A Narrative Review on Designing End-to-End (E2E) Services for E-Government in Developing Countries

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Abstract

Developing countries worldwide are increasingly adopting e-government initiatives to enhance the efficiency and effectiveness of public service delivery. Despite limited financial resources, governments are implementing various strategies to meet citizens' dynamic demand, often influenced by the seamless digital experiences offered by the private sector. However, the pursuit of fully online, end-to-end (E2E) e-government services is frequently hindered by technological, organizational, and regulatory barriers. E2E services refer to fully online public services from the beginning to the end of the process, accessible anytime and anywhere without requiring face-to-face interaction. This paper presents a narrative review to explore citizen-centric design elements in e-government for developing effective public service delivery systems that enhance user convenience and minimize the need for in-person visits to government offices. A literature search on different databases was conducted, including Scopus, Web of Science, and Google Scholar, using determined keywords and filtering criteria were included. The review highlights three overarching themes which are challenges of E2E services implementation, innovation in e-government practices, and essential design characteristics for E2E service delivery. The implementation of seamless e-government services in developing countries faces several challenges. However, designing end-to-end services can potentially open new venues for enhancing the service engagement journey for citizens while engaging with the public sector.

Keywords: End-To-End, E-Government, Narrative Review, Service Design

Introduction

Electronic government, or e-government, has served as a catalyst of public administration transformation for the past two decades, aiming to enhance efficiency and effectiveness in delivering valuable public services to citizens. The United Nation (UN) defines "e-government" as "the use of ICTs for improving the efficiency of government agencies and providing government services online." (United Nations, 2022). E-government development

cycle comprises three key stages: information, transaction, and engagement (Zhang & Kimathi, 2022). Initially, the informational stage of e-government involves delivering basic information about public services to citizens (Joshi & Islam, 2018). At this stage, citizens typically access government agencies' web portals to obtain details on available services, including guidelines and procedures required to complete specific tasks, often in preparation for a physical visit to the government office. Subsequently, enhanced e-government functionalities were introduced, allowing citizens to interact more directly with public agencies through transactional services (Butt et al., 2019). These developments enabled online submission of applications and digital payments via government web portals, offering a more convenient and efficient means of engaging with the public sector. Citizen participation has become a vital component of public sector decision-making, particularly during the engagement stage of e-government development (Zhang & Kimathi, 2022). Governments now actively seek feedback from citizens by leveraging various digital platforms, such as social media, online review systems, e-participation, and other interactive tools to better understand public perceptions and evolving needs.

Implementing e-government services that meet the high expectations and dynamic demands of the public, is a global challenge. Although e-government initiatives have made significant progress in incorporating ICT into the service delivery system, the aim to achieve integrated, seamless, and uninterrupted service delivery is still ambiguous (Siddiquee & Mohamed, 2020). In this context, many developing nations continue to face challenges in providing fully online services, from start to finish or the term that is occasionally used in current e-government research, 'end-to-end services' (Asian Productivity Organization, 2021). E2E services refer to fully online services from the beginning to the end of the process, accessible anytime and anywhere without requiring face-to-face interaction (MAMPU, 2022a). These challenges have affected many government services, hindering the progress of digital technologies in these areas. For instance, many government agencies still require physical attendance, succeeding online engagement. In this context, citizen which apply of public services through digital platform, will eventually needs to attend government offices to complete their task (Huque & Ferdous, 2024). This situation can also be seen in most e-government services in Malaysia such as the applying for birth certificate, applying for marriage registration, driving license and etc. One of the components for e-government sustainability is through streamlined services which, stakeholders could acquire specific government services without having to visit relevant government offices (Joshi & Islam, 2018).

In this regard, there is a need to explore service design aspects to better meet citizens' needs and ensure they fully benefit from the digital transformation of government services (Chan et al., 2025; Equey et al., 2024; Scholta et al., 2020). There is a lack of research focusing on e-government service delivery process in developing countries through the lens of service design approach from the perspective of citizens' experiences and their entire service engagement journey. This study therefore aims to analyse existing literature on e-government service delivery in developing countries by identifying key challenges in addressing the impediments of fully online services, from start to finish, explore e-government innovation practices, and uncover foundational characteristics in designing end-to-end e-government services according to citizen needs. Hence, this study will address the following research question: What are the fundamental concepts of end-to-end service delivery in e-government? What are the design elements in establishing end-to-end service

delivery in e-government? While there are several implementation strategies to spearhead e-government capability in the public sector, understanding the process used to develop them is crucial as these strategies are diverse in contextual factors and administrative levels (Osah & Pade-Khene, 2020). This study seeks to provide a comprehensive understanding e-government systems can be effectively designed and executed to ensure seamless, citizen-centric service delivery in a resource-constrained setting such as developing countries.

Research Background

E-government Services Constrains

The development of most e-government services focuses on the digitalization of government processes rather than building citizen-centric digital services. This has resulted in fragmented in service delivery through e-government, which citizen is still required to attend physically at a government office to complete their task (OECD, 2020; Paradkar, 2021). Based on (Gao et al., 2013), government fragmentation refers to the disintegrating of a complete unit into separate sub-units within governmental institutions. In the context of this study, it refers to the disconnected process of complete online services into separate channels, the combination of online and offline to deliver government services. Service fragmentation is due to several challenges that impede e-government services in developing countries to become a fully online service or E2E services. The reliance on legacy systems is one of those challenges that are often not designed to handle high-volume transactions or integrate with contemporary technologies (Abu Bakar et al., 2022). This situation can be observed in the implementation of the majority of e-government services in developing countries, which currently serve the community as partial online services as some of the processes are still performed using conventional methods.

On the other hand, the lack of integration between internal systems is another critical barrier to achieving seamless e-government services. The lack of integration within department services results in inefficiencies, as citizens frequently provide the same information across different platforms due to the lack of integrated service systems (Glyptis et al., 2020). For instance, in Malaysia, face-to-face interaction and offline intervention are still necessities for several processes such as document verification, identity authentication, and service output that impede the establishment of E2E services. Another challenge is outdated laws frequently do not offer the essential structure for the growth of digital services, whereas inflexible regulatory frameworks can hinder innovation. Government agencies are unable to adapt their legislation quickly enough to keep up with swift technological progress, resulting in a disconnect between policy goals and practical situations (Nnaji et al., 2023). For example, in civil registration services such as children's birth registration services, the existing Birth and Death Registration Act, necessitates that birth verification of a child must be given to the informer in a designated form and certified by the Registrar. Similarly, in the Islamic marriage registration service, as stipulated in the Islamic Family Laws (State of Selangor) Enactment 2003, permission to marry must be given in the prescribed form after being satisfied with the truth stated in the marriage application by the local marriage registrar. Due to these constraints, fully online e-government services may not be established.

Previous literature in e-government service delivery has discussed similar scenarios of disconnected or disintegrated services but more focused on broader contexts such as inter-departmental and cross-boundaries collaboration such as no-stop-shop, joined up

government, and holistic governance (Aoki et al., 2024; Gao et al., 2013; Scholta et al., 2019). The no-stop-shop model discussed by Scholta et al. (2019) emphasizes on the combination of various government digital services into a single platform that eliminates the access to multiple platforms offered by different government institutions. On the contrary, joined-up government focuses on government arrangements of working together through shared resources and information (Aoki et al., 2024) while holistic governance emphasizes the coordination of levels and functions through ICT integration to overcome fragmentation (Gao et al., 2013). While these previous models emphasize government efforts to streamline services across various levels of management and administration jurisdictions, there is very limited focus on addressing e-government service fragmentation towards realizing E2E services within a single institution that will provide a stepping stone in addressing a larger issue of cross-agency e-government collaboration.

Understanding End-to-End (E2E) Services
When the E2E concept first emerged, it found wide applications in the computer networking field, which focused on network communication over the Internet. (Saltzer et al., 1984) developed the end-to-end principle through their renowned scientific work "End-to-End Arguments in System Design". According to their study, important tasks or functions should be completed at the beginning or end of the task, not in the middle. The communication system was explained in detail to ensure correct data transmission. This idea was later widely used in the design of the Internet's communication protocols, such as TCP/IP, and later extended into other domains, including business processes, supply chain management, and software development, where it currently denotes smooth, all-inclusive solutions that cover a process from beginning to end.

In the context of technology, E2E systems are designed to ensure that data, services, or transactions move seamlessly across communication networks without manual intervention or disruption. The primary goal is to deliver a complete and automated workflow that minimizes complexity, improves speed, and enhances reliability. When translated into the context of digital public service delivery, E2E refers to a fully digital, seamless process in which citizens can access, apply for, and receive government services from start to finish without needing to visit physical offices (MAMPU, 2022b). The underlying principle is the same, which is to eliminate fragmentation, reduce handovers between departments, and streamline the service journey across multiple service touchpoints. For example, in a traditional setting, applying for a birth certificate in Malaysia may involve initiating the process online, but still requires physical presence at a hospital and submission of printed forms at the National Registration Department (JPN). This fragmented service is not end-to-end. In contrast, a true E2E service would allow hospitals to directly update the JPN system electronically, and for citizens to receive the digital certificate through a secure government portal, all without in-person interaction. Another relevant case is the Islamic marriage registration system (SPPIM). While some parts are digitized such as general application procedure, online application form, checking application status, applicants are still required to attend physical identity verification processes and manual form submission. Future E2E service framework would enable attending online marriage pre-course, remote document verification, digital signature from the wali (guardian), and issuance of the marriage certificate through a centralized system.

In Malaysia, the National Digital Department (NDD) has been a driving force behind the development of Digital Government, to transform existing digital services into E2E services as stipulated in the Malaysia Digital Economy Blueprint (MyDigital) strategies. This firm dedication has resulted in a mission to convert 80% of online government services into E2E services by 2025 and to elevate Malaysia into the top 12 countries in the UN's Online Service Index (OSI). To identify whether these services are considered E2E, NDD established a working definition which refers to "A fully online service from the beginning to the end of the process, accessible anytime and anywhere without requiring face-to-face interaction", to guide public institutions in identifying and developing E2E e-government services (MAMPU, 2022a). However, current practices are not sufficient to spearhead practicality in establishing an end-to-end online environment for public digital services. On the other hand, in terms of theoretical perspectives, a small number of literatures have referred E2E services as encompassing a comprehensive, citizen-centric approach to service delivery in e-government that enhances value and improves the user experience (Deloitte, 2023; Idowu Lamid et al., 2021). For instance, (Downe, 2020) explains that designing a good service requires end-to-end approach by (1) starting from when user trying to achieve a goal until finish (2) front-end, user facing service to back-end, internal process (3) using every channel. While many studies acknowledge the benefits of E2E in e-government context, there is still a limited understanding of this concept, especially concerning the delivery of e-government services. Furthermore, literature that provides fundamental principles and characteristics of end-to-end services in e-government research is still scarce.

Key Theoretical Perspectives

Understanding the systemic nature and complexity of digital public service delivery, requires exploration into current work system-based theories. This approach will assist the authors in identifying the elements of an e-government working environment and specifying relationships among them. While no theories can perfectly apply to all situations, choosing the most pertinent theories for the study can help refine the research focus and scope (Yin, 2018). Work Systems Theory (WST) offers a thorough framework for understanding and analyzing systems that rely on information technology and involve the interaction between human and systems. A "work system," as defined by WST, refers to a system where humans and/or machines carry out tasks utilizing particular resources to create specified products or services for clients (Alter, 2013). A study by Lindgren et al. (2021) has utilized this theory to develop a comprehensive framework, including how digital technology, information, and participants interact in providing digital public services. Based on the E-government Work Systems Framework (EGovWSF), there are 12 elements that constitute the work systems of e-government services, this include (1) social, economic and political environment (2) policies and strategies (3) law and regulation (4) digital infrastructure (5) value for society (6) external stakeholders (7) public e-services (8) processes and activities (9) internal stakeholders (10) information (11) digital technologies (12) internal policies and strategies (Lindgren et al., 2021). This framework can be viewed to describe and clarify the characteristics of e-Government work systems in Malaysia across different levels of government. It also offers authors descriptive tools to assess the present state of Malaysian e-government, which can help to disentangle elements and uncover intricate structures and phenomena within these specific services.

Furthermore, several studies have pointed out that citizen's service experience is one of key factors that determined the success of government service delivery to achieve broader social benefits (Twizeyimana & Andersson, 2019). Achieving valuable e-government services outcome, including perceived service quality and user satisfaction, thus impacting citizen's experiences with the service, require the establishment of service design component (Li & Shang, 2020). Therefore, further research regarding service design in e-government could focus on examining case studies from specific governments and developing a model tailored to that government (Sangolt & Keitsch, 2016). Service design (SD) is one of the several design theories that emerged to fill the gap between service design and design thinking integration, focusing on a deep understanding of user needs and experiences by putting people first in every stage of service design (Stickdorn & Schneider, 2011). SD is widely acknowledged and extensively adopted within business management context, where customer experience and satisfaction are the utmost goal. In business environments, service design emphasizes user-centeredness, co-creation, and seamless customer journeys, aiming primarily at improving customer and employees' experience (Liu et al., 2020). However, the public service context, structured by governance, regulatory frameworks, and diverse stakeholder interests, has fallen behind in fully embracing this service design approach. This gap highlights an opportunity, incorporating robust service design practices and emerging technologies into the public sector, could significantly enhance the efficiency, responsiveness, and overall user experience of e-government services (Chan et al., 2021a). However, SD has yet to be effectively integrated, especially in the context of digital services. It is thus crucial for public sector decision-maker to explore how these proven methodologies can be operationalized effectively within the unique constraints and requirements essential, in the age of digitalization.

Service practitioners have developed theories, tools, and real-world case studies to successfully offer a workable solution to enhance the provision of valuable services through service design principles in business and management. SD encompasses principles to guide the process of designing or re-designing institutional services to provide good services (Downe, 2020). According to Stickdorn & Schneider (2011), there are five service design principles that guide organizations in designing systems and processes to deliver a holistic user experience (1) user-centered (2) co-creative (3) sequencing (4) evidencing and (5) holistic. These principles ensure that services are designed with a focus on understanding user needs through their eyes and in a way that they experience service engagement that is valuable to them. User-centered draws upon the insight of customer experience to understand and fulfil their needs, rather internal needs of the organizations (Chen & Chou, 2015; DPER, 2022). Co-creative requires the involvement of various stakeholders in the design processes, from the management role to the end user, and from frontline staff to third-party suppliers (Polaine et al., 2013). In particular, co-creation empowers citizens by enabling them to participate in public service design and policy decision-making that are meaningful and valuable (Khan & Krishnan, 2021). Sequencing represents the timeline in which the customer interacts with various service touchpoints throughout their journey (Stickdorn & Schneider, 2011). Due to the nature of services being mostly intangible, through evidencing, customers can get tangible products from behind-the-scenes process, such as bills, emails notification etc. (Polaine et al., 2013). It is crucial that in any design process, a holistic view of the entire landscape be considered, including as many elements as possible (DPER, 2022). In this case, a

holistic view of e-government service delivery process would take into account internal and external elements of its systemic nature, as addressed by the eGovWSF discussed earlier.

In business environment, a service process consists of (1) pre-service (2) actual service and (3) post-service which are experienced by the customer through customer journey (Stickdorn & Schneider, 2011). Similarly, in public sector, citizens experienced the exact journey through a series of public services engagement, beginning from preparation, application and result (Scholta et al., 2020). During preparation, citizens will recognize the need and seek information through the chosen service channel (online or offline). The application phase requires citizens to complete key steps, beginning with accessing the application form (online or offline), undergoing authentication (e.g., personal appearance, e-ID verification, background check), completing and submitting the form, and paying the processing fee. On the other hand, the result phase involves checking the application status via telephone or other communication channels, receiving the outcome, and taking necessary follow-up actions. For example, applicants may receive a physical passport, enabling them to travel internationally. As such, we argue that the incorporation of the service design approach and WST as the theoretical perspective is an attempt to understand the characteristics of end-to-end services in the context of e-government.

When combined, these two approaches provide a significant dual lens for public sector reform. WST helps public agencies understand the systemic realities of how services are delivered, while SD ensures that redesign efforts remain grounded in citizen expectations. For instance, in the context of e-government, WST may reveal internal siloed systems across organization, while SD can uncover user frustrations due to repetitive paperwork or lack of transparency. The unique value of using both theories lies in their ability to align internal system logic with external user logic, a necessary step toward creating truly end-to-end e-government services. This combination ensures that digital transformation efforts are not only technically feasible but also socially acceptable, user-friendly, and responsive to real-world needs.

Methodology
The identification of articles for this narrative review was conducted using several core keywords, including *e-government*, *digital government*, *digital service*, *service delivery*, *end-to-end*, and *service design*. These initial keywords were refined and expanded through a systematic identification process that involved exploring synonyms, equivalent terms, and related variations. As a result, additional relevant keywords were identified, such as *e-service*, *comprehensive delivery*, *holistic delivery*, and *design thinking*. The article search was carried out using two high-impact scholarly databases: Web of Science and Scopus. These platforms were selected due to their comprehensive indexing, advanced search capabilities, high-quality control standards, and extensive coverage across multiple disciplines, particularly in information systems research (Gusenbauer, 2020). A total of 531 potentially relevant articles were retrieved from both databases, 336 from Scopus and 195 from Web of Science. Given the high volume of irrelevant publications, inclusion and exclusion criteria were applied to systematically eliminate studies that did not address any element of the research questions (Kitchenham & Charters, 2007). The filtering process was subsequently conducted using the criteria outlined in Table 1.

Table 1

Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Timeline	2020 - 2025	<2020
Document type	Article journal (empirical data)	Article review, chapters in book, book series, book, conference proceeding
Language	English	Non-English
Database	Web of Science & Scopus	Duplicated studies

The filtering process resulted in a total of 148 papers and after screening their titles and abstracts, 115 articles were excluded due to their irrelevant topics, and the 28 papers were carried forward to the review process. Furthermore, a total of 7 papers were excluded due to unavailability of full text while 13 papers were also excluded due to duplication. Apart from using journal database, manual search techniques such as handpicking, snowballing, and backward tracking were also employed throughout the process which eventually accumulate a total of additional 19 papers. Finally, a total of 27 papers were reviewed in this study. Based on the content analysis conducted in this study and insights from AI tools like ChatGPT, 3 themes emerged in this review, selected based on references to previous studies: challenges of e-government services implementation, innovative practices in e-government services delivery, and essential design characteristics for achieving holistic and integrated E2E service delivery.

Findings and Discussion

Challenges of E2E Services Implementation

The implementation of e-government systems across developing and transitional contexts continues to face significant barriers that undermine the delivery of seamless, citizen-centric public services. One of the most persistent and systemic issues is infrastructural deficiency, particularly in terms of digital connectivity. Countries such as Bangladesh and Tanzania exemplify how poor internet coverage, frequent power outages, and underdeveloped telecommunications infrastructure severely limit the accessibility and effectiveness of digital public services, especially in rural and remote areas where the digital divide remains stark (Huque & Ferdous, 2024; Mbano et al., 2025). The absence of a unified national strategy or clear inter-agency coordination mechanisms frequently leads to duplicated efforts, inconsistent service quality, and inefficiencies across the digital ecosystem (Jibladze et al., 2024). Equally critical are the deficiencies in policy and legal frameworks that support digital transformation. In South Africa, for example, the continued reliance on outdated legislation such as the Electronic Communications and Transactions Act of 2002 has impeded the adoption of emerging technologies such as artificial intelligence and cloud computing in public service delivery (Shibambu & Ngoepe, 2024). In the absence of modern, forward-looking digital governance policies, government departments are left to interpret mandates inconsistently, resulting in ad hoc and reactive implementation rather than strategic planning.

Moreover, the design and delivery of e-government platforms often fail to account for user experience. In Brazil and other countries, chatbot interfaces were found to lack fundamental usability features such as natural language processing, multilingual support, and error recovery mechanisms, resulting in user frustration and low adoption rates (Monteiro et al., 2023). In India, digital service delivery across different stages, from search and agreement

to fulfilment and after-sales, often lacks coherence, negatively affecting user satisfaction and weakening long-term engagement (Gupta et al., 2020). These design and interface shortcomings highlight the need for a more holistic approach to digital service architecture that accounts for user needs across the entire service journey. Finally, weak institutional frameworks for citizen participation in digital governance processes limit the potential for co-creation and public ownership of services. Many countries lack legal mandates to facilitate citizen feedback, participation in policy design, or collaborative governance practices. As a result, citizens remain passive recipients rather than active partners in digital innovation (Khan & Krishnan, 2021). This absence of participatory mechanisms undermines the responsiveness, accountability, and legitimacy of e-government initiatives and often leads to the development of systems that are misaligned with local needs and realities.

Innovation in E-Government Practices
While the challenges confronting e-government implementation are numerous, a parallel body of literature highlights a range of innovative practices that can enable the delivery of seamless, efficient, and user-centric digital public services. Table 2 summarizes several e-government design innovations to overcome crucial challenges in e-government practices.

Table 2
Summary of Design Innovation in E-Government

Country	Design Innovation	Sources
Netherland	Collaborative efforts among stakeholders are the key to designing citizen-centric e-government solutions. In the Netherlands, a co-creation tools encourages public and private participation in designing public services to deliver better services.	(Bharosa et al., 2020)
Pakistan	The concept of co-design was utilized in Pakistan to operationalized design process that offers an executive approach to develop specific e-services in a governmental domain-context	(Nusir, 2020)
Denmark	Citizen journey maps are essential tools of service design that can identify service touchpoints in entire service engagement cycle. It creates in-depth exploration of ideal steps that citizen experience during acquiring products or services. It enables the identification of service limitations and potential improvement in service activities. Public administration in Denmark has utilized citizen journey maps to create and analyze citizen journey in designing public services.	(Scholta et al., 2020)
India	Website quality is an essential component of digital engagement through e-government portals. In India, the design of public services that prioritize accessibility and enhance the usability of e-government websites is a critical success factor in building citizen trust.	(Paul & Das, 2020)

Essential Design Characteristic for E2E Services
Service design has played a pivotal role in enhancing the development and delivery of public sector services, both in the creation of new services and the redesign of existing ones. The

Government of Ireland has adopted a design-driven approach to modernizing its public services, aiming to enhance efficiency and service quality (DPER, 2022). Similarly, in the United States, service design principles have been mandated into governmental internal policy, focusing on the transformation of high-impact core services to improve citizen interactions and service delivery (Deloitte, 2019). This aligns with the argument by (Sangolt & Keitsch, 2016), that government can implement changes effectively through service design, provided it is effectively enforced. Furthermore, in Australia, the state authority has taken a significant step forward by implementing a practical guideline for enhancing government service design, emphasizing the use of a service design toolkit to drive innovation and efficiency in public service delivery (State Government of Victoria, 2018). Designing or redesigning digital services requires exploring elements that citizens perceive as valuable and enable them to achieve their goals. As indicated by Downe (2020), its start from the event that a user recognizes their need to the moment they complete their task, by maximizing seamless journey experiences. Most of the prior studies have discussed various contexts of design approach utilization in e-government. Prior studies such as Sangolt & Keitsch (2016), explore the opportunities of service design in Norway's digital transformation while highlighting several challenges that hinder progress. They suggest that establishing a centralized agency to lead digitization efforts would provide a holistic approach to designing public services, fostering collaboration among agencies, and integrating service systems. Additionally, priority should be given to frequently used services that involve multiple public organizations.

A recent study by Chan et al. (2021) identified 10 service design characteristics in e-government which are accuracy, completeness, self service capability, convenience, accessibility, privacy protection, security protection, user support, personalization capability, and transparency. They found that these characteristics significantly impact on three service perceptions of service quality, which, in turn, influence citizen satisfaction with e-government services. Furthermore, self-service capability and convenience are two prominent characteristics that influence service quality when citizens opt for online channels (Chan et al., 2021). Self-service capabilities enhance user empowerment by allowing citizens to take control of their interactions, from seeking information to completing tasks. Downe (2020) concurs with this idea, emphasizing that well-designed services should enable the completion of outcomes without prior knowledge of the services. On the other hand, convenience is often closely linked to time and effort, the more citizens perceive a service as convenient, the higher the likelihood of their continued use of e-government services (Jiang et al., 2013). According to Sangolt & Keitsch (2016), feedback mechanisms incorporated into digital services are often overlooked by government, leading to increased dissatisfaction and frustration among users. Post-service feedback is an essential component of a digital platform, providing opportunities for continuous improvement (Lopes & Dhaou, 2018). Similarly, feedback can also trigger the government's sense of responsibility to provide response and continuous evaluation of e-government services (Tiwari et al., 2023). It should be actively assessed and reviewed on a regular basis. For instance, public sector agencies can utilize Google Reviews as an alternative method for gathering user feedback when an integrated feedback mechanism is unavailable on their digital platform. This approach offers valuable insights into user experiences, helping agencies enhance service quality and responsiveness. Responsiveness is a core characteristic of citizen-centric e-government design, as citizens expect the government to act swiftly on their service experiences, especially when they encounter issues or inefficiencies (Downe,

2020). As per Kamaruddin and Noor (2017), real-time communication and clear, easy-to-follow instructions are among the most valued features of responsive e-government services.

A study by Tiwari et al. (2023) highlighted that ICT-enabled responsive governance can enhance service consistency through active collaboration with citizens. Designing digital services with a uniform experience across the entire service engagement process helps prevent confusion and reduces the risk of misleading service procedures. Additionally, digital service representation should maintain a cohesive and unified look and feel across all channels, ensuring that citizens receive a seamless experience regardless of how they engage with the service (Downe, 2020). Security risks remain a major challenge in digital service implementation, particularly the potential leakage of sensitive information if not managed effectively. Enhancing security measures must be a core priority for e-government services to sustain citizens' trust in the government (Tiwari et al., 2023). According to Chan et al. (2021), citizens' perception of security protection is largely influenced by their understanding of the security measures implemented in an e-government service. Designing services that have clear communication of these measures is essential to reinforce public confidence and the continuous use of e-government services. Trustworthiness connections between the service providers and users are pivotal in ensuring long-term public digital services sustainability. These criteria can be achieved if the government practices openness and transparency in all service offerings (Kamaruddin & Noor, 2017). Transparency reflects the extent of information accessibility and the ability to track a process (e.g., a service request) throughout its entire lifecycle (Chan et al., 2021b). It is essential that e-government services incorporate these elements into the design processes. Based on these identified design characteristics, this study further develops the foundation for end-to-end services through a service design approach in e-government.

Conclusion

The growing demand for seamless service engagement with public agencies has compelled governments in developing countries to reimagine and redesign service delivery processes to meet the evolving expectations of e-government users. By harnessing the potential of end-to-end e-government services, these countries can significantly enhance the effectiveness of public service delivery and address longstanding challenges that hinder the transition to fully online services. Ultimately, this transformation can improve citizens' quality of life by increasing service convenience and reducing the need for physical visits to government offices.

This study has also highlighted key challenges that hinder the delivery of end-to-end e-government services. Addressing these challenges requires a comprehensive evaluation of the current state of service delivery, along with a thorough exploration of citizens' service journey experiences to effectively identify areas for improvement. Drawing on innovative solutions and real-world experiences from other countries can offer valuable insights for designing e-government services that align with the social engagement patterns of local communities. Additionally, this study provides essential design elements that can be explored and integrated into the planning and development of e-government services across various sectors. Lastly, given that much of the existing literature emphasizes the quantitative benefits of e-government in developing countries, this review underscores the importance of

qualitatively assessing its practical impact, enabling government agencies to design more citizen-centric, end-to-end service delivery frameworks.

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