The adoption and usage of e-government tools by South African metropolitan municipalities

Gibson Muridzi, Shepherd Dhliwayo

The adoption and usage of e-government tools by South African metropolitan municipalities

Gibson Muridzi*

Department of Business Management,
University of Johannesburg,
P.O. Box 524, Auckland, South Africa
Email: gmuridzi@uj.ac.za
*Corresponding author

Shepherd Dhliwayo

Department of Business Management,
University of Johannesburg,
P.O. Box 524, Auckland, South Africa

and

Centre for Organisational Change and Agility (COCA),
Torrens University Australia,
Adelaide, SA, Australia
Email: sdhliwayo@uj.ac.za

Abstract: This study examines citizens' adoption and use of e-government tools to access services in South Africa's metropolitan municipalities. As e-government initiatives expand globally, local authorities embrace digital solutions to improve service delivery. Using a qualitative approach, interviews were conducted with executive members from three metropolitan areas, and the data were analysed using Atlas.Ti 7.2. The findings reveal that factors such as 24/7 website access, political support, public internet availability, shared applications, skilled professionals, strong communication infrastructure, modern technology, and public-private partnerships are essential for promoting e-government adoption. The study recommends that practitioners design e-government services as integrated digital ecosystems to enhance citizen engagement and improve service efficiency. Overall, this study offers practical insights through a digital framework aimed at fostering the adoption and effective use of e-government tools in South Africa's metropolitan municipalities.

Keywords: e-government; adoption; usage; municipalities.

Biographical notes: Gibson Muridzi is a Post-Doc Research Fellow at University of Johannesburg, South Africa. His research interests are in Leadership, e-governance, IoT, AI, SMEs, incubation and accelerations and Management. He is a seasoned Senior lecturer, lecturing and supervising

management courses such as Management Information Systems, Human Resource Management, Principles of management, change management, strategic management, Small and Family Businesses and entrepreneurship at undergraduate and post graduate level. Besides academics, he worked as an Executive Director for Zimbabwe Farmers Development Trust in 2003–2007 where he worked with international donors in implementing Community Based projects as a way of reducing poverty.

Shepherd Dhliwayo is a Full Professor in the Department of Business Management, School of Management, College of Business and Economics at the University of Johannesburg and an Adjunct Professor at Torrens University Australia. He holds a PhD in Entrepreneurship and teaches and researches broadly in the field of Entrepreneurship and Business Strategy.

1   Introduction

With advancement in information and communication technologies (ICT), metropolitan municipalities have embraced the trend of providing online services to their citizens. E-government involves the use of ICT by governments with the aim of improving productivity, accountability, and efficiency in election management, transport system monitoring, healthcare provision, tourism management, public finance management, public participation, and reaching a digital maturity level of services in this field (Muzafar and Jhanjhi, 2020). E-government in municipalities has emerged as a response to growing need to rethink services delivery driven by enhanced efficiency and effectiveness enabled by internet-based services (Mushi, 2024). E-government services help metropolitan municipalities in improving connectivity and access (Lin and Lu, 2011; Sun et al., 2015; Sá et al., 2017) by its citizens. The development of e-governance has become an increasing priority in political agendas, but the focus has largely been on digital transformation at the national level. Meanwhile, local city and municipal administrations, which have more direct engagement with residents and handle issues impacting daily lives have received comparatively less attention (UN E-Government Survey, 2020).

While e-government enhances the delivery of public service delivery to citizens (Panagiotopoulos et al., 2019), overall, many government agencies such as metropolitan municipalities face significant challenges when implementing e-government (Munyoka, 2019; Adam, 2020; Safarov, 2021). These challenges stem from insufficient skills in designing, implementing, and managing e-government systems (Khan et al., 2021; Safarov, 2020) which in-turn discourages citizens from adopting and using these tools. Although there has been a steady growth in internet subscriptions and improvements in internal bandwidth quality (Statistic Mauritius, 2014), developing countries continue to face low level of participation in e-government services. Furthermore, e-government faces deployment gaps, with usage rate significantly trailing behind implementation efforts (Mellouli et al., 2020). Challenges like digital literacy gaps, unequal internet access, data privacy concerns, and the absence of monitoring and evaluation of e-government initiatives prevent the full realisation of electronic government's potential (Nkgapele, 2024) for metropolitan municipalities in South Africa.

In Sub-Saharan Africa, most e-government websites are characterised by poor usability (Verkijika and De Wet, 2018), and inaccessibility issues. For example, Nakatumba-Nabende et al. (2019) examined 63 websites belonging to municipalities, government ministries, departments, and agencies in Uganda, and reported that none of these websites satisfied the intermediate accessibility requirements. Similar findings have been reported in other countries, such as Lesotho (Matsieli and Sooryamoorthy, 2021), and Tanzania (Elisa, 2020), where government websites remain inaccessible. Manoharan et al. (2021) indicated that the percentage of e-government project failure in various countries is higher than their success.

The literature also confirms that the lack of sophistication in most African countries has led to the adoption of ICT strategy certified fit for other countries and that these strategies fail to address local problems due to severe mismatches in contexts (Muparadzi, 2024). Consequently, e-government has raised citizens' expectations of how municipalities should operate (Undi-Phiri and Phiri, 2022). The failure to satisfy these service delivery expectations in South Africa, a country that is plagued by service delivery protests, many of which turn violent is being witnessed in other countries (Marumahoko, 2020) and the accelerated demand for world-class services by citizens has increased the need for remote and real-time transactions, transparency, accountability, information security, and responsiveness. This study focuses on the adoption and use of e-government tools by South African metropolitan municipalities to address service delivery problems. The assumption is that improved adoption and usage may improve the service delivery by local municipalities.

Therefore, the objectives of this study were to

1 examine the uptake and usage of ICT tools for service delivery by citizens in metropolitan municipalities in South Africa

2 assess the E-services offered to citizens by Metropolitan Municipalities in South Africa

3 develop a framework that promotes the adoption and usage of e-government tools by accessing services offered by metropolitan municipalities in South Africa.

The major contribution of this study is the proposed general digital framework that promotes the adoption and usage of e-government tools by citizens to access the services offered by metropolitan municipalities in South Africa. Although the study is focused on South Africa, the framework may be relevant to other developing countries facing similar challenges of uptake and usage. The remainder of this paper is structured as follows: A literature review provides some insights into e-governance adoption and usage broadly and specifically in South Africa. The methodology, results, and practical implications are discussed.

2 Literature review

The concepts of e-government, e-governance, digital governance, e-services and their derivates is defined as they will be used in this study. UNESCO (2005) defined e-governance as the application of ICT in government operations to facilitate efficient, effective, and transparent interactions with citizens, businesses, and other arms of government. Digital governance refers to the framework of policies, regulations, and

technological strategies that guide how governments, organisations, and institutions use digital technologies to manage operations, deliver services, and engage with stakeholders (OECD, 2020). E-service (electronic service) refers to the delivery of services through digital platforms, leveraging ICTs to facilitate interactions between service providers and users. E-services can be provided by governments, businesses, or other organisations to enhance accessibility, efficiency, and convenience (Rust and Kannan, 2003).

In local governance, the use of e-government services has become a significant force in reshaping interactions between citizens and local authorities (Alsarraf et al., 2023; Faroqi et al., 2020; Hujran et al., 2022). Municipalities around the globe are therefore striving to provide service delivery through e-government, that is, online products and services to citizens of their respective countries. In addition, Murenzi and Olivier (2017) point out that in the digital age, e-government has emerged as a transformative mechanism for making good changes to service delivery for metropolitan municipalities in South Africa, thereby promoting transparency, accountability, and citizen participation. Tejedo-Romero et al. (2022) believe that e-government serves as a powerful tool to foster citizen engagement through e-participation, creating opportunities for the general public to take part in the decision-making procedures of governance, thereby promote its adoption and usage.

2.1   *Critical factors influencing the adoption of e-government*

When discussing e-government across metro departments, previous literature highlights inter-organisational factors such as coordination (Eynon and Dutton, 2007; Eynon and Margretts, 2007), openness of agencies to relinquish their autonomy (Eynon and Dutton, 2007; Fung, 2015), municipal wide leadership and political support (Schwester et al., 2009), the ability to address privacy and security concerns (Gilbert et al., 2004; Hein, 2014; West, 2004), and the interoperability of information communication technologies (ICTs) across municipal departments (Eynon and Margretts, 2007). Cross-sectoral factors that influence e-government affect two-way communication and collaboration between citizens and their governments. One of the most reported barriers is the 'digital divide', which refers to the variation among citizens in terms of their access to emerging ICTs, understanding of digital devices, and use of ICTs (OECD, 2003; Van Deursen and Van Dijk, 2011). Other cross-sectoral factors include

a   technological features, such as ease of use and an effective two-way communication interface (Piexoto and Fox, 2016; Reddick and Zheng, 2017)

b   organisational factors, such as government responsiveness and transparency (Sjoberg et al., 2017), and systematic leadership and strategies for participatory governance (Dawes, 2008; Fung, 2015)

c   environmental factors, such as citizens' trust in the government and the political environment (Reddick and Zheng, 2017; Yeh, 2017).

Therefore, these critical factors are considered by the authors as building blocks for the proposed framework that promotes citizens' adoption and usage of e-government tools to access the services offered by metropolitan municipalities in South Africa.

2.2 *Local e-government*

Effective local e-government development may not only require sufficient financial resources but also an enabling environment and targeted support mechanisms, such as a comprehensive local e-government vision and strategy (UN E-Government Survey, 2020), as well as technology adoption and decisions to undertake costly innovation efforts by local authorities (Hartley, 2006). On the demand side, the pressures exerted by users (voters) on local governments to improve the quality of services supplied also contribute to the availability and usage of services (Clark et al., 2008). With regard to local government, most metropolitan municipalities have made significant progress in electronic governmental initiatives. For example, City of Tshwane has made progress in e-government having successfully established 'e-Tshwane' as a digital platform for offering services (Kariuki et al., 2019; Reddy and Govender, 2019). On the other hand, Kariuki et al. (2019); Reddy and Govender (2019) explain that the city of e-Thekwini has made progress towards the achievement of e-government initiatives, but the effectiveness of digital government in this municipality is limited by internet connections. Furthermore, the City of Johannesburg, has implemented various e-services such as e-statements, e-recruitment, and e-payments. However, this transition process and integration of new technologies at municipal level can entail some challenges and risks.

However, e-government although developed with good intentions, can also act as a tool of exclusion of citizens for several reasons, including poorly designed e-government services, lack of digital literacy, lack of awareness surrounding web content accessibility, and limited access to assistive technology (Almourad et al., 2019; Harder, 2017). Moreover, many e-government systems lack adequate resources. For example, although access to information technology experts as well as knowledge workers that are involved in the designing and implementation of e-government services is important; this remains one of the consistent organisational challenges that most public institutions such as metros face (Kurt, 2018). Maluleka et al. (2023) highlight certain implementation challenges associated with e-government. These include poor ICT infrastructure, leadership challenges, lack of ICT skills, inadequate funding, and the fragmentation of e-government projects.

Between 2020 and 2024, South Africa made significant strides in e-government development, as reflected in the United Nations E-Government Development Index (EGDI) (2024). The EGDI is a composite measure assessing the readiness and capacity of national institutions to use ICTs to deliver public services. This progression indicates a continuous enhancement in South Africa's digital government infrastructure, online services, and human capital development. Notably, in 2024, South Africa, along with Mauritius as shown in Table 1, was recognised as a leader in e-government development in Africa, achieving a 'very high' EGDI rating for the first time (UN E-Government Survey, 2024). This milestone reflects the country's advancements in digital government skills, services, and infrastructure. The consistent upward trajectory in South Africa's EGDI ranking underscores the nation's commitment to leveraging digital technologies to enhance public service delivery and governance. These rankings are important in determining citizens' adoption and usage of e-government tools to access services in metropolitan municipalities in African countries. Statistics in Table 1 reflects that EGDI with the quantitative composite metric namely

1   online services index (OSI), which is referred to as local online services index
     (LOSI) at local level

2   telecommunications infrastructure index (TII)

3   human capital index (HCI) (UN E-Government Survey, 2024) dominated by
     metropolitan municipalities in 193 countries.

These metropolitan areas can invest in telecommunications infrastructure to roll out e-government initiatives as they are close to citizens.

2.2.1 Comparative analysis of e-government services in African and European countries

E-government implementation at the local authority level exhibits both universal challenges and region-specific nuances across African and European countries. A comparative analysis of EGDI and LOSI results indicates that national portals continue to outperform city portals (UN E-Government Survey, 2024) in both African and European countries. There are significant disparities between the two in terms of development and performance, indicating the need for focused efforts to improve local e-government and support digital transformation at the municipal level. The more populous cities tend to have relatively high LOSI values, as they are able to benefit from superior resources and a higher demand for online services. Populous cities in European countries such as Istanbul in Turkey with an estimated population of 15,029,231, and Bucharest in Romania with an estimated population of 1,829,000, London in UK with an estimated population of 8,982,000 are good examples.

Table 1   Top countries for e-governance in Africa

Country	Rating class	EGDI rank	Subregion	OSI	HCI	TII	EGDI (2024)	EGDI (2022)
South Africa	V2	40	Southern Africa	0.8872	0.8026	0.8951	0.8616	0.7357
Mauritius	V1	76	Eastern Africa	0.5903	0.7456	0.9159	0.7506	0.7201
Tunisia	HV	87	Northern Africa	0.5951	0.6497	0.8357	0.6935	0.6530
Morocco	HV	90	Northern Africa	0.5618	0.6078	0.8827	0.6841	0.5915
Seychelles	H3	92	Eastern Africa	0.4638	0.6769	0.8913	0.6773	0.6793
Egypt	H13	95	Northen Africa	0.7002	0.6150	0.6946	0.6699	0.5895
Ghana	H2	108	Western Africa	0.6084	0.5586	0.7281	0.6317	0.5824
Kenya	H2	109	Eastern Africa	0.7770	0.5271	0.5901	0.6314	0.5589
Cabo Verde	H2	111	Western Africa	0.6892	0.5694	0.6128	0.6238	0.5660
Botswana	H2	112	Southern Africa	0.3985	0.5719	0.8649	0.6118	0.5495
Eswatini	H2	113	Southern Africa	0.4557	0.5836	0.7851	0.6081	0.4498
Namibia	H2	114	Southern Africa	0.4996	0.5738	0.7288	0.6007	0.5322
Algeria	H2	116	Northern Africa	0.3320	0.6418	0.8129	0.5956	0.5611
Rwanda	H2	118	Eastern Africa	0.8207	0.5467	0.3724	0.5799	0.5489
Gabon	H2	121	Middle Africa	0.3187	0.5772	0.8263	05741	0.5521
Cote D'Ivoire	H1	124	Western Africa	0.5219	0.4848	0.6693	0.5587	0.5467
Libya	H1	125	Northern Africa	0.0808	0.5951	0.9639	0.5466	0.3375
Zambia	H1	130	Eastern Africa	0.4958	0.6225	0.5088	0.5424	0.5022
Senegal	H1	135	Western Africa	0.4749	0.3380	0.7328	0.5162	0.4479

Source: UN E-Government Survey (2024)

Over time, the UK has transitioned from providing basic information to offering a comprehensive range of interactive online services, enabling citizens to access and use public services efficiently (Bhatia and Bhatia, 2025). However, around 22% of the cities assessed in African countries such as Lagos in Nigeria with an estimated population of 9 million, Kinshasa in DRC with an estimated population of 7.8 million do not offer evidence of an operational official website because of higher levels of unemployment among citizens in Nigeria and war in DRC. A study assessing e-government implementation in Zambian local authorities revealed that only 14.29% had functional websites, primarily offering basic information. Notably, the Lusaka City Council provided online services, including payments. These findings suggest that there are a substantial number of cities lacking an online presence, which can hinder access to essential digital services. Barriers to creating and maintaining municipal websites include budget constraints, a lack of technical expertise, and infrastructure limitations (UN E-Government Survey, 2024).

2.3 Theoretical underpinning

To clearly address the objectives of this study, the following section will discuss how a system such as e-government tools is accepted and used to deliver services to citizens in metros.

2.3.1 Technology acceptance model (TAM)

This study draws on a widely accepted model of technology acceptance to explain the adoption and usage of e-government tools by South African metropolitan municipalities. The theoretical underpinning of this study is based on the TAM, which was developed by Davis (1989), as depicted in Figure 1.

Figure 1 Technology acceptance model
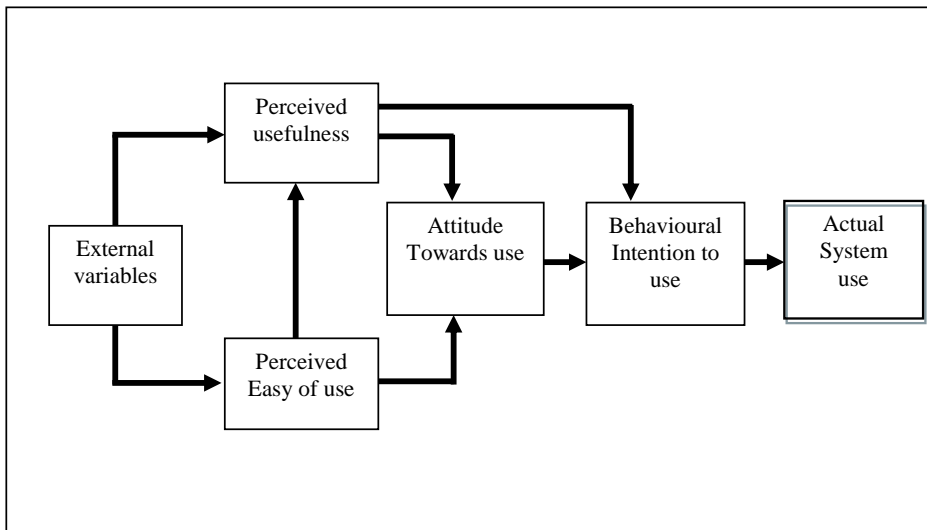
Source: Adapted from: Ajzen (1991)

Davis (1989) identified five dimensions that influence how a system can be used which are perceived usefulness (PU), perceived ease of use (PEU), behavioural intention (BI), attitude toward using (ATU), and actual use (AU). The key elements are discussed below.

2.3.1.1 Perceived usefulness (PU)

Davis et al. (1989) indicate that PU is the extent which a person believes that using a specific system will benefit them. This element helps this study to determine how the adoption and use of e-government tools can benefit both employees and citizens of metropolitan municipalities when delivering and accessing public services. The concept suggests that even if an application is considered useful, any challenges in using or operating it can diminish its benefits. The effort needed to make it work may outweigh its advantages, making it seem like a less ideal solution for users (Türker et al., 2022). In addition, Robey (1979) explain that no matter how hard a person in metro municipality works in trying to offer services to citizens, a system that cannot assist a person in performing his or her job will not be accepted. The significant impact of perceived usefulness on the intention to use e-government services is well established in the literature. However, the user perception of the usefulness of new technologies of digital platforms, can influence the user to recommend its adoption in accessing municipal services to others.

2.3.1.2 Perceived ease of use (PEU)

Davis (1989) explained that PEU is the level in which a user believes in using the application as not challenging. This dimension is premised on the understanding that when a person decides to use a particular system it does not involve much work. This construct indicates a person's willingness to use or avoid using a system as it relies on users' perception that the system will improve their current or upcoming activities (Davis, 1989). The more end users of e-government tools (both municipal officials and citizens) perceive that e-government systems are easy to use, the more they perceived that the systems are useful when accessing government services (Mushi, 2024).

2.3.1.3 Behavioural intention (BI)

Svenningsson et al. (2022) point out that behavioural intention (BI), such as the propensity to employ technology includes the attitude dimension. The mental and emotional dimension is important in shaping a person's attitude. Moreover, Eraslan et al. (2019) illustrated an important nexus between intention to use and perceived ease of use, which ultimately contributes to person's attitude in using a system (Quansah, 2021). This element is important for examining the uptake and usage of ICT tools for service delivery by citizens in metropolitan municipalities in South Africa.

2.3.1.4 Attitude toward using (ATU)

According to Dasgupta et al. (2002), Attitude Towards Use (ATU) emphasises that when an individual engages in an activity using a specific system, they develop certain feelings about using that system. It also reflects a person's tendency to respond either positively or negatively to ideas, objects, individuals, or situations (Fishbein and Ajzen, 1975). When a person uses a system or application for work, ATU is understood in the context

of their attitude toward adopting and using system, which ultimately influences their decision to accept or reject it (Davis, 1989). This element is important for establishing whether e-government initiatives can be resisted by employees and citizens of metropolitan municipalities.

2.3.1.5 Actual use (AU)

Actual Use (AU), also referred to as actual users, refers to the application of technology in its real-world setting (Dasgupta et al., 2002), specifically by employees and citizens of the metropolitan municipality. The real use of the system was conceptualised in terms of measuring both frequency and duration of people's engagement with technology (Davis, 1989), meaning that citizen can use e-government tools 24/7, and be supported by call centres that also work 24/7. Employees and citizens of metropolitan municipalities are more likely to use technology if they believe it is easy to use and will enhance their productivity, as reflected in actual usage scenarios. This is the outcome of the TAM rolling out e-government tools in delivering services to its citizens by metropolitan municipalities in South Africa.

3 Material and methods

A qualitative approach was adopted to address the research objectives. A multiple case study involving the cities of Ekurhuleni, Johannesburg, and Tshwane was conducted to explore the practical implementation of e-governance in South Africa's metropolitan municipalities. Semi structured instruments were used during interviews to collect data from 12 executive members of the three Metros in the Gauteng Province, where these three metros are located. Four executives were purposefully selected to obtain rich information related to adoption and use of e-government tools to access services in metropolitan municipalities in South Africa. These executives were drawn from the Information Technology (IT) Department of each metro, which oversees e-governance tools. This group of individuals are especially knowledgeable about or experienced with a phenomenon of interest (Cresswell and Plano Clark, 2011), and that they are the brains behind the e-government strategies in these metros. The group included one top-level manager, one middle-level manager, and two lower-level managers (operatives). Gauteng province was chosen for the study because it is regarded as the economic hub of Southern Africa and leads the continent in the use of e-government tools by citizens to access local government services.

The total number of interviews conducted was 12. Interviews were audio recorded, complemented by detailed notes for accountability and transparency. Collected data was coded and thematically analysed using ATLAS.ti 7.2 as it is a powerful software tool designed to assist researchers in the analysis of qualitative data. Ethical approval was obtained for the study from the Human Resource Research Ethics Committee (HRREC), Informed consent for participation in the study was verbally obtained. Participants in this study were given adequate information about the study such as the purpose, procedures, potential risks, confidentiality, and they voluntarily agreed to participate. Verbal consent was therefore a practical and effective means of obtaining their agreement.

4   Results and discussions

The results of this study were mapped to research objectives and emerging themes. Five (5) thematic areas emerged:

1   presence of website

2   uptake and usage of ICT

3   hindrances to use of online services

4   services offered by municipalities

5   strategies to improve online service delivery, as shown in Table 2.

Table 2   Research objectives, thematic areas and quotations

Research objective	Thematic area	Quotes
Examine the uptake and usage of ICT tools for service delivery by citizens at Metropolitan Municipalities in South Africa	4.1 Presence of website	JB. "*Yes, we do we have a public website that display general information, and then we have e-government, e-governance website it's an online website for citizens*" EK. "*Yes, it does*"
	4.2 Uptake and usage of ICT	JB. "*The vision of the City of Johannesburg's IT is to strive towards an integrated paperless environment where anyone with the necessary authorisation can access relevant information any time, securely and easily*" EK. "*developing and delivering a lot of the services through e-channels that include for example we have developed an app now that we call a CRM Mobi app that enables citizens to log incidences with the municipality and to request for services .We have also developed a payment channel for bill payment, electronic bill presentment and payment we call it Esia Koca that also enables citizens to be able to request their bills, view them and pay them on a web portal or via a mobile device*"
	4.3 Hindrances to use of online services	JB. "*Currently, the website and the internal applications are faced with various challenges calling for the modernisation of this environment. The current platform has become old and outdated which cause the site to go down frequently*" EK "*the majority of our citizens are not computer literate. Secondly, the other major disadvantage is that while a lot of services can now be accessed via the mobile devices and so forth, not many of our citizens have got smart phones so they are mostly reliant on USSD type of phones which unfortunately cannot support the kind of applications that we develop*" EK "*The last reason for me that I think is major throughout the country is internet connectivity*" EK. "*Sometimes we are limited by infrastructure and sometimes there is a lack of adoption or resistance*" EK. "*Yoooh! I don't know where this information will go so, I don't want to do that. Or you are saying to them yaah you can pay your bill on the phone, and they are saying what! I would rather come with cash and pay the bill over the counter so you experience that resistance from both sides actually and that can be quite a challenge*"

Table 2   Research objectives, thematic areas and quotations (continued)

| Research objective	Thematic area	Quotes
Assess the services offered to citizens by Metropolitan Municipalities in South Africa	4.4 Services offered by municipalities	JB. "*Currently we have a 24-Hour Call Centre, where customers can phone and report all city related problems like accounts issues. And there is also an Emergency Call Centre to dispatch Ambulances and emergency vehicles. We have Customer Walk-in Centres where customers can go and log a query in a specific region. There is Various Customer Pay-points, Libraries, Clinics, Waste Management, Water, Electricity, etc.*"
		JB. "*We have the accounts by email online, we have building plans tracker, we have evaluation of properties, we have got goggle jar information special information, we have How Do I facility, like frequently asked questions where customers can look for possible to answers to the questions. This is currently available on our e-services*"
		EK. "*Ok, we offer social services, like health services, police services, emergence services, and then we offer infrastructure services like roads, water, energy, and then we also offer financial services like payment of bills, licencing, yaah*"
		EK. "*One of them is the electronic bill payment and presentment, bill payment and presentment is a big one. We have put on both on the Customer Relationship Management Services CRM mobile app and on the Esia Koca channel, ability to request application forms for different services, so users can request forms and download them instead of walking to Triple C to stand in a queue to quest forms and whatever*"
Develop a framework that promotes adoption and usage of e-government tools in accessing services offered by metropolitan municipalities in South Africa	4.5 Strategies to improve online service delivery	JB. "*Staff needs to be trained be more professional and productive and employ skilled professionals*"
		JB. "*24/7 Available online web service*"
		JB. "*Citizens who don't have access to online services should make provision in regions for citizens to have public access to the internet*"
		EK. "*I think that they must be some kind of Private-Public-Partnership. Where the private sector is encouraged to come and built infrastructure network infrastructure that will enable the full coverage of broadband across the city*"

Source: Authors own compilation

4.1   *Theme1: availability of website*

The study found out that all the interviewees pointed that their metros have functional websites which is always available, as explained by the comments in Table 2, item 4.1. These findings are in agreement with Mawela et al.'s (2017) findings which indicate that local government at provincial level in South Africa have working websites. Rokhman (2011) highlighted that e-government offers public services 24h through websites, whenever, and wherever the user is located. However, this study established that metros

are at different stages of e-government implementation. Onyancha (2010) similarly evaluates the South African government's website against the stages of e-government development, suggesting that South Africa is likely the only African nation nearing full e-government implementation, particularly in its metropolitan municipalities. Figures 2 and 3 show examples of South African municipalities best practice websites.

Figure 2   City of Tshwane website (see online version for colours)
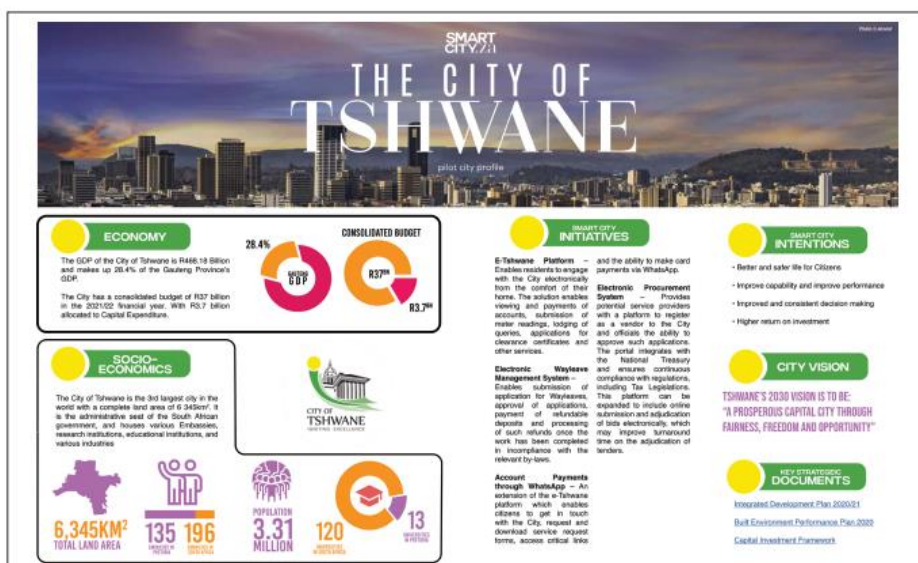
Source: Development Bank of Southern Africa (DBSA), 2021, "Smart city" the South African context: Preparing common ground: The four pilot city profiles, pp. 14–15, Development Bank of Southern Africa, Johannesburg

Figure 3   City of Johannesburg website (see online version for colours)

Source: Development Bank of Southern Africa (DBSA), 2021, "Smart city" the South African context: Preparing common ground: The four pilot city profiles, pp. 20–21, Development Bank of Southern Africa, Johannesburg

Xu and Tang (2020) summarised that the swift adoption of Web 2.0 and mobile technologies has created new avenues for public agencies to engage with citizens in co-producing public services, as seen in the City of Johannesburg, Ekurhuleni Metropolitan Municipality, and the City of Tshwane. This aligns with the UN E-Government Survey (2020), which emphasises that local governments should prioritise connecting citizens to the internet and improving satisfaction with service delivery. Governments can enhance access to e-services through metropolitan websites by providing Wi-Fi services – and in some cases, Wi-Fi-enabled devices, at public venues such as libraries, city halls, schools, kiosks, and other community spaces like transport stations, parks, and hospitals.

4.2   Theme 2: uptake and usage of ICT

The study found that residents of the City of Johannesburg, Tshwane, and Ekurhuleni Metropolitan Municipality use e-channels, such as customer relationship management (CRM) Mobi apps, to report issues to their municipalities. O'Brien (2016) and Tang et al. (2019) also noted that widespread access to smartphones and the internet has made citizens more inclined to use Mobi apps or websites to communicate their service needs, particularly when they lack the political capital to engage directly with municipalities. This use of technology enables citizens to gain greater attention from municipal authorities, helping to reduce inequities in service delivery.

Xu and Tang (2020) highlighted the growing prevalence of the internet and smartphones, noting that interactive service platforms powered by these technologies offer disadvantaged citizens a convenient alternative for engaging with metropolitan municipalities and participating in co-production. This has led to increased adoption and use of ICT by residents in the City of Johannesburg, Ekurhuleni Metropolitan, and Tshwane municipalities, as reflected in the feedback on item 4.2 in Table 2. Similarly, Tang et al. (2019) emphasise that citizens' use of ICT for real-time, location-specific service requests can enhance the efficiency and effectiveness of service delivery.

The adoption of technology involves both technological and societal challenges, with earlier research identifying several key determinants (Vesnic-Alujevic et al., 2020). Critical technical aspects include operational reliability, seamless feedback mechanisms between end-users and service or technology providers, and user-friendly interfaces. Additionally, data security and clear responsibility for service provision are essential foundations for implementing e-services (Chen et al., 2021). To maximise citizen adoption and use of ICT, municipalities must consider these factors. Figure 4 illustrates various issues related to the uptake and use of ICT e-government initiatives by metropolitan municipalities in South Africa.

4.3   Theme 3: hindrances to use of online services

This study found that internet connectivity is a major hinderance to the use of online services by the citizens of the metros under study, as many citizens do not have smart phones. In addition, there is limited infrastructure, as shown by the responses on item 4.3 in Table 2. Confirmation of the results of the study comes from Akgül (2024) and Nkohkwo and Islam (2013), who suggest that Sub-Saharan African local governments are currently struggling with a lack of ICT infrastructure.

Al Mudawi et al. (2020), Meiyanti et al. (2018), Salamat (2020), and Sharma et al. (2021) identified additional challenges such as inadequate ICT infrastructure, limited internet access, and insufficient financial resources. In other developing countries, obstacles include complex managerial issues, budget limitations, and the absence of robust legal frameworks to support digital transformation (Meiyanti et al., 2018; Sharma et al., 2021; Sihotang et al., 2023). Furthermore, significant barriers arise from concerns over data security and privacy (Al Mudawi et al., 2020; Pangaribuan, 2019) as demonstrated by the quotation which says "*Yoooh! I do not know where this information will go, so, I do not want to do that. ..... I would rather come with cash and pay the bill over the counter*". Thompson (2019) express that municipalities must implement robust security measures to protect their online systems from cyber threats to gain citizen's trust. Key strategies such as multi-factor authentication (MFA) adds an extra layer of security by requiring users to provide multiple forms of verification before accessing systems. This was supported by Graham (2024) who argue that continuous monitoring and incident response can be implemented continuously to allow for rapid detection of anomalies and having an incident response plan which can ensure a swift action to mitigate potential threats. In addition, municipalities can also utilise cloud-based systems to enhance security by providing automatic updates and advanced protection measures, thereby reducing data loss and system downtime (Thompson, 2019). Figure 5 highlights the barriers to utilising online services as part of e-government initiatives.

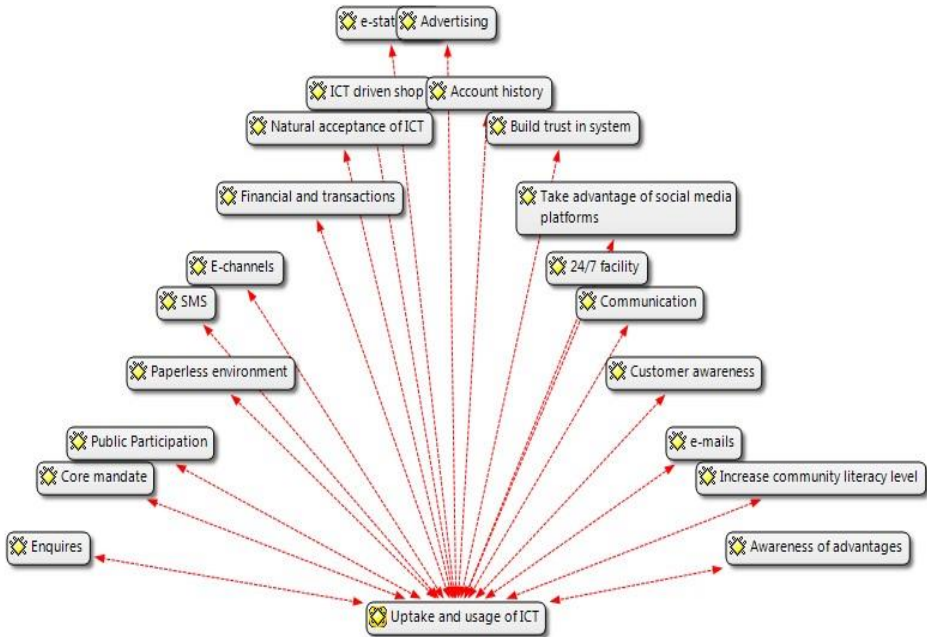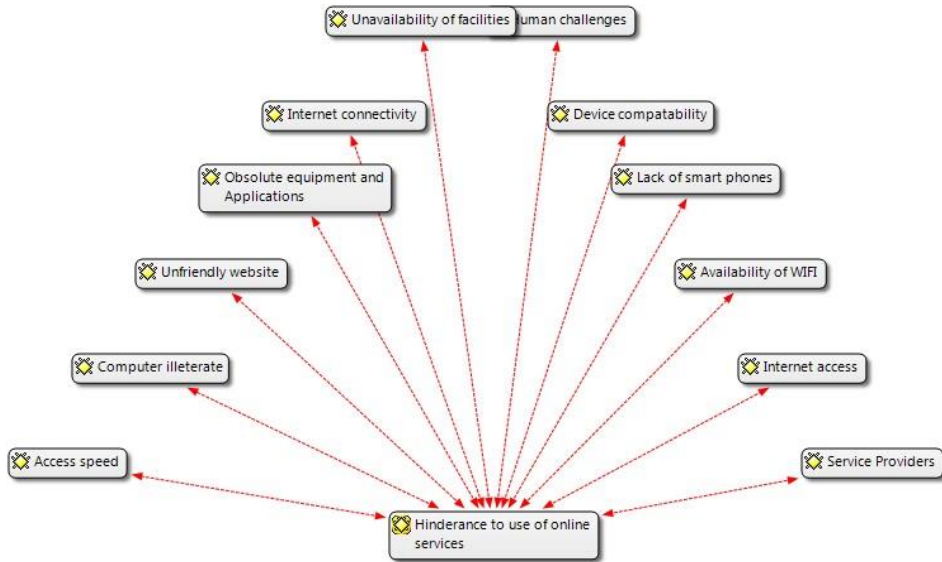**Figure 4**   Network diagram on uptake and usage of ICT (see online version for colours)

Figure 5 Network diagram on the hindrance to use of online services (see online version for colours)

4.4 Theme 4: services offered by metros

This study determined that metro municipalities offer a variety of services, both online and physical as shown in Figure 6.

Figure 6 Services offered by metropolitan municipalities (see online version for colours)
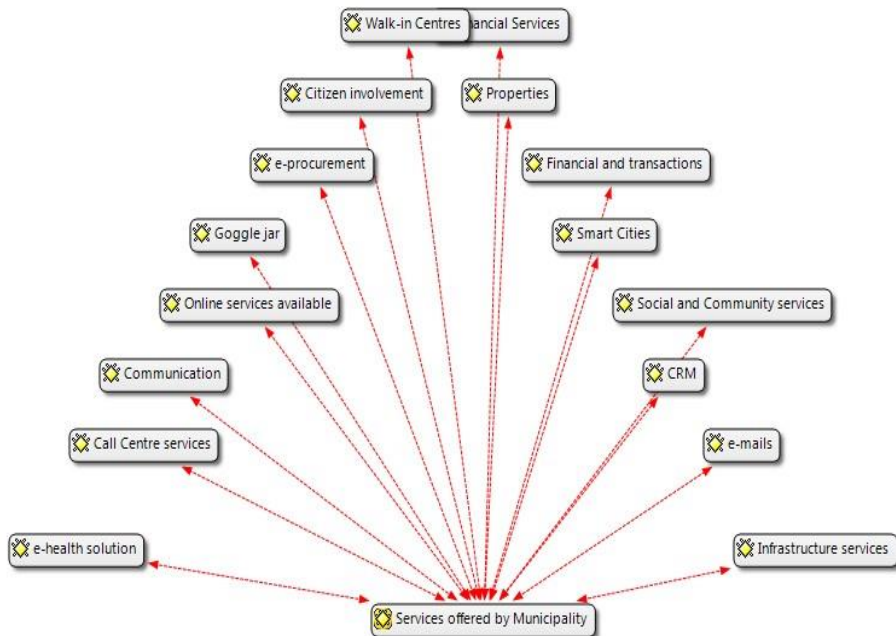
The common services offered are social, such as health services, police services, emergence services, and infrastructure, such as roads, water, and energy. Financial services include the payment of bills and licencing. These findings align with Nili et al. (2022), who highlight that providing essential public services, such as health and security (e.g., police and fire departments), has traditionally been the responsibility of local governments. Consequently, cities are tasked with maintaining and enhancing their communities. In this context, numerous applications demonstrate how ICT can enhance the efficiency and reliability of these services.

The study also established that online services are offered through various platforms such as CRM services, the Esia Koca channel, accounts payments by email (online), and how Do I facilities. Physical services are offered by walking to Triple C and customer walk-in centres, such as customer pay-points, libraries and clinics. Items 4.1.4 in Table 2 has some quotes that support the above discussion.

5   Conclusions

Digitalisation in public service delivery by metropolitan municipalities in South Africa offers numerous benefits that can significantly enhance governance and public satisfaction. The integration of digital technologies and the transformation of public sector processes have been shown to improve both service delivery and governance (Alvarenga et al., 2020). This is especially evident in citizen-focused initiatives, where digital transformation seeks to deliver user-friendly and citizen-centric services, ultimately enhancing quality of life and fostering a more favourable business environment (Debeljak and Dečman, 2022). These advancements encourage the adoption and utilisation of e-government tools by South African metropolitan municipalities.

5.1   Recommendations

This study encourages leaders of metropolitan municipalities to stay committed to their digital transformation goals, continuously innovating even in challenging times. In the short-term municipalities must evaluate the existing technological infrastructure to determine its capacity to support e-government initiatives and be able to address immediate gaps such as internet connectivity, hardware availability, and software requirements. Municipalities must also be able to launch initiatives to inform citizens about available e-government services, their benefits, and how to access them. This initiative will increased awareness which can drive user adoption and engagement. In the long-term, municipalities should come up with strategic planning and policy development for e-government that aligns with national digital agendas and local development goals. This will provide clear roadmap for implementation and ensures consistency with broader objectives of the municipalities.

By embracing digitisation, municipalities can streamline and automate processes, boost efficiency and effectiveness, and improve the overall citizen experience. Along with these advantages, digital transformation in the public sector requires municipalities to manage citizen expectations and create value through digital services (Teixeira et al., 2021), thereby increasing their usage. Local governments should also focus on enhancing digital literacy and equipping both current and future employees with the necessary e-skills to support e-government services.

Citizens should be informed about the benefits of using e-government services, such as cost reduction, improved efficiency, better record-keeping, and greater convenience. This awareness can be raised through roadshows and media campaigns, including television and radio. Political buy-in should be considered as an important aspect. Municipalities should have clear governance structures and leadership roles as they are essential for guiding e-government projects. In South Africa, the lack of well-defined roles among entities like the Office of the Government Chief Information Officer (OGCIO), the State Information Technology Agency (SITA), and Government Information Technology Officers (GITOs) has led to fragmented efforts and slowed e-government progress. Therefore, effective e-government services require strong political and administrative leadership to initiate, implement, and sustain these projects (Coetzer, 2022). Without adequate support, e-government projects in municipalities may lack clear objectives and resource allocation, leading to inefficiencies and subpar outcomes. We propose a framework designed to promote the adoption and use of e-government tools for accessing services provided by metropolitan municipalities in South Africa (Figure 7).

Figure 7   Framework for promoting adoption and usage of e-government tools for metropolitan municipalities in South Africa
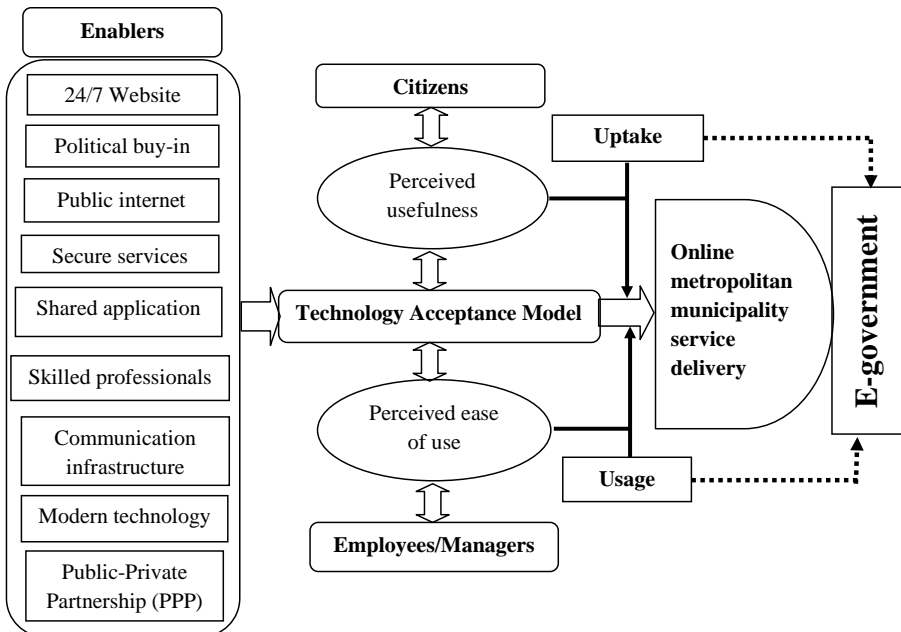
Source: Authors' own compilation

Practitioners see e-government as a comprehensive ecosystem that meets all the service needs of citizens. Nine important triggers or enablers that promote the adoption and use of e-government tools by citizens of metropolitan municipalities in South Africa were identified. These include the availability of 24/7 websites, political buy-in, public internet, shared applications, skilled professionals, communication infrastructure, modern technology and public-private partnerships (PPP). These enablers are hinged on the technology acceptance model (TAM), by Davis (1989), which is based on the perception of usefulness and ease of use of e-government tools.

5.2   *Implications*

The implications of these findings go beyond academic discussions, providing valuable guidance for policymakers and practitioners in the e-government sector. Metropolitan municipalities should focus on delivering high-quality e-government services, prioritising accurate information, user-friendly interfaces, and strong data protection measures. By addressing these areas, municipalities can better serve the changing needs of their citizens and foster democratic governance in the digital age (Fadrial et al., 2024).

6   Limitations and future studies

While this study provides valuable insights, it is important to recognise its limitations. Firstly, it was conducted within the context of a specific metropolitan municipality, which may limit the generalisability of the findings to other non-metropolitan local authorities. To enhance the applicability of the results, future research should replicate the study in the context of district municipalities. In addition, this study focused on the executive members of the three metropolitan areas, and future studies should focus on citizens' experiences and perspectives on the adoption and usage of e-government tools in accessing municipal services. Municipalities (executives) as service providers are likely to be biased by the effectiveness and efficiency of the service they provide. Citizens may have a completely different experience of what is considered good service delivery by a municipality. Future studies should be conducted from a service recipient's viewpoint. This is important in South Africa, a country plagued by service delivery protests, many of which turn violent. Future research could also employ longitudinal studies to assess the long-term effects of enhancing service quality, information quality, security, and differences in user experiences to support global e-government strategies, especially in rural areas.

Consent of publication

Authors agree on the publication of this paper if accepted.

References

Adam, I.O. (2020) 'Examining e-government development effects on corruption in Africa: the mediating effects of ICT development and institutional quality', *Technology Society*, Vol. 61, No. 101245, pp.1–10.

Ajzen, I. (1991) 'The theory of planned behaviour', *Organisational Behaviour and Human Decision Processes*, Vol. 50, No. 2, pp.179–211.

Akgül, Y. (2024) 'Evaluating the performance of websites from a public value, usability, and readability perspectives: a review of Turkish national government websites', *Universal Access in the Information Society*, Vol. 23, No. 2, pp.975–990, doi.org/10.1007/s10209-022-00909-4.

Al Mudawi, N., Beloff, N. and White, M. (2020) 'Issues and challenges: cloud computing e-government in developing countries', *International Journal of Advanced Computer Science and Applications*, Vol. 11, No. 4, pp.7–11, doi.org/10.14569/IJACSA.2020.0110402.

Almourad, M.B., Hussein, M., Kamoun, F. and Wattar, Z. (2019) 'Analysis of WCAG 2.0 data accessibility success criterion of e-government websites', *Periodicals of Engineering and Natural Sciences*, Vol. 7, No. 1, pp.496–503.

Alsarraf, H.A., Aljazzaf, S. and Ashkanani, A.M. (2023) 'Do you see my effort? an investigation of the relationship between e-government service quality and trust in government', *Transforming Government: People, Process and Policy*, Vol. 17, No. 1, pp.116–133, https://doi.org/10.1108/TG-05-2022-0066

Alvarenga, A., Matos, F., Godina, R. and Matias, J.C.O. (2020) 'Digital transformation and knowledge management in the public sector', *Sustainability*, Vol. 12, No. 5824, pp.1–24.

Bhatia, V. and Bhatia, S. (2025) 'Evaluating e-governance: a comparative analysis and way forward', *Digital Policy, Regulation and Governance*, pp.1–22, DOI: 10.1108/DPRG-08-2024-0187.

Chen, H., Li, L. and Chen, Y. (2021) 'Explore success factors that impact artificial intelligence adoption on telecom industry in China', *Journal of Management Analytics*, Vol. 8, No. 1, pp.36–68, DOI: 10.1080/23270012.2020.1852895.

Clark, J., Good, B. and Simmonds, P. (2008) *Innovation in the Public and Third Sectors*, National Endowment for Science, Technology and the Arts (NESTA) Innovation Index Working Paper, London.

Coetzer, S. (2022) *A Comparative Study of the e-Government Services of South Africa, Brazil, and Estonia*, Master Thesis, Stellenbosch University.

Cresswell, J.W. and Plano Clark, V.L. (2011) *Designing and Conducting Mixed Method Research*, 2nd ed., Sage, Thousand Oaks, CA.

Dasgupta, S., Granger, M. and McGarry, N. (2002) 'User acceptance of e-collaboration technology: an extension of the technology acceptance model', *Group Decision and Negotiation*, Vol. 11, pp.87–100, DOI: 10.1023/A: 1015221710638.

Davis, F.D. (1989) 'Perceived usefulness, perceived ease of use, and user acceptance of information technology', *Management Information Systems Quarterly*, pp.319–340, DOI: 10. 2307/249008.

Dawes, S.S. (2008) 'The evolution and continuing challenges of e-governance', *Public Administration Review*, Vol. 68, pp.S86–S102, DOI: 10.1111/puar.2008.68.issue-s1.

Debeljak, A. and Dečman, M. (2022) 'Digital transformation of Slovenian urban municipalities: a quantitative report on the impact of municipality population size on digital maturity', *NISPAcee Journal of Public Administration Policy*, Vol. 15, pp.25–51.

Eynon, R. and Dutton, W.H. (2007) 'Barriers to networked governments: evidence from Europe', *Prometheu*s, Vol. 25, No. 3, pp.225–242, DOI: 10.1080/08109020701531361.

Eynon, R. and Margretts, H. (2007) 'Organisational solutions for overcoming barriers to eGovernment', *European Journal of ePractice*, Vol. 1, No. 6, pp.1–20.

Fadrial, R., Sujianto, Simanjuntak, H.T.R.F., Wirman, W. and Wibowo, W.S. (2024) 'Fostering trust through bytes: unravelling the impact of e-government on public trust in Indonesian local government', *Interdisciplinary Journal of Information, Knowledge, and Management*, Vol. 19, No. 15, pp.1–36, doi.org/10.28945/5317.

Faroqi, A., Suryanto, T.L.M. and Safitri, E.M. (2020) 'The determinant of e-government services adoption among citizen in Indonesia', *Proceeding of the 6th Information Technology International Seminar,* Surabaya, Indonesia, pp.130–134, doi.org/10.1109/ITIS50118.2020.9321068.

Fishbein, M. and Ajzen, I. (1975) *Chapter 1. Belief, Attitude, Intention, and Behaviour: An Introduction to Theory and Research*, Addison-Wesley, Reading, MA.

Fung, A. (2015) 'Putting the public back into governance: The challenges of citizen participation and its future', *Public Administration Review*, Vol. 75, No. 4, pp.513–522, DOI: 10.1111/puar.12361.

Gilbert, D., Balestrini, P. and Littleboy, D. (2004) 'Barriers and benefits in the adoption of e-government', *International Journal of Public Sector Management*, Vol. 17, No. 4, pp.286–301, DOI: 10.1108/09513550410539794.

Graham, K. (2024) *5 Essential Elements of a Municipal Cyber Security Plan*, Bitsight.

Harder, S.K. (2017) *Ensuring Universal Design in ICT-solutions-towards Identifying Critical Success Factors*, Master's Thesis, Norwegian University of Science and Technology.

Hartley, J. (2006) *Innovation and Improvement in Local Government*, %3cwww.ipeg.org.uk/presentations/bp_hartley_pres.pdf?PHPSESSID=f3f227c19c18b31719e4b0c170ce2489%3e (Accessed 30 November, 2024).

Hein, N.M. (2014) 'A study on evaluation of e-government service quality', *International Journal of Humanities and Social Sciences*, Vol. 8, No. 1, pp.16–19.

Hujran, O., Al-Debei, M.M., Al-Adwan, A.S., Alarabiat, A. and Altarawneh, N. (2022) 'Examining the antecedents and outcomes of smart government usage: an integrated model', *Government Information Quarterly*, Vol. 40, No. 1, pp.101783, doi.org/10.1016/j. giq.2022.101783.

Kariuki, P., Ofusori, L. and Goyayi, M. (2019) 'E-government and citizen experiences in South Africa: ethekwini metropolitan case study', *Proceedings of the 12th International Conference on Theory and Practice of Electronic Governance*, pp.478–480, doi.org/10.1145/3326365.3326432.

Khan, S., Rahila Umer, R., Umer, S. and Naqvi, S. (2021) 'Antecedents of trust in using social media for e-government services: an empirical study in Pakistan', *Technology Society*, Vol. 64, No. 101400, pp.1–10.

Kurt, S. (2018) 'Moving toward a universally accessible web: web accessibility and education', Assistive *Technology*, Vol. 31, pp.1–11.

Lin, K.Y. and Lu, H.P. (2011) 'Why people use social networking sites: an empirical study integrating network externalities and motivation theory', *Computer Human Behaviour*, Vol. 27, No. 3, pp.1152–1161.

Maluleka, S.M., Budree, A. and Van Belle, J.P. (2023) 'A systematic literature review on South African government to harness software as a service for enhanced e-government', *2023 Ninth International Conference on e-Democracy and e-Government (ICEDEG) IEEE*, Bern, Switzerland, pp.1–6.

Manoharan, Ingrams, A., Kang, D. and Zhao, H. (2021) 'Globalisation and worldwide best practices in E-government', *International Journal for Public Administration*, Vol. 44, No. 6, pp.465–476.

Marumahoko, S. (2020) 'A conceptual framework for improved municipal service delivery in urban Zimbabwe', *Applied Research in Administrative Sciences*, Vol. 1, No. 2, pp.24–36.

Matsieli, M.L. and Sooryamoorthy, R. (2021) 'Evaluation of e-government websites in Lesotho: an empirical study', *African Journal of Governance and Development*, Vol. 10, No. 1, pp.80–97.

Mawela, T., Ochara, N.M. and Twinomurinzi, H. (2017) 'E-government implementation: a reflection on South African municipalities', *South African Computer Journal*, Vol. 29, No. 1, pp.147–171.

Meiyanti, R., Utomo, B., Sensuse, D.I. and Wahyuni, R. (2018) 'e-government challenges in developing countries: a literature review', *Proceedings of the 6th International Conference on Cyber and IT Service Management*, Parapat, Medan, Indonesia, doi.org/10.1109/ CITSM.2018.8674245.

Mellouli, M., Bouaziz, F. and Bentahar, O. (2020) 'E-government success assessment from a public value perspective', *International Review of Public Administration*, Vol. 25, No. 3, pp.153–174, doi.org/10.1080/12294659.2020.1799517.

Munyoka, W. (2019) 'Electronic government adoption in voluntary environments – a case study of Zimbabwe', *Information Development*, Vol. 36, No. 3, pp.1–24.

Muparadzi, T. (2024) *Digital Technologies for a Resource Efficient Economy, Evidence And Lessons From Selected Country Cases*, IGI Global Scientific Publishing, New York.

Murenzi, P. and Olivier, C.D. (2017) 'E-government challenges faced by selected district municipalities in South Africa and Rwanda', *Administration Publication*, Vol. 25, No. 1, pp.141–172.

Mushi, R.M. (2024) 'Assessing the factors influencing intention to use e-government in Tanzania: the perspective of trust, participation and transparency', *Journal of Electronic Business and Digital Economics*, Vol. 3, No. 2, pp.156–169, DOI: 10.1108/JEBDE-08-2023-0017.

Muzafar, S. and Jhanjhi, N.Z. (2020) 'Employing recent technologies for improved digital governance', *Success Stories of ICT Implementation in Saudi Arabia*, IGI Global Scientific Publishing, New York.

Nakatumba-Nabende, J., Kanagwa, B., Kivunike, F.N. and Tuape, M. (2019) 'Evaluation of accessibility standards on Ugandan e-government websites', *Electronic Government an International Journal*, Vol. 15, No. 4, pp.355–371.

Nili, A., Desouza, K. and Yigitcanlar, T. (2022) *What Can The Public Sector Teach us About Deploying AI Technologies*, Institute of Electrical and Electronics Engineers Software, DOI: 10.1007/10.1109/MS.2022.3193154.

Nkgapele, S.M. (2024) 'The usability of E-government as a mechanism to enhance public service delivery in the South African government', *Digital Policy Studies*, Vol. 3, No. 1, pp.116–132.

Nkohkwo, Q.N. and Islam, M.S. (2013) 'Challenges to the successful implementation of e-government initiatives in sub-saharan Africa: a literature review', *Electronic Journal of E-Government*, Vol. 11, No. 2, pp.253–267, https://api.semanticscholar.org/CorpusID: 10924 7746

O'Brien, D. (2016) '311 hotlines, territoriality, and the collaborative maintenance of the urban commons: examining the intersection of a co-production policy and evolved human behaviour', *Evolutionary Behavioural Sciences*, Vol. 10, No. 2, pp.123–41.

OECD (2020) *Digital Government Index: 2019 Results*, Organisation for Economic Co-operation and Development.

Onyancha, O.B. (2010) 'E-governance and e-government in Africa: a webometrician's perception of challenges, trends and issues', *Mousaion*, Vol. 28, No. 2, pp.32–63.

Organisation for Economic Cooperation and Development (2003) *Seising the Benefits of ICT in a Digital Economy*, Retrieved from https://www.scribd.com/document/359122335/benefits-digital-economy-oecd-pdf (Accessed 21 November, 2024).

Panagiotopoulos, P., Klievink, B. and Cordella, A. (2019) 'Public value creation in digital government', *Government Information Quartey Review*, Vol. 36, No. 4, p.101421, pp.1–8.

Pangaribuan, A.A. (2019) 'The challenges of e-procurement implementation in infrastructure projects', *Journal of Public Administration Studies*, Vol. 4, No. 1, pp.260–229.

Quansah, R. (2021) 'The use of learning management system (LMS) moodle in the midst of covid-19 pandemic: students' perspective', *Journal of Education Technology. Online Learn*, Vol. 4, pp.418–431, DOI: 10.31681/jetol.934730.

Reddick, C.G. and Zheng, Y. (2017) 'Determinants of citizens' mobile apps future use in Chinese local governments: an analysis of survey data', *Transforming Government: People*, *Process and Policy*, Vol. 11, No. 2, pp.213–235, DOI: 10.1108/TG-11-2016-0078.

Reddy, P.S. and Govender, N. (2019) 'Effectiveness of governance towards digitalisation at eThekwini metropolitan municipality in KwaZulu-natal province, South Africa', *Africa's Public Service Delivery and Performance Review*, Vol. 7, No. 1, pp.1–9, doi.org/10.4102/apsdpr.v7i1.336.

Robey, D. (1979) 'User attitudes and management information system use', *Academy Management Journal*, Vol. 22, pp.527–538, DOI: 10.2307/255742.

Rokhman, A. (2011) 'E-government adoption in developing countries; the case of Indonesia', *Journal of Emerging Trends in Computing and Information Sciences*, Vol. 2, No. 5, pp.228–236.

Rust, R.T. and Kannan, P.K. (2003) 'E-service: a new paradigm for business in the electronic environment', *Communications of the ACM*, Vol. 46, No. 6, pp.36–42.

Sá, F., Rocha, Á., Gonçalves, J. and Cota, M.P. (2017) 'Model for the quality of local government online services', *Telematics Information*, http://dx.doi.org/10.1016/j.Tele.2016.09.002, in press (Accessed 17 November, 2024).

Safarov, I. (2020) 'Institutional dimensions of open government data implementation: evidence from transition countries', *Public Performance Management Review*, Vol. 43, No. 6, pp.1359–1389.

Safarov, N. (2021) 'Personal experiences of digital public services access and use: older migrants' digital choices', *Technology Society*, Vol. 66, No. 101627, pp.1–9.

Salamat, A. (2020) *Opportunities and Challenges of e-Governance in Rural India*, https://api.semanticscholar.org/Cor-pusID: 235416219 (Accessed 15 November, 2024).

Schwester, R., Carrizales, T. and Holzer, M. (2009) 'An examination of the municipal 311 system', *International Journal of Organisation Theory and Behavior*, Vol. 12, No. 2, pp.218–236, DOI: 10.1108/IJOTB-12-02-2009-B003.

Sharma, S.K., Metri, B., Dwivedi, Y.K. and Rana, N.P. (2021) 'Challenges common service centers (CSCs) face in delivering e-government services in rural India', *Government Information Quarterly*, Vol. 38, No. 2, pp.101573, doi.org/10.1016/j. giq.2021.101573.

Sihotang, D.M., Purwandari, B. and Diana, E. (2023) 'Factors affecting e-government adoption at the micro level of government in developing countries: a systematic literature review', *Proceedings of the 7th International Conference on Business and Information Management*, Bangkok, Thailand, pp.26–30, doi.org/10.1109/ICBIM59872.2023.10303127.

Sjoberg, F., Mellon, J. and Peixoto, T. (2017) 'The effect of bureaucratic responsiveness on citizen participation', *Public Administration Review*, Vol. 77, No. 3, pp.340–351, DOI: 10.1111/puar.12697.

Statistic Mauritius (2014) *Information and Communication Technologies* (*ICT*) *Statistics*, Retrieved from: http://statsmauritius.govmu.org/English/StatsbySubj/Documents/ei%201188/ESI%20ICT%20Year%202014.pdf (Accessed 15 November, 2024).

Sun, P.L., Ku, C.Y. and Shih, D.H. (2015) 'An implementation framework for e-government 2.0', *Telematic Information*, Vol. 32, No. 3, pp.504–520.

Svenningsson, J., Höst, G., Hultén, M. and Hallström, J. (2022) 'Students' attitudes toward technology: exploring the relationship among affective, cognitive and behavioral components of the attitude construct', *International Journal of Technology and Design Education*, Vol. 32, pp.1531–1551, DOI: 10.1007/s10798-021-09657-7.

Tang, T. and Ho, A. (2019) 'A path-dependence perspective on the adoption of internet of things: evidence from early adopters of smart and connected sensors in the United States', *Government Information Quarterly*, Vol. 36, No. 2, pp.321–32.

Tang, T., Hou, J., Daniel, L. and Annis, C. (2019) 'Revisit the drivers and barriers to e-governance in the mobile age: a case study on the adoption of city management mobile apps for smart urban governance', *Journal of Urban Affairs*, Vol. 43, No. 4, pp.563–585, doi.org/10.1080/07352166.2019.1572455.

Teixeira, A.F., Gonçalves, M.J.A. and Taylor, M.d.L.M. (2021) 'How higher education institutions are driving to digital transformation: a case study', *Education. Science*, Vol. 11, No. 636, pp.1–14.

Tejedo-Romero, F., Araujo, J.F.F.E., Tejada, Á. and Ramírez, Y. (2022) 'E-government mechanisms to enhance the participation of citizens and society: exploratory analysis through the dimension of municipalities', *Technology in Society*, Vol. 70, No. 101978, pp.1–14, doi.org/10.1016/j. techsoc.2022.101978.

Thompson, L. (2019) 'Cybersecurity best practices for municipalities', *New Hampshire Bar Association Intellectual Property*, Hage Hodes, Manchester.

Türker, C., Altay, B.C. and Okumuş, A. (2022) 'Understanding user acceptance of QR code mobile payment systems in Turkey: an extended TAM', *Technology, Forecast. Social. Chang*, Vol. 184, p.121968, DOI: 10.1016/j. techfore.2022.121968.

UN E-Government Survey (2022) https://desapublications.un.org/sites/default/files/publications/ 2022-09/Web%20version%20EGovernment%202022.pdf (Accessed 25 November, 2024).

UN E-Government Survey (2022) https://desapublications.un.org/sites/default/files/publications/ 2022-09/Web%20version%20EGovernment%202022.pdf (Accessed 26 November, 2024).

UN E-Government Survey (2020) *Digital Government in the Decade of Action for Sustainable Development, Public Institutions and Digital Government* United Nations.

UN E-Government Survey (2024) *Accelerating Digital Technologies for Sustainable Development, Public Institutions and Digital Government*, United Nations.

Undi-phiri, B. and Phiri, J. (2022) 'Assessing factors affecting the adoption of e-government services in developing countries for transport sector, amidst the covid-19 pandemic', *Communications and Network*, Vol. 14, No. 2, pp.69–90, DOI: 10.4236/cn.2022.142006'.

UNESCO (2005) *E-Governance Capacity Building*, United Nations Educational, Scientific and Cultural Organization.

Van Deursen, A. and Van Dijk, J. (2011) 'Internet skills and the digital divide', *New Media and Society*, Vol. 13, No. 6, pp.891–916.

Verkijika, S.F. and De Wet, L. (2018) 'A usability assessment of e-government websites in sub-saharan Africa', *International Journal of Information Management*, Vol. 39, pp.20–29.

Vesnic-Alujevic, L., Nascimento, S. and Pólvora, A. (2020) 'Societal and ethical impacts of artificial intelligence', *European Policy Frameworks. Telecommunications Policy*, Vol. 44, No. 6, pp.101961, DOI: 10.1016/j. telpol.2020.101961.

West, D.M. (2004) 'E-government and the transformation of service delivery and citizen attitudes', *Public Administration Review*, Vol. 641, No. 1, pp.15–27, DOI: 10.1111/puar.2004.64.issue-1.

Xu, C.K. and Tang, T. (2020) 'Closing the gap or widening the divide: the impacts of technology-enabled coproduction on equity in public service delivery', *Public Administration Review*, Vol. 80, No. 6, pp.962–975, DOI: 10.1111/puar.13222.

Yeh, H. (2017) 'The effects of successful ICT-based smart city services: from citizens' perspectives', *Government Information Quarterly*, Vol. 34, pp.556–565, DOI: 10.1016/j. giq. 2017.05.001.