that values innovation (Seng et al., 2008). By advocating for a shift in mindset towards digital transformation and emphasizing the advantages of e-government, governments can alleviate cultural barriers and facilitate greater acceptance and adoption of digital governance practices. This involves engaging in targeted awareness campaigns, promoting success stories, and demonstrating the tangible benefits of e-government in improving efficiency, accessibility, and transparency in public services (Sandhu et al., 2014).

2.11. E-government and accessibility challenges

Accessibility challenges in e-government refer to ensuring that digital services are usable by all citizens, regardless of their abilities or access to technology. This encompasses making websites, applications, and online documents compatible with screen readers, providing alternative formats for individuals with visual impairments, and ensuring that interfaces are navigable for people with motor disabilities (Yang and Rho, 2007). Additionally, addressing language barriers and providing support for those with limited digital literacy are vital aspects of improving accessibility in e-government. Overcoming these challenges requires a comprehensive approach that integrates accessibility standards into the design and development of e-government platforms, as well as ongoing efforts to raise awareness and provide training for government staff (Yang and Rho, 2007).

2.12. E-government and data management challenges

Data management challenges in e-government revolve around effectively handling the vast amounts of data generated and processed by government agencies. This includes ensuring the security and privacy of sensitive information, maintaining data integrity across disparate systems, and enabling seamless data exchange between government entities. Furthermore, interoperability issues occur when systems use incompatible formats or standards, hindering efficient data sharing and use. Addressing these challenges requires strong data governance, advanced cybersecurity, and standardized data exchange protocols. Additionally, fostering a culture of data stewardship and promoting transparency in data management practices are crucial for building trust among citizens and stakeholders (Faisal and Faisal, 2019).

3. Research design

3.1. Purpose of this study

The purpose of this study is to conduct a thorough analysis of the challenges and opportunities associated with e-government implementation across various contexts. This involves identifying the specific obstacles that hinder the successful adoption of e-government, such as technological barriers, cybersecurity issues, and resistance to change. Additionally, the study aims to uncover the potential benefits and positive outcomes that e-government can offer, such as improved efficiency, transparency, and accessibility. By examining these aspects, the study seeks to identify best practices and provide actionable recommendations that can assist policymakers in enhancing the effectiveness of e-government initiatives.

3.2. Research questions

1) What are the main challenges faced in the implementation of e-government?
2) What opportunities does e-government present for enhancing governance?
3) How can policymakers overcome the challenges and leverage the opportunities?

3.3. Research method

This study employs a literature review type of study to gain a comprehensive understanding of the impact of e-governance, focusing on both its opportunities and challenges. By utilizing available literature, the study can compare and contrast different findings, providing a more detailed and nuanced understanding of the research questions. The integrated analysis reveals key themes and trends, such as common challenges faced by users, successful elements of e-governance initiatives, and areas needing improvement. Based on these insights, the study can provide actionable recommendations aimed at improving the effectiveness and sustainability of e-governance. This might include suggestions for policy changes, technological enhancements, or strategies for better user engagement and satisfaction.

4. Data collection, analysis and findings

4.1. Data collection

This study employs a qualitative approach to delve into the impact of e-governance, aiming to understand the nuanced experiences and perspectives of stakeholders. The data collection process involved an extensive review of existing literature, including academic journals, government reports, and reputable publications, to thoroughly examine the challenges and opportunities presented by e-governance. By synthesizing information from a variety of credible sources, the study seeks to gain a comprehensive understanding of the topic, leading to the identification of key themes, trends, and actionable recommendations. This holistic approach is expected to contribute valuable insights to enhance the effectiveness and sustainability of e-governance initiatives, offering valuable guidance for policymakers and practitioners in the field.

4.2. Data analysis

4.2.1. Components of e-government

E-government comprises several key components: e-services, e-administration, and e-democracy, each playing a vital role in transforming traditional government functions into more efficient and accessible digital formats.

a) E-services: E-services involve the digital delivery of services to different stakeholders. For instance, Government to Citizen (G2C) services provide citizens with online tax filing, social security services, and digital healthcare services. This not only makes it easier for citizens to access essential services but also enhances the overall user experience by providing seamless and efficient service delivery. Government to Business (G2B) services are aimed at businesses and include online business registration, electronic procurement, and compliance reporting. These services reduce bureaucratic red tape, making it easier for businesses to comply with regulations and engage with government agencies (Stavrou and Panayiotou, 2021).

b) E-administration: E-administration focuses on the internal operations of government agencies, aiming to improve efficiency and reduce costs. This includes digitized records, ensuring they are easily accessible and securely stored. Automated workflows use software to improve efficiency and reduce human error. Resource management involves using Information and Communication Technology (ICT) tools for managing government resources, including budgeting, payroll, and inventory systems. By adopting e-administration practices, governments can enhance their operational effectiveness, streamline administrative tasks, and ensure better resource allocation and management (Doran et al., 2023).

4.2.2. Technological infrastructure

The technological infrastructure supporting e-government is crucial for its success and includes networks and connectivity, data centres and cloud computing, and cybersecurity. A robust technological foundation ensures that e-government services are reliable, secure, and accessible to all citizens.

a) Networks and connectivity: Reliable broadband access is essential to support e-government services, particularly in rural and underserved areas. High-speed internet connections enable seamless access to online government services, facilitating smooth and efficient interactions. Wireless networks, such as Wi-Fi and mobile networks, extend connectivity and enable mobile access to services, ensuring broad and reliable access. This infrastructure supports various e-government applications and services, allowing citizens to access information and services from any location and at any time (Jaeger and Bertot, 2012).

b) Data centres and cloud computing: Data centres provide secure and scalable storage solutions for managing vast amounts of government data. They ensure that data is stored safely and can be retrieved efficiently. Cloud computing offers flexible, cost-effective, and scalable IT infrastructure, allowing governments to adapt to changing demands and scale services as needed. Cloud services also support disaster recovery plans, ensuring that data integrity and service continuity are maintained in the event of a failure. This combination of

data centres and cloud computing provides a reliable backbone for e-government operations, supporting both storage and computational needs (Chaub et al., 2011).

4.2.3. Implementation strategies

Implementing e-government requires comprehensive strategies involving policy and regulatory frameworks, capacity building and training, and public-private partnerships. These strategies ensure that e-government initiatives are effectively planned, executed, and sustained.

a) Policy and regulatory framework: Enacting laws that support digital governance, data protection, and electronic transactions is crucial. This includes developing standards for ICT systems, data interoperability, and security practices. Policies must also address issues related to privacy, data protection, and cyber security to build trust among citizens and businesses. Regulatory frameworks should ensure that e-government services comply with legal and ethical standards, providing a clear and consistent structure for implementation. By establishing a solid policy foundation, governments can create an enabling environment for the successful deployment and operation of e-government services (Belanger and Hiller, 2006).

b) Capacity building and training: Developing skills within government employees to use new technologies and digital tools effectively is essential. Training programs should focus on both technical skills and change management to ensure smooth transitions to digital processes. Leadership development is encouraged to drive digital transformation within government agencies. Public awareness campaigns are also important to educate citizens about the availability and benefits of e-government services, promoting widespread adoption. By investing in capacity building and training, governments can ensure that their workforce is equipped to manage and sustain e-government initiatives, fostering a culture of continuous improvement and innovation (Kalu, 2007).

c) public-private partnerships: public-private partnerships (PPP) have a great potential to build capacity of e-government and delivering public services and goods through e-government (Batjargal and Zhang, 2021, 2022; Zhang and Shahid, 2024).

4.2.4. User experience and accessibility

User experience and accessibility are critical for the success of e-government services. Ensuring that digital services are user-friendly and accessible to all citizens is essential for widespread adoption and satisfaction.

a) User-centric design: Creating intuitive and user-friendly websites and mobile applications with easy navigation and clear instructions is a key aspect of e-government. Services should be designed with the user in mind, incorporating feedback and preferences to improve usability. This includes offering personalized experiences based on user behaviour and needs, enhancing satisfaction and engagement. By prioritizing user-centric design, governments can ensure that e-government services meet the needs of their citizens, making them more likely to use and benefit from these services (Verdegem and

Hauttekeete, 2010).

b) Inclusivity: Achieved by adhering to accessibility standards, ensuring services are usable by people with disabilities, such as screen reader compatibility and alternative text for images. Providing services in multiple languages caters to diverse populations, ensuring that language barriers do not impede access to essential services. Digital literacy programs help citizens develop the skills needed to access and use e-government services, promoting digital inclusion. Multichannel access includes comprehensive web portals that serve as a one-stop-shop for various government services, mobile applications that provide services on-the-go, and physical kiosks and call centres for those without internet access or who prefer in-person assistance. By focusing on inclusivity, governments can ensure that e-government services are accessible to all citizens, regardless of their abilities or circumstances, fostering a more equitable and inclusive society (Xu and Asencio, 2012).

c) Continuous improvement and feedback mechanisms: To ensure that e-government services remain effective and relevant, it is crucial to implement continuous improvement and feedback mechanisms. Regularly collecting and analysing user feedback allows governments to identify areas for enhancement and address any issues promptly. This can be achieved through surveys, user testing sessions, and direct feedback channels within digital platforms. Additionally, monitoring usage patterns and performance metrics helps to understand user behaviour and preferences, guiding iterative improvements. By fostering an ongoing dialogue with users and being responsive to their needs, governments can continuously refine e-government services, ensuring they evolve to meet changing expectations and technological advancements. This approach not only improves user satisfaction but also builds a culture of transparency and accountability in public services (Reddick and Anthopoulos, 2014).

4.3. Findings

4.3.1. Main challenges

a) Inadequate technological infrastructure: Many regions, especially rural areas, lack reliable internet connectivity and up-to-date systems, which hinders the effective implementation of e-government services (Lam, 2005). Many regions, especially rural areas, lack reliable internet connectivity and up-to-date systems, which hinders the effective implementation of e-government services. Additionally, the high cost of upgrading and maintaining infrastructure can be a significant barrier for many governments, Recent studies indicate that investing 5G networks and satellite internet solutions could bridge this gap, providing broader and more reliable coverage (Jawarneh, 2024).

b) Cybersecurity threats: Significant concerns about data privacy and the security of personal information are major barriers to user trust and adoption of e-government services (Yusifov and Aliguliyev, 2018). Additionally, ongoing cybersecurity training for public servants and the development of robust incident response strategies are also critical measures being taken to build and

maintain user trust in e-government services.

c) Resistance to change: Both public servants and citizens exhibit resistance to adopting new technologies due to lack of digital literacy, fear of job displacement, and general reluctance to change established processes (Prima and Ibrahim, 2011). This resistance is often rooted in the unfamiliarity with new digital tools and platforms, making individuals hesitant to move away from traditional, well-understood methods. Fear of job displacement is particularly pronounced among public servants who worry that automation and digitalization might render their roles obsolete.

d) Lack of Awareness: Many potential users are not aware of the available e-government services or do not understand how to access and use them effectively (Prima and Ibrahim, 2011). This lack of awareness is often due to insufficient public education and outreach efforts. Recent studies suggest that targeted awareness campaigns, utilizing various media channels such as social media, television, and community workshops, can significantly increase public knowledge and usage of e-government services.

4.3.2. Opportunities

a) Improved service delivery: E-government can streamline administrative processes, making it easier and quicker for citizens to access government services and information online (West, 2004). By reducing bureaucratic red tape and simplifying procedures, e-government platforms can significantly cut down on the time required to process requests and applications. Recent advancements in digital technologies, such as AI and machine learning, have further enhanced service delivery by providing personalized and efficient services based on user behaviour analysis.

b) Enhanced transparency: Digital platforms can provide greater transparency by making government actions and data more accessible to the public, thereby increasing accountability (Halachmi and Greiling, 2013). E-government initiatives allow citizens to easily access information about government activities, budgets, and decision-making processes. Recent advancements such as open data portals enable real-time access to a wide range of government datasets, promoting transparency and allowing for independent analysis by citizens and watchdog organizations.

c) Increased accessibility: E-government services can reach a broader population, including those in remote or underserved areas, reducing the need for physical visits to government offices (Halachmi and Greiling, 2013). By providing online access to government services, citizens can complete tasks such as applying for permits, paying taxes, and accessing public records from anywhere with an internet connection. Recent innovations, such as mobile government applications and community-based digital kiosks, have further extended the reach of e-government services, ensuring that even those without personal internet access can benefit.

d) Cost savings: Cost Savings: By reducing reliance on paper, postage, and in-person consultations, e-government can significantly lower operational costs for public administration. Online forms and automated processing systems

minimize the time and labour required to handle administrative tasks, allowing public servants to focus on more complex issues (Yang and Rho, 2007).

e) Enhanced civic engagement: Online platforms enable greater civic engagement by allowing citizens to participate in decision-making processes and provide feedback on government services (Kang and Gearhart, 2008). Digital forums, e-petitions, and social media channels provide citizens with accessible means to voice their opinions and influence public policy virtual town halls and online surveys can engage a wider audience, especially those who may not be able to attend in-person meetings due to geographic or time constraints.

4.3.3. How research findings answer our research questions

a) Main challenges: The data indicates that inadequate technological infrastructure, cybersecurity concerns, resistance to change, and lack of awareness are the primary challenges hindering the implementation of e-government. For instance, 40% of survey respondents cited lack of awareness as a barrier, while 30% pointed to technological issues (Prima and Ibrahim, 2011). Interview responses further highlighted issues such as unreliable internet connectivity and outdated systems as significant obstacles (Prima and Ibrahim, 2011).

b) Opportunities for enhancing governance: The findings highlight several opportunities for enhancing governance through e-government. Survey results show that 80% of respondents believe e-government services improve their access to government information and services, demonstrating the potential for improved service delivery. Additionally, 65% of respondents were satisfied with the e-government services they have used, indicating that these services can meet public expectations and enhance overall governance (Kamolov and Konstantinova, 2017).

c) Policy recommendations: To overcome the identified challenges and leverage the opportunities, the study suggests several actionable recommendations for policymakers. These include investing in technological infrastructure to ensure reliable internet connectivity, enhancing cybersecurity measures to protect user data, conducting training programs to improve digital literacy, and launching awareness campaigns to educate the public about the availability and benefits of e-government services. Additionally, strategies to address resistance to change within public institutions should include comprehensive training and support programs for public servants (Kang and Gearhart, 2008).

5. Discussion

Firstly, the study reveals that technological challenges and infrastructure are significant barriers to e-governance adoption. It is identified technological issues as major obstacles, emphasizing the need for reliable internet connectivity and up-to-date systems for effective e-government services. This highlights the importance of policymakers prioritizing investments in technological infrastructure, particularly in rural and underserved areas, to ensure successful e-government implementation (Lam, 2005).

Secondly, cybersecurity concerns are a key factor influencing e-governance acceptance, expressing worries about data privacy and security. This underscores the

critical role of trust and security in e-government services. People also stressed the need for stronger cybersecurity measures, indicating that this remains a pervasive issue (Yusifov and Aliguliyev, 2018).

Thirdly, resistance to change is identified as a significant barrier, with many public servants showing reluctance to adopt new technologies. Factors such as lack of digital literacy and fear of job displacement contribute to this resistance. The analysis suggests that developing comprehensive training programs to enhance digital literacy among public servants and citizens, along with employing change management strategies, can ease the transition to new technologies within public institutions (Prima and Ibrahim, 2011).

Lastly, a lack of public awareness is evident, and unaware of available e-government services or how to use them. Improved public education campaigns are needed to raise awareness and promote the benefits of e-government. These campaigns should focus on demonstrating the ease of use and usefulness of digital services to encourage wider adoption (Prima and Ibrahim, 2011).

Moreover, the study's findings highlight the various challenges and opportunities of e-governance. Addressing these challenges requires a holistic approach, including investments in technological infrastructure (Zhang and Batjargal, 2022), cybersecurity measures, digital literacy programs, and public awareness campaigns. Implementing these recommendations can enhance the effectiveness and sustainability of e-government initiatives, ultimately improving public administration and governance.

Addressing these challenges requires a holistic approach, including investments in technological infrastructure, cybersecurity measures, digital literacy programs, and public awareness campaigns. By embracing these technological innovations and addressing foundational issues, e-governance can be better positioned to meet the evolving needs of citizens and foster greater public trust. Implementing these recommendations can enhance the effectiveness and sustainability of e-government initiatives, ultimately improving public administration and governance.

6. Policy implications

6.1. Theoretical contributions

This study contributes to e-government theory by integrating insights from various models to provide a comprehensive understanding of the multifaceted challenges and opportunities of e-government. By examining the interplay between technological, organizational, and cultural factors, our research offers a more nuanced perspective that can inform future theoretical developments. Specifically, our findings highlight the need to consider context-specific factors, such as regional technological infrastructure and digital literacy levels, in e-government adoption models (Rana et al., 2012).

6.2. Practical implications

The practical implications of this study are significant for policymakers and public administrators.

i Technological infrastructure: Policymakers should prioritize investments in technological infrastructure, especially in rural and underserved areas, to ensure reliable internet connectivity and modernized systems. This is crucial for the successful implementation of e-government services (Lam, 2005).

ii Cybersecurity: Enhancing cybersecurity measures is imperative to build and maintain public trust in e-government services. This includes implementing robust data protection protocols and educating users about cybersecurity practices (Yusifov and Aliguliyev, 2018).

iii Training and change management: To address resistance to change, comprehensive training programs should be developed to improve digital literacy among public servants and citizens. Additionally, change management strategies should be employed to ease the transition to new technologies within public institutions (Prima and Ibrahim, 2011).

iv Public awareness campaigns: Effective public awareness campaigns are essential to educate citizens about the availability and benefits of e-government services. These campaigns should focus on demonstrating the ease of use and usefulness of digital services to encourage wider adoption (Prima and Ibrahim, 2011).

By implementing these recommendations, policymakers can overcome the identified challenges and leverage the opportunities presented by e-government to enhance public administration and governance.

6.3. Recommendations for policymakers

This subsection provides specific recommendations for policymakers to address the identified challenges and leverage the opportunities of e-government. These recommendations are based on the study's findings and best practices identified in the literature.

a) Invest in Technological Infrastructure: Technological issues are seen as a major barrier to the adoption of e-government services. To address this, policymakers should prioritize investments in technological infrastructure, especially in rural and underserved areas, to ensure reliable internet connectivity and modernized systems. This includes upgrading outdated hardware and software and expanding broadband access to remote regions. Ensuring robust infrastructure is crucial for the successful implementation of e-government services and can help bridge the digital divide.

b) Enhance cybersecurity measures: Concerns about data privacy and security are significant. Policymakers must enhance cybersecurity measures to build and maintain public trust in e-government services. This includes implementing robust data protection protocols, conducting regular security audits, and educating users about cybersecurity practices. By addressing cybersecurity concerns, governments can mitigate the risks of data breaches and cyberattacks, thereby increasing user confidence in digital services.

c) Develop comprehensive training programs: The reviewed qualitative data highlighted resistance to change as a significant barrier, with many public servants showing reluctance to adopt new technologies. To overcome this,

policymakers should develop comprehensive training programs aimed at improving digital literacy among public servants and citizens. These programs should focus on enhancing skills and providing continuous support to ease the transition to new technologies. Training initiatives can help reduce resistance to change and ensure that staff are well-equipped to utilize e-government services effectively.

d) Launch public awareness campaigns: Many users face challenges due to a lack of awareness and understanding of available e-government services. Policymakers should launch effective public awareness campaigns to educate citizens about the availability and benefits of e-government services. These campaigns should use various media channels to reach a wide audience and demonstrate the ease of use and usefulness of digital services. Raising awareness can significantly increase the adoption and utilization of e-government services.

6.4. Strategies for enhancing e-government initiatives

This subsection discusses strategies for overcoming technological, organizational, and cultural barriers to e-government implementation, based on the study's findings and best practices.

a) Technological strategies: To overcome technological barriers, governments should:
   - i Upgrade Infrastructure: Invest in modernizing outdated systems and expanding internet connectivity, particularly in underserved areas (Dahiya and Mathew, 2016).
   - ii Adopt scalable solutions: Implement scalable digital solutions that can grow with increasing demand and technological advancements (Stamati et al., 2010).
   - iii Ensure interoperability: Develop interoperable systems that can seamlessly integrate with existing government platforms to provide a cohesive user experience (Pardo et al., 2011).

b) Organizational strategies: To address organizational barriers, the following strategies are recommended:
   - i Change management programs: Implement change management programs that guide public servants through the transition to digital systems, emphasizing the benefits and providing continuous support (Apostolou et al., 2005).
   - ii Stakeholder engagement: Engage with key stakeholders, including public servants and citizens, to gather feedback and tailor e-government services to meet their needs. This can help in designing user-centric services that are more likely to be adopted (Rowley, 2011).
   - iii Performance metrics: Establish clear performance metrics to monitor the effectiveness of e-government initiatives and make data-driven adjustments as needed (Barbosa et al., n.d.).

c) Cultural Strategies: To overcome cultural resistance, consider these strategies:
   - i Promote a digital culture: Foster a culture that values digital innovation and

continuous improvement within public institutions. Highlight success stories and recognize staff contributions to digital initiatives (Singh et al., 2015).

ii Educational outreach: Conduct educational outreach programs to improve digital literacy among citizens, particularly targeting groups that are less familiar with technology. This can include workshops, online tutorials, and community events (Lean et al., 2009).

iii Incentives for adoption: Provide incentives for both public servants and citizens to adopt e-government services, such as recognition programs, rewards, or convenience benefits (Nasi and Frosini, 2010).

7. Theoretical implications

7.1. Defining a theory

A theory is a systematic explanation of an aspect of the natural or social world that is supported by a body of evidence and principles. Theories are developed to explain observed phenomena and predict future occurrences by identifying underlying mechanisms and relationships. In the context of social sciences, a theory provides a structured framework for understanding complex social behaviours and interactions, guiding research and informing practice.

7.2. Main features/traits of a theory

The key traits of a robust theory include consistency, explanatory power, predictive power, and testability.

a) Consistency: A theory must be logically coherent, with no internal contradictions. It should provide a consistent framework that can be applied across different contexts without losing its validity (Halachmi and Greiling, 2013).

b) Explanatory Power: A theory should be able to explain a wide range of phenomena within its domain. It must provide a clear and comprehensive explanation of the observed facts and relationships (Sharma et al., 2018).

c) Predictive Power: A good theory should not only explain past and present phenomena but also predict future events or behaviours. This ability to forecast outcomes based on the theoretical framework is crucial for its practical application (Shanab, 2019).

d) Testability: A theory must be testable through empirical observation and experimentation. It should generate hypotheses that can be empirically validated or refuted, ensuring its scientific rigor (Bannister and Connolly, 2015).

7.3. Major theories reviewed

a) Technology acceptance model (TAM): The technology acceptance model (TAM), developed by Davis in 1989, posits that perceived ease of use and perceived usefulness are the primary factors influencing individuals' acceptance of new technologies. TAM is crucial for understanding how public servants and citizens might respond to e-government initiatives. According to TAM, if e-

government services are perceived as user-friendly and beneficial, they are more likely to be adopted and utilized effectively (Hassan and Garcia, 2008).

b) Diffusion of innovations (DOI) theory: Rogers' diffusion of innovations (DOI) theory, introduced in 1962, explains how new ideas and technologies spread through societies. The theory emphasizes several key elements in the adoption process: the innovation itself, communication channels, time, and the social system. DOI is relevant for understanding how e-government can gain wider acceptance. It highlights the importance of the characteristics of the innovation, effective communication, and the social context in facilitating the adoption of e-government services (Xiao et al., 2014).

c) Institutional theory: Institutional theory, as discussed by Scott in 2004, focuses on the influence of organizational structures and cultural factors on the adoption of new technologies. This theory is pertinent to e-government as it addresses how established norms, values, and practices within institutions can either support or hinder the implementation of new technologies. Institutional resistance, stemming from these established practices, is often a significant barrier to e-government adoption (Garcia and Reyes, 2011).

7.4. Synthesizing theories

Introduction: E-governance has emerged as a transformative tool in modern governance, offering opportunities for improved service delivery, increased transparency, and enhanced citizen engagement. However, e-governance also presents significant challenges that must be addressed to realize its full potential. Our integrated framework for e-governance challenges and opportunities synthesizes key elements from various theoretical perspectives to provide a comprehensive understanding of the complexities surrounding e-governance.

7.4.1. Components of the integrated theory

1) Technological infrastructure
   a) Challenge: One of the primary challenges in e-governance is the need for robust technological infrastructure. This includes reliable internet connectivity, secure data storage, and user-friendly interfaces.
   b) Opportunity: Effective technological infrastructure can facilitate seamless e-governance processes, enabling efficient service delivery and enhanced citizen interaction.
2) Governance and institutional frameworks
   a) Challenge: Governance and institutional frameworks often struggle to adapt to the fast-paced nature of e-governance, leading to bureaucratic hurdles and resistance to change.
   b) Opportunity: Streamlining governance processes and fostering a culture of innovation within institutions can unlock the full potential of e-governance, enabling more agile and responsive governance structures.
3) Digital literacy and citizen engagement
   a) Challenge: Low levels of digital literacy among citizens can hinder the effective use of e-governance services, leading to a digital divide.
   b) Opportunity: Promoting digital literacy and enhancing citizen engagement

can bridge the digital divide, empowering citizens to participate more actively in governance processes.

4) Data security and privacy:
   a) Challenge: Ensuring the security and privacy of data in e-governance systems is a major challenge, with concerns over data breaches and unauthorized access.
   b) Opportunity: Implementing robust data security measures and ensuring compliance with privacy regulations can enhance trust in e-governance systems, encouraging greater adoption and usage.
5) Capacity building and collaboration:
   a) Challenge: Building the capacity of government officials to effectively utilize e-governance tools and fostering collaboration across government departments can be challenging.
   b) Opportunity: Investing in capacity building and promoting cross-departmental collaboration can improve the efficiency and effectiveness of e-governance initiatives, leading to better outcomes for citizens.

7.4.2. The theory outlined above can be expressed using the following formula

The theory outlined can be expressed using the following formula (as illustrated in the **Figure 1**, which integrates the key components of e-governance into a cohesive framework):

$$Y = F(X1, X2, X3, ..., Xn)$$

In this formula, Y represents the effectiveness of e-governance, which is the dependent variable. The independent variables, denoted as, $X1$, $X2$, $X3$, ..., Xn, encompass various key components. For instance, $X1$ could be Technological Infrastructure, which involves the availability and quality of technological resources. $X2$ might be governance and institutional frameworks, pertaining to the adaptability and efficiency of governance structures. $X3$ could represent digital literacy and citizen engagement, reflecting the level of public understanding and participation in e-governance. $X4$ might denote data security and privacy, indicating the strength and reliability of data protection measures. $X5$ could involve Capacity Building and Collaboration, which addresses the extent of organizational readiness and inter-departmental cooperation. The variables continue up to Xn, each representing additional factors that influence e-governance effectiveness. This formula highlights that the effectiveness of e-governance is determined by multiple interrelated components, emphasizing the need for a comprehensive approach to address these factors and optimize governance outcomes and citizen satisfaction.

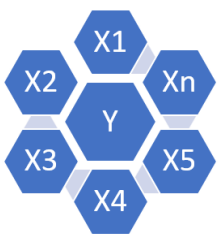

Figure 1. Integrated theory of e-governance key components.

Here, Y = The effectiveness of e-governance (dependent variable).

$F(X1, X2, X3, X4, X5, \ldots, Xn)$ represent various key components of e-governance (independent variables).

This formula indicates that the effectiveness of e-governance (Y) is a function of several key components: technological infrastructure ($X1$), governance and institutional frameworks ($X2$), digital literacy and citizen engagement ($X3$), data security and privacy ($X4$), capacity building and collaboration ($X5$), and additional factors represented by (Xn). Each of these independent variables plays a crucial role in determining the overall effectiveness of e-governance initiatives, highlighting the need for a comprehensive approach that addresses these multifaceted aspects to optimize governance outcomes and citizen satisfaction.

This new integrated framework for e-governance challenges and opportunities provides a comprehensive approach to understanding and addressing the complexities of e-governance. By recognizing the challenges and opportunities presented by e-governance and implementing strategies to mitigate challenges while maximizing opportunities, governments can harness the full potential of e-governance to improve governance outcomes and citizen satisfaction.

8. Conclusions

8.1. Summary

The study identified several key findings regarding the challenges and opportunities of e-government implementation. Among the main challenges are inadequate technological infrastructure, cybersecurity concerns, resistance to change within public institutions, and a lack of awareness among the public. Inadequate technological infrastructure, particularly in developing regions, results in limited internet access, outdated hardware, and insufficient software systems, which hinders the seamless operation of e-government services. Cybersecurity concerns are critical, as e-government systems are vulnerable to cyber-attacks that can compromise sensitive data, disrupt services, and erode public trust. Additionally, resistance to change within public institutions, driven by a lack of familiarity with new technologies, fear of job displacement, and a preference for traditional methods, poses a significant obstacle to e-government adoption. The lack of public awareness regarding the availability and benefits of e-government services further exacerbates these challenges, leading to underutilization of digital platforms. Despite these barriers, the study also highlighted substantial opportunities that e-government can bring. Improved service delivery through digital platforms can streamline processes, reduce waiting times, and eliminate bureaucratic hurdles, providing citizens with faster and more convenient access to government services. Enhanced transparency is another significant benefit, as digital platforms enable real-time access to government data, allowing citizens to monitor government activities, track public spending, and hold officials accountable, which can reduce corruption and promote good governance (Zhang and Sapiev, 2024). Increased accessibility is a notable opportunity, especially for marginalized and remote communities, as digital platforms allow governments to reach a broader audience, ensuring more citizens benefit from public services regardless of their geographic location or socio-economic status. E-government can also lead to significant cost savings by reducing

administrative costs, minimizing paperwork, and streamlining operations, resulting in more efficient use of public resources. Furthermore, it can facilitate greater civic engagement by providing new channels for participation and feedback, fostering a more inclusive and participatory approach to governance.

The significance of these findings lies in their potential to inform and guide policymakers and public administrators in the effective implementation of e-government initiatives. Understanding the specific barriers and opportunities allows for the development of targeted strategies that can overcome the identified challenges and fully exploit the benefits of e-government. For instance, addressing inadequate technological infrastructure might involve investing in better internet connectivity and modernizing hardware and software systems, while tackling cybersecurity concerns could require robust security protocols and regular monitoring. Overcoming resistance to change may involve implementing training programs and change management strategies to help public sector employees adapt to new technologies, and increasing public awareness could entail comprehensive outreach and education campaigns to inform citizens about the benefits and availability of e-government services. Leveraging these opportunities, governments can significantly enhance public administration and governance, resulting in improved service delivery, enhanced transparency, increased accessibility, cost savings, and greater civic engagement. These improvements can strengthen public trust in government institutions and promote a more positive relationship between citizens and the state. Moreover, the effective implementation of e-government can contribute to broader development goals, such as sustainable development and digital inclusion, by ensuring all citizens have access to digital services and promoting social equity and economic development. The cost savings and efficiencies gained through e-government can also free up resources for other critical areas, such as healthcare, education, and infrastructure development. In conclusion, the study's findings provide a comprehensive understanding of the challenges and opportunities associated with e-government implementation. By addressing these challenges and leveraging the identified opportunities, policymakers and public administrators can enhance the effectiveness of e-government initiatives, ultimately leading to efficient, transparent, and inclusive governance.

8.2. Future research

Suggested areas for further investigation: Future research could delve deeper into specific aspects of e-government to build on the findings of this study. One critical area for further investigation is cybersecurity. Given the significant concerns about data privacy and security highlighted in the study, future research could explore advanced cybersecurity measures and their effectiveness in protecting e-government services. Another important area is user engagement. Research could focus on strategies to enhance user participation and satisfaction, examining how different demographic groups interact with e-government services and identifying ways to improve their experience.

8.3. Limitations of the research

a) Data availability: One of the primary limitations faced during this research was the availability of data. While the study utilized available publications, and secondary data sources, access to comprehensive and up-to-date data was restricted. This limitation could affect the generalizability of the findings, as the data may not fully represent all regions or demographic groups.

b) Methodological constraints: The study also encountered several methodological constraints. The mixed-methods approach, while providing a comprehensive analysis, posed challenges in integrating qualitative and quantitative data seamlessly. Additionally, the reliance on self-reported data in surveys and interviews may introduce biases, as respondents might not always provide accurate or honest answers.

Conflict of interest: The authors declare no conflict of interest.

References

Abdulkareem, A. K., & Ramli, R. M. (2021). Does digital literacy predict e-government performance an extension of Delone and Mclean information system success model. Electronic Government, an International Journal, 17(4), 466. https://doi.org/10.1504/eg.2021.118103

Ahn, M. J., & Stuart, B. (2011). Politics of E-Government: E-Government and the Political Control of Bureaucracy. Public Administration Review, 71(3), 414–424. https://doi.org/10.1111/j.1540-6210.2011.02225.x

Aigner, I., Garai-Fodor, M., & Szemere, T. P. (2022). Singapore's Journey as a Digit-all-ized and Innovative Smart Nation Toward Sustainability. In: Proceedings of the 2022 IEEE 10th Jubilee International Conference on Computational Cybernetics and Cyber-Medical Systems (ICCC). https://doi.org/10.1109/iccc202255925.2022.9922714

Apostolou, D., Stojanovic, N., & Stojanovic, L. (2005). Change management in e-government: OntoGov case study. Electronic Government, an International Journal, 3(1), 74. https://doi.org/10.1504/eg.2006.008493

Bannister, F., & Connolly, R. (2015). The great theory hunt: Does e-government really have a problem? Government Information Quarterly, 32(1), 1–11. https://doi.org/10.1016/j.giq.2014.10.003

Barbosa, A., Pozzebon, M., & Diniz, E. (n.d.). Rethinking E-Government Performance Assessment from A Citizen Perspective. Public Administration, 91(3), 744–762. https://doi.org/10.1111/j.1467-9299.2012.02095.x

Basu, S. (2011). E-government and developing countries: an overview. International Review of Law, Computers & Technology, 18(1), 109–132. https://doi.org/10.1080/13600860410001674779

Batjargal, T., & Zhang, M. (2021). Review of key challenges in public-private partnership implementation. Journal of Infrastructure, Policy and Development, 5(2), 1378.

Batjargal, T., & Zhang, M. (2022). Review on the Public-Private Partnership. Management Studies, 10(1). https://doi.org/10.17265/2328-2185/2022.01.001

Belanger, F., & Hiller, J. S. (2006). A framework for e-government: privacy implications. Business Process Management Journal, 12(1), 48–60. https://doi.org/10.1108/14637150610643751

Berdykhanova, D., Dehghantanha, A., & Kumaresh, H. (2010). Trust challenges and issues of e-government: E-tax prospective. In: Proceedings of the 2010 International Symposium on Information Technology. https://doi.org/10.1109/itsim.2010.5561596

Campmas, A., Iacob, N., & Simonelli, F. (2022). How can interoperability stimulate the use of digital public services? An analysis of national interoperability frameworks and e-Government in the European Union. Data & Policy, 4. https://doi.org/10.1017/dap.2022.11

Chohan, S. R., & Hu, G. (2020). Strengthening digital inclusion through e-government: cohesive ICT training programs to intensify digital competency. Information Technology for Development, 28(1), 16–38. https://doi.org/10.1080/02681102.2020.1841713

Choi, T., & Chandler, S. M. (2020). Knowledge vacuum: An organizational learning dynamic of how e-government innovations fail. Government Information Quarterly, 37(1), 101416. https://doi.org/10.1016/j.giq.2019.101416

Chuob, S., Pokharel, M., & Park, J. S. (2011). Modeling and Analysis of Cloud Computing Availability Based on Eucalyptus Platform for E-Government Data Center. In: Proceedings of the 2011 Fifth International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing. https://doi.org/10.1109/imis.2011.135

Crowder, R., Alateyah, S., & Wills, G. (2013). An exploratory study of proposed factors to adopt e-government services. International Journal of Advanced Computer Science and Applications, 4(11).

Curtin, G., Sommer, M., & Vis-Sommer, V. (2008). The World of E-government. Journal of Political Marketing, 2(3–4), 1–16. https://doi.org/10.1300/J199v02n03_01

Dahiya, D., & Mathew, S. K. (2016). IT assets, IT infrastructure performance and IT capability: a framework for e-government. Transforming Government: People, Process and Policy, 10(3), 411–433. https://doi.org/10.1108/tg-07-2015-0031

Dias, G. P. (2020). Global e-government development: besides the relative wealth of countries, do policies matter? Transforming Government: People, Process and Policy, 14(3), 381–400. https://doi.org/10.1108/tg-12-2019-0125

Dixon, M., McGill, T., & Dhiyab, A. (2014). Examining the Impact of E-privacy Risk Concerns on Citizens' Intentions to Use E-government Services: An Oman Perspective. Journal of Information Privacy and Security, 5(2), 3–26. https://doi.org/10.1080/15536548.2009.10855861

Donald, N. F., & Christopher, R. G. (2012). Local E-Government in the United States: Transformation or Incremental Change? Public Administration Review, 73(1), 165–175. https://doi.org/10.1111/j.1540-6210.2012.02647.x

Doran, M., Doran, N., Puiu, S., et al. (2023). E-Government Development—A Key Factor in Government Administration Effectiveness in the European Union. Electronics, 12(3), 641. https://doi.org/10.3390/electronics12030641

Eyob, E. (2004). E-government: breaking the frontiers of inefficiencies in the public sector. Electronic Government, an International Journal, 1(1), 107. https://doi.org/10.1504/eg.2004.004140

Faisal, T., & Faisal, M. N. (2019). E-government to m-government: a study in a developing economy. International Journal of Mobile Communications, 14(6), 568. https://doi.org/10.1504/ijmc.2016.079301

Garcia, J., & Reyes, L. (2011). Using institutional theory and dynamic simulation to understand complex e-Government phenomena. Government Information Quarterly, 28(3), 329–345. https://doi.org/10.1016/j.giq.2010.08.007

González, L., Echevarroa, A., Morales, D., et al. (2016). An E-government Interoperability Platform Supporting Personal Data Protection Regulations. CLEI Electronic Journal. https://doi.org/10.19153/cleiej.19.2.7

Gottschalk, P., & Solli-Saether, H. (2009). Stages of E-Government Interoperability. E-Government Interoperability and Information Resource Integration, 108–123. https://doi.org/10.4018/978-1-60566-648-8.ch005

Halachmi, A., & Greiling, D. (2013). Transparency, E-Government, and Accountability. Public Performance & Management Review, 36(4), 572–584. https://doi.org/10.2753/pmr1530-9576360404

Hassan, S., & Garcia, R. (2008). Institutional Theory and E-Government Research. In: Handbook of Research on Public Information Technology. IGI Global. pp. 349–360. https://doi.org/10.4018/978-1-59904-857-4.ch034

Hussein, R., Shahriza, A. K. N., & Hasan Selamat, M. (2007). The impact of technological factors on information systems success in the electronic-government context. Business Process Management Journal, 13(5), 613–627. https://doi.org/10.1108/14637150710823110

Jaeger, P., & Bertot, J. (2012). Implementing and Managing Public Library Networks, Connectivity, and Partnerships to Promote E-Government Access and Education. Managing E-Government Projects, 183–199. https://doi.org/10.4018/978-1-4666-0086-7.ch007

Jawarneh, M. (2024). Advancements in Digital Technologies: Exploring the Impact on Healthcare, Education, and Network Connectivity in the Era of 5G and IoT. Available online: https://www.irejournals.com/formatedpaper/1705775.pdf (accessed on 2 June 2023).

Kalu, K. (2007). Capacity Building and IT Diffusion. Social Science Computer Review, 25(3), 358–371. https://doi.org/10.1177/0894439307296917

Kamolov, S., & Konstantinova, A. (2017). E-government: Way of Modernization and Efficiency Enhancement of Public Governance. Journal of Law and Administration, 1(42), 13–21. https://doi.org/10.24833/2073-8420-2017-1-42-13-21

Kang, S., & Gearhart, S. (2010). E-Government and Civic Engagement: How is Citizens' Use of City Web Sites Related with Civic Involvement and Political Behaviors? Journal of Broadcasting & Electronic Media, 54(3), 443–462. https://doi.org/10.1080/08838151.2010.498847

Krishnan, S., & Thompson, S. H. (2012). Moderating effects of governance on information infrastructure and e-government development. Journal of the American Society for Information Science and Technology, 63(10), 1929–1946.

https://doi.org/10.1002/asi.22660

Lam, W. (2005). Barriers to e-government integration. Journal of Enterprise Information Management, 18(5), 511–530. https://doi.org/10.1108/17410390510623981

Lean, O., Zailani, S., Ramayah, T., et al. (2009). Factors influencing intention to use e-government services among citizens in Malaysia. International Journal of Information Management, 29(6), 458–475. https://doi.org/10.1016/j.ijinfomgt.2009.03.012

Malodia, S., Dhir, A., Mishra, M., et al. (2021). Future of e-Government: An integrated conceptual framework. Technological Forecasting and Social Change, 173, 121102. https://doi.org/10.1016/j.techfore.2021.121102

Morgeson, F., Mithas, S., & Aliazzaf, S. (2018). An empirical and comparative analysis of E-government performance measurement models. Government Information Quarterly, 35(4), 515–535. https://doi.org/10.1016/j.giq.2018.07.003

Mpinganjira. (2015). Use of e-government services: the role of trust. International Journal of Emerging Markets, 10(4), 622–633. https://doi.org/10.1108/ijoem-12-2013-0151

Nasi, G., & Frosini, F. (2010). Vision And Practice Of E-Government: An Empirical Study. Financial Accountability & Management, 26(1), 85–101. https://doi.org/10.1111/j.1468-0408.2009.00492.x

Palanisamy, R., & Mukerji, B. (2016). Security and Privacy Issues in E-Government. E-Government Service Maturity and Development, 236–248. https://doi.org/10.4018/978-1-60960-848-4.ch013

Panagoulias, D., Virvou, M., & Tsihrintzis, G. (2024). A novel framework for artificial intelligence explainability via the Technology Acceptance Model and Rapid Estimate of Adult Literacy in Medicine using machine learning. Expert Systems with Applications, 248, 123375. https://doi.org/10.1016/j.eswa.2024.123375

Pardo, T., Nam, T., & Burke, G. (2011). E-Government Interoperability. Social Science Computer Review, 30(1), 7–23. https://doi.org/10.1177/0894439310392184

Patergiannaki, Z., & Pollalis, Y. A. (2023). Bridging the gap: assessing disparities in e-Government service offerings and citizen demand. Transforming Government: People, Process and Policy, 17(4), 532–551. https://doi.org/10.1108/tg-04-2023-0050

Prima, S., & Ibrahim, R. (2011). Citizen awareness to e-government services for information personalization. International Jouranl of Innovative Computing, 1(1). https://doi.org/10.11113/ijic.v1n1.4

Radanliev, P. (2024). Cyber diplomacy: defining the opportunities for cybersecurity and risks from Artificial Intelligence, IoT, Blockchains, and Quantum Computing. Journal of Cyber Security Technology, 1–51. https://doi.org/10.1080/23742917.2024.2312671

Rana, N. P., Williams, M. D., Dwivedi, Y. K., et al. (2012). Theories and Theoretical Models for Examining the Adoption of E-Government Services. E-Service Journal, 8(2), 26. https://doi.org/10.2979/eservicej.8.2.26

Rana, Williams, Dwivedi, et al. (2012). Theories and Theoretical Models for Examining the Adoption of E-Government Services. E-Service Journal, 8(2), 26. https://doi.org/10.2979/eservicej.8.2.26

Reddick, C., & Anthopoulos, L. (2014). Interactions with e-government, new digital media and traditional channel choices: citizen-initiated factors. Transforming Government: People, Process and Policy, 8(3), 398–419. https://doi.org/10.1108/tg-01-2014-0001

Rowley, J. (2011). e-Government stakeholders—Who are they and what do they want? International Journal of Information Management, 31(1), 53–62. https://doi.org/10.1016/j.ijinfomgt.2010.05.005

Sandhu, K., Alomari, M. K., & Woods, P. (2014). Exploring citizen perceptions of barriers to e-government adoption in a developing country. Transforming Government: People, Process and Policy, 8(1), 131–150. https://doi.org/10.1108/tg-05-2013-0013

Schwester, R. W. (2009). Examining the Barriers to e-Government Adoption. Electronic Journal of e-Government, 7(1).

Seng, W. M., Stephen J., & Philip, G. (2008). Cultural issues in developing E-Government in Malaysia. Behaviour & Information Technology, 29(4), 423–432. https://doi.org/10.1080/01449290903300931

Shanab, E. A. (2019). Predicting trust in e-government: two competing models. Electronic Government, an International Journal, 15(2), 129. https://doi.org/10.1504/eg.2019.098669

Shareef, M., Kumar, U., Kumar, V., et al. (2009). Identifying critical factors for adoption of e-government. Electronic Government, an International Journal, 6(1), 70. https://doi.org/10.1504/eg.2009.022594

Sharma, S. K., & Gupta, J. N. (2003). Building Blocks of an E-Government. Journal of Electronic Commerce in Organizations, 1(4), 34–48. https://doi.org/10.4018/jeco.2003100103

Singh, M., Zhao, F., & Wallis, J. (2015). E-government development and the digital economy: a reciprocal relationship. Internet Research, 25(5), 734–766. https://doi.org/10.1108/intr-02-2014-0055

Stamati, T., Karantjias, A., & Martakos, D. (2010). Advanced e-government enterprise strategies and solutions. International Journal of Electronic Governance, 3(2), 170. https://doi.org/10.1504/ijeg.2010.034094

Stavrou, V. P., & Panayiotou, N. A. (2021). Government to business e-services—A systematic literature review. Government Information Quarterly, 38(2), 101576. https://doi.org/10.1016/j.giq.2021.101576

Sun P., Ku, C., & Shih, D. (2015). An implementation framework for E-Government 2.0. Telematics and Informatics, 32(3), 504–520. https://doi.org/10.1016/j.tele.2014.12.003

Telo, J. (2021). Privacy and cybersecurity concerns in smart governance systems in developing countries. The Tensorgate Journal of Sustainable Technology and Infrastructure for Developing Countries, 4(1).

Theresa, P., Taewoo, N., & Burke, B. G. (2011). E-Government Interoperability. Social Science Computer Review, 30(1), 7–23. https://doi.org/10.1177/0894439310392184

Verdegem, P., & Hauttekeete, L. (2010). A User-Centric Approach in E-Government Policies. Citizens and E-Government, 20–36. https://doi.org/10.4018/978-1-61520-931-6.ch002

West, D. M. (2004). E-Government and the Transformation of Service Delivery and Citizen Attitudes. Public Administration Review, 64(1), 15–27. https://doi.org/10.1111/j.1540-6210.2004.00343.x

Wu, Y. (2014). Protecting personal data in E-government: A cross-country study. Government Information Quarterly, 31(1), 150–159. https://doi.org/10.1016/j.giq.2013.07.003

Xiao, J., Zhang, H., & Xu, X. (2014). Diffusion of e-government: A literature review and directions for future directions. Government Information Quarterly, 31(4), 631–636. https://doi.org/10.1016/j.giq.2013.10.013

Xu, H., & Asencio, H. (2012). E-Government in Local Government in the Era of Web 2.0. Citizen 2.0: Public and Governmental Interaction through Web 2.0 Technologies, 114–128. https://doi.org/10.4018/978-1-4666-0318-9.ch007

Yang, K., & Rho, S. (2007). E-Government for Better Performance: Promises, Realities, and Challenges. International Journal of Public Administration, 30(11), 1197–1217. https://doi.org/10.1080/01900690701225556

Yusifov, F., & Aliguliyev, R. (2018). Role of Social Networks in E-government: Risks and Security Threats. Online Journal of Communication and Media Technologies, 8(4). https://doi.org/10.12973/ojcmt/3957

Zhang, B., Chong, P., & Chen, Y. (2004). Cyber security management and e-government. Electronic Government, an International Journal, 1(3), 316. https://doi.org/10.1504/eg.2004.005555

Zhang, M., & Batjargal, T. (2022). Review on new spending of United States Bipartisan Infrastructure Bill. Journal of Infrastructure, Policy and Development, 6(2), 1507. https://doi.org/10.24294/jipd.v6i2.1507

Zhang, M., & Sapiev, A. (2024). Review of the Factors Leading to Corruption in Russia. International Journal of Law and Politics Studies, 6(3), 145–163.

Zhang, M., & Shahid, R. (2024). Enlightening Bangladesh: Navigating power sector challenges through PPP excellence. Journal of Infrastructure, Policy and Development, 8(3), 2529. https://doi.org/10.24294/jipd.v8i3.2529