

## Evaluating the Performance of E-government: Does Citizens' Access to ICT Matter?

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### ABSTRACT

Different studies have evaluated the success of e-government in developed and developing countries. However, many of these studies rely on the economic and conventional approaches to evaluate e-government like other ICT projects. Also, they do not consider citizens' access to ICT in their studies. This study, therefore, examines the moderating effect of citizens' access to ICT on the performance of e-government within the context of IS Success Model and public value theory. The public value of e-government represents the net benefits of e-government. Data were collected from 369 experienced e-government users through a range of selected e-government services. The results show that citizens' access to ICT positively and significantly moderates the relationship between actual use and the public value of e-government. This finding implies that access to ICT will drive more use of e-government and increase the value of e-government services. Also, the quality dimensions affect the actual use and user satisfaction with e-government. The most significant effect was established in the relationship between service quality and the actual use of e-government. In essence, this study emphasized the efficacy of ICT access as a stimulating effect on creating public value through increased citizens' use of e-government for interacting with the government. Ultimately, it prompts the government to improve ICT access for the citizens to use more e-government services.

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### INTRODUCTION

E-government uses of information and communications technology (ICT) to disseminate government information and deliver quality services to the citizens. ICTs

was advanced to improve and reorganise the public sector by changing the internal operations, external communications and capacity to deliver various stakeholders' services (Meijer, 2011). The growing level of e-government use and adoption in the public sector has increased sporadically in recent years. Almost all the world countries have adopted the electronic means of service delivery to their respective stakeholders, identifying their benefits. Consequently, the urgent need to evaluate the performance of different initiatives and projects of e-government has gained attention among academics and professionals (Deng, 2008).

E-government services are intended for all the people; however, unequal access to ICT hampers the government's efforts to make their electronic services fair and beneficial. A high failure rate has characterised e-government projects in developing countries, usually with less than expected outcomes (Gartner, 2007; Heeks, 2008). The failure of e-government is not only a manifestation of weak government policies, inadequate infrastructure and political will. Recently, it has been advanced that successful e-government hinges on citizens' ability to access ICT. The rate and level of ICT usage, particularly in developing countries, is often slowed down by digital divide between those who have access to ICT and those who do not have it due to socio-economic barriers. The citizens' inability to access smart technologies accounts for user failure (Lee & Porumbescu, 2019), culminating in the failure of e-government and jeopardise the overall objective of e-government.

For citizens to benefit from the effective implementation of e-government, their capacity and knowledge to use ICT must be considered in the readiness stage. Citizens who have no access to ICT will continue to use the conventional service delivery and information dissemination mode. They may later be cut off from the society as accessibility to a computer and the internet are indispensable today. Therefore, accessibility becomes a central point in the evaluation of the success of e-government programs.

E-government started in Nigeria in the early 2000s with the National Communications Act 2003, approval of the National Information Technology Policy in 2001 and the National Information Technology Development Agency in 2007 as the implementation agency. The objective was to serve as a panacea to excessive bureaucracy problems in the public service and provide the governments with the avenue to increase its efficiency, effectiveness, and transparency in delivering public services. Since its implementation, the government has strived to make services available to the citizens through web and mobile platforms ([www.services.gov.ng](http://www.services.gov.ng) and \*347\*48#) such as application and renewal of international passports, driver licence, registration of businesses and filing of taxes (Abdulkareem & Ishola, 2016). Similarly, capacity building and infrastructure programmes have been embarked upon, such as the eNigeria project, National eGovernment Strategies (NeGST), ICT for Development (ICT4D) SchoolNet Nigeria, DigiNet Project, and the Nigerian Universities Network (Fatile,

2012; National eGovernment Strategies, 2019).

Currently, ICT is integrated into people's daily activities; however, the majority are still unable to have access to it, especially in developing countries. There are currently around 4.1 billion people around the world who access the internet. With just a partly 28.2 per cent of the population having internet access, Africa remains the region with the least internet penetration (International Telecommunications Union, 2019). As of January 2020, internet users in Nigeria were estimated at 128 million, while broadband penetration was 38.5 per cent (Nigeria Communications Commission, 2020). The spread, use and acceptance of ICTs in the public sector are growing in Nigeria, signalling the country's potential to become an ICT hub in sub-Saharan Africa (Abdulkareem & Ishola, 2016). United Nations e-government survey showed that Nigeria rose from 162<sup>nd</sup> among the United Nations member states in 2012 to 143<sup>rd</sup> in 2018 (United Nations, 2018). In Africa, Nigeria moved from 30<sup>th</sup> place in 2012 to 21<sup>st</sup> place in 2018.

Some studies have analysed Nigeria's e-government performance, with some of them relying on conventional strategies such as the e-readiness approach to test government and citizens willingness and capacity to pursue such initiatives such as infrastructure and human capital assessment (Adeyemo, 2011; Ifinedo & Davidrajuh, 2005; Matthew & Monica, 2011). Some other studies used the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology

(UTAUT) to access citizens' behavioural attitudes to adopt e-government at the individual levels. Similarly, the impact assessment of e-government services in Nigeria was also assessed by some studies. The studies assessed the separate effects of e-government on, for example, transparency, trust and the quality of service (Abdulkareem et al., 2016), the openness (Ayo & Azeta, 2009) and on the quality of service (Abasilim et al., 2017; Ibrahim et al., 2016).

It is crucial to understand and examine the performance of e-government, particularly from the users' perspective. It is because it helps the Nigerian government to have an in-depth understanding of the actual value of its investments in the e-government project to understand the critical factors that contribute to the performance. Also, it helps in tracking the progress of policies and programmes in e-government. According to Agbabiaka (2018), for investments in e-government to be justified, it is important to seek feedback from the citizens who are the primary users of e-government. Therefore, in evaluating the performance of e-government, it becomes imperative to examine the moderating role of citizens' access to ICT on the relationship between e-government use and the performance of e-government in Nigeria. Several studies have investigated the adoption and performance of e-government in Nigeria; however, there is scarce literature on the moderating role of ICT access. This gap is expected to form the research gap and contribute to developing increasing e-government literature.

## LITERATURE REVIEW

### Citizens' Access to ICT

The citizens' expectation in developed and developing countries is that the government will provide high-quality G2C services. The ultimate purpose of G2C services is to facilitate government and citizens' proximity through government web portals. It is also seen as the primary objective of e-government (Seifert & Chung, 2009). However, how far G2C services have been delivered remains a matter of multiple variables. Arguably, not all government services and information are accessed online. In addition, users can face various obstacles to entirely using all of these online government services. Obstacles such as inadequate infrastructure, low internet speed (Du Bois & Chigona, 2018), different levels of literacy, and physical limitations (e.g. older people, adolescents and people with disabilities) (Sorn-In et al., 2015) can limit citizens' access to e-services.

G2C networks are expected to be designed based on multi-channel communication options to allow the government to support more citizens as much as possible (Rao, 2018). Although the internet and information kiosks are the necessary means of providing government services and information to individuals, other channels such as computers, emails and mobile technologies remain relevant in G2C interactions (Rao, 2018). However, ICT penetration within the local community in developing countries remains a significant obstacle to implementing e-government (Asongu & Le Roux, 2017). However,

mobile payment kiosks and information gathering continue to be necessary, especially in rural areas. Similarly, in more industrialised economies and developed nations with wider smartphone use, governments experience providing services and information through mobile technologies. Therefore, the achievement of G2C by the citizens is, largely dependent on access to multi-channel distribution methods (Rao, 2018).

Citizens have various ways to access G2C services, including internet ownership of cell phones, computers and other ICT devices at home and workplaces (Siddiquee, 2016). In the schools and libraries, some people rely on internet connectivity and computer access to G2C services and developing countries. In addition, there are times where neighbourhoods provide community members with access centres to access the internet (Joshi & Islam, 2018). Apart from these facilities' ownership, there is also a high presence of online commercial service access centres, such as cyber cafes, pay per site centres or pay per access municipalities. Those possessing personal computers and mobile technologies can also use public service access centres to reduce access costs (Zeleti & Mustonen-Ollila, 2011).

### Public Value Theory

The public value theory affirms that the public service aims to create values for the citizens (Moore, 1995; Try & Radnor, 2007). Citizens are the ultimate consumers of public services. Therefore, they derive

values from such services' consumption (Alford et al., 2017; Kelly et al., 2002; Omar et al., 2011). On this assumption, public organisations' actions are guided by citizens' preferences in producing such services (Moore, 1995). Kavanagh (2014) explained that public value makes officials reflect on the benefits of public services from the economic angle and how the government can influence important social values such as participation, democratic principles and human rights.

Kelly et al. (2002) developed Moore (1995)'s public value theory's strategic triangle. In their model, they expressed public value as the preferences of the citizens articulated through various means. Their model produced three comprehensive dimensional sources of public values; Services, Outcomes and Trust. Kearns (2004) argues that these three areas are not mutually exclusive; they overlap. Moreover, they can be useful to examine the performance of government services. Though too broad and generic for evaluation hence, other scholars such as Deng et al. (2018), Golubeva and Merkurjeva (2006), and Scott et al. (2016) have developed on it to produce more quantifiable indicators for the evaluation of e-government. Their frameworks suggested that the concept of public value affords a valuable means of presenting public sector reform strategies, a way of achieving and evaluating them. Many studies have employed the public value theory as an analytical tool to analyse research in various ways (Agbabiaka, 2018; Alomari et al., 2012; Bossert et al., 1998; Erridge, 2007; Grimsley et al., 2007;

Karunasena & Deng, 2012; Marie, 2016; Scott et al., 2016; Talbot & Wiggan, 2010; Try, 2007; Try & Radnor, 2007).

### **DeLone and McLean Information System Success Model**

DeLone and McLean (1992, 2003) Information System (IS) success model is the theory that guides this study. It is the most widely cited assessment framework within IS's discipline (Lowry et al., 2007). It is also one of the most popular success models of IS to have been used to assess the impact of the quality of service on e-government. DeLone and McLean (1992, 2003) IS success model was developed to address the growing challenge of inadequacy in measuring the information system's net benefits. When developed, six variables were initially identified to make IS success components: system quality, information quality, use, user satisfaction, individual, and organisational impacts. Changes were made to the model in 2003 due to the authors' calls to improve the model. Quality of service was added to the variables, while net benefits replaced individual and organisational impacts (Urbach & Müller, 2012). The model argues that the performance of an IS is determined by the collective or independent impact of the quality dimensions (information quality, system quality and service quality) to affect the use (or perceived usefulness), user satisfaction, and the net benefits as depicted in Figure 1 (DeLone & McLean, 2003).

The model was initially conceived for IS within the context of the private sector. However, the model was extended over the

years by different studies to accommodate for other areas of IS such as smartphone use and social media use (Cho & Park, 2012), e-health (Wu, 2018), e-procurement (Aminah et al., 2018), e-learning (Aldholay et al., 2018), tax e-filing (Veeramootoo et al., 2018) and e-government (Widiyanto et al., 2016). For example, Y.-S. Wang and Liao (2008) used the model in the assessment of e-commerce websites. In addition, Connolly et al. (2010), Scott et al. (2016) and Teo et al. (2008) measured the delivery of e-government services using the model.

Similarly, most of the studies that used the D&M performance model were from the private sector. Even the limited studies that emerged in the public sector study, especially from the e-government side, focused mainly on governments' internal relationships and employees' satisfaction (Ali & Al Kabbi, 2018; Gable et al., 2008). However, a further

need to improve measures to evaluate IS's efficiency was suggested (Petter et al., 2012). Nevertheless, the net benefits conceived in this model match the human preferences and organisational advantages well, as these were the initial variables that led to the conceptualisation of net benefits (Gable et al., 2008; Van der Heijden, 2004). Therefore, in response to Delone and McLean (2003) request to further evaluate and validate the model, various studies have expanded and revised the model (Abdelsalam et al., 2012; Agbabiaka, 2018; Teo et al., 2008; Urbach & Müller, 2012). Therefore, the model was updated to measure the net benefits based on the public value perspective in the context of this study and to examine the moderating role of citizens' access to ICT in assessing the relationship between actual use, user satisfaction, and the public value of e-government.

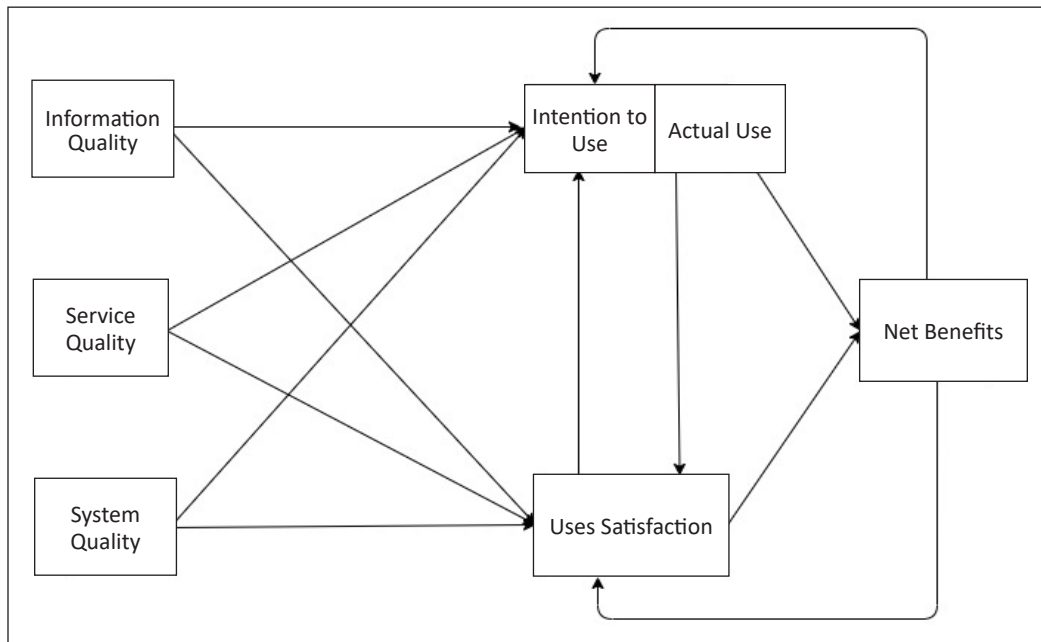


Figure 1. DeLone and Mclean IS Success Model



### Conceptual Model and Hypotheses Formation

As shown in Figure 2, this study's conceptual model and hypotheses are formed according to the DeLone and Mclean (2003) IS success model and the public value theory (Moore, 1995).

**Quality Dimension.** Actual usage is the degree to which users utilise the IS in terms of frequency, complexity and length of use (DeLone & McLean, 2016). It means that it is vital to determine the effect of the quality dimensions on IS use. The IS quality dimensions have been researched and found to predict actual usage based on the accuracy, completeness, comprehensibility and timeliness of the information made available on the e-government platform. Also, the information's consistency is useful in predicting the degree and justification of citizens' use of IS. Studies like Susanto and Aljoza (2015) have shown that completeness of information, cost and time savings can motivate individual e-government services. Other characteristics of a quality e-government system, such as privacy and security users' data, ease of accessing government websites, ability to quickly browse through government website pages (Hirwade, 2010), frequently asked questions (FAQ), ability to easily use site maps, short, friendly and straightforward website addresses (Deng et al., 2018), all influences the use of an e-government system (L.-Y. Wang et al., 2019).

The DeLone and McLean (2003) model indicate that IS's three qualities (information

quality, system quality and service quality) that affect users' satisfaction. Kearns (2004) observed that service quality is a major underlying factor influencing IS users' expectations. The citizens' perceived qualities of an IS as the essential factors that influence service use or non-use. Satisfaction is defined in the IS success model as the level at which IS users are satisfied with the degree of privacy, navigability, content, accuracy, completeness and usefulness of the e-government platform's information. It also defines the extent of fulfilment of the system's usefulness in terms of its flexibility and ability to provide the necessary services based on users' requests (DeLone & McLean, 2003). Studies have found that quality dimensions are good predictors of user satisfaction with IS in various ways, such as online tax filing for e-commerce (Chen et al., 2015; Floropoulos et al., 2010), e-learning (Mtebe & Raphael, 2018; Yakubu & Dasuki, 2018), and e-government system (Agbabiaka, 2018; Al-Haddad et al., 2011; Y.-S. Wang & Liao, 2008). It is therefore hypothesised thus:

H1: Information quality has a positive and significant influence on the actual use of e-government.

H2: Service quality has a positive and significant influence on the actual use of e-government.

H3: System quality has a positive and significant influence on the actual use of e-government.

H4: Information quality has a positive and significant influence on user satisfaction with e-government.

H5: Service quality has a positive and significant influence on user satisfaction with e-government.

H6: System quality has a positive and significant influence on user satisfaction with e-government.

**Actual Use.** The actual use of IS is the degree, rate and frequency at which a citizen uses the electronic medium for activities that may otherwise be performed manually (Delone & McLean, 2003). In the IS literature, the Delone and Mclean IS success model is fundamental to the assumption that IS's actual usage impacts user satisfaction (Delone & McLean, 2003). Based on the model's assumption, users' satisfaction with the e-services provided is predicted by their level, frequency or behaviour. They are more likely to be fulfilled if the earlier expectations from ICT services are met. Positive experience with the use of e-government will also predict the degree of satisfaction with the e-government system in this context (DeLone & McLean, 2016; Y.-S. Wang & Liao, 2008). Some studies have found a strong correlation between IS's use and user satisfaction (Isaac et al., 2017; Makokha & Ochieng, 2014; Mensah et al., 2017).

Numerous studies have also studied the interrelationship between IS's use and the net benefits obtained from it (Aldholay et al., 2018; Martins et al., 2019). Y.-S. Wang and Liao (2008) find that the greater use of IS predicted by website performance dimensions leads to a greater realisation of IS values. F. Wang (2009) discovered that

the greater use of IS predicted by website efficiency dimensions contributes to a greater realisation of the benefits of IS. Lin (2007) also acknowledged the use of quality e-learning platforms as part of other factors that promote predictors of the net benefits of using e-learning platforms. Similarly, Balaban et al. (2013) discovered a strong, positive and significant relationship between students' actual use of IS and the net benefits. Therefore, it is hypothesised thus:

H7: The actual usage of e-government systems influences user satisfaction positively and significantly.

H8: The actual use of e-government influences the public value of e-government positively and significantly.

**User Satisfaction.** Various studies have studied user satisfaction as a proxy for the success of IS. However, we observe user satisfaction as a predictor for IS's success (Gong et al., 2018; Ma & Zheng, 2019). Satisfaction is perceived using an online service driven by innovativeness, efficiency, and the ability to carry out tasks for the citizens (Agbabiaka, 2018, F. Wang & Chen, 2010). The user satisfaction of e-government initiatives focuses on the accessibility of information, the quality of services and the degree of choice available to users (Kearns, 2004). Citizen satisfaction describes the degree to which users or people are generally pleased with the overall use of e-government (Zaidi et al., 2017). Based on the IS performance model, the satisfaction derived from using an online



service determines the net benefits of services (Hsu & Chiu, 2004; Li & Shang, 2019). Similarly, the study of Ma and Zheng (2019) on the e-government ranking (performance) found satisfaction with the net benefits of IS as a significant predictor. We, therefore, hypothesise thus:

H9: User satisfaction with e-government positively and significantly influence the public value of e-government.

**Access to ICT.** The rationale for the use of ICT differs among citizens. For example, some use the internet to search for information, learn and satisfy themselves, connect and communicate with others, and engage in business, trade, and other financial transactions (Papacharissi & Rubin, 2000). Scheerder et al. (2017) examine how ICT use leads to various economic, social, cultural, and political effects. The use of ICT today serves as a vital connection for accessing e-government services (Alhabshi, 2009).

Therefore, getting e-government users to access ICT is a critical deciding factor for the use and satisfaction of e-government (Farhan & Sanderson, 2010). Specifically, broadband access continues to generate issues in both developed and developing countries, owing to the proliferation of ICT, the country's infrastructure capability, and the cost of access.

Therefore, a few studies have explored the effect of access to ICT, its use and satisfaction. Access to ICT is proposed here in this study to affirm the positive relationship between actual use, user satisfaction and the public value of e-government. In these relationships, previous studies have reported mixed findings. For example, Ismail et al. (2016) examined the relationship between internet access frequency, internet attitudes, and internet self-efficacy and behavioural intention to use the internet. Their study showed that the frequency of internet access and internet self-efficacy both affect

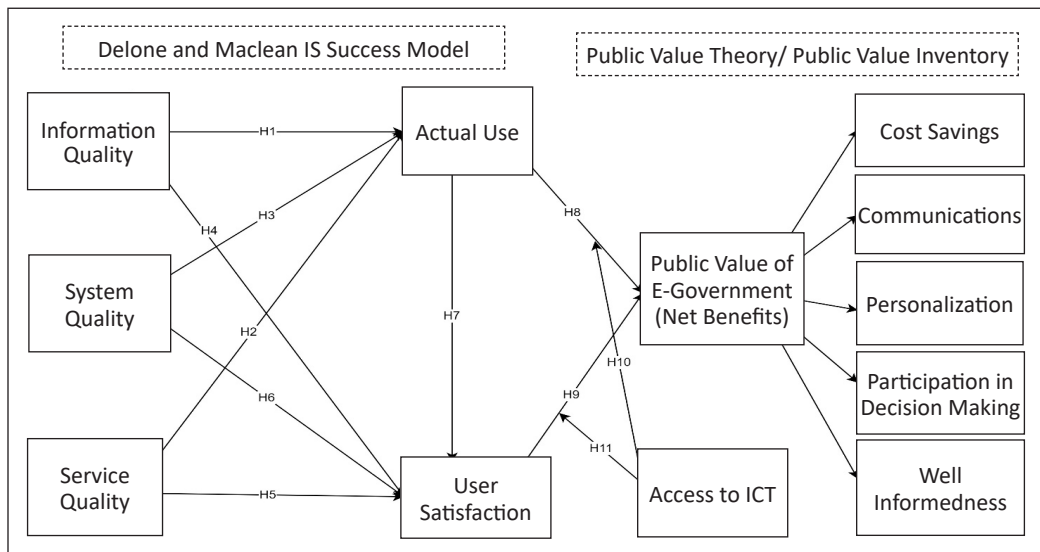


Figure 2. Conceptual Model

behavioural intent. Through various studies, Khan et al. (2020) explore how internet access affects the online contribution of services and resources in the Appalachian region of Ohio, United States, considered fundamental to social needs (education, health, jobs and social media). Their research indicates a mixed outcome, i.e. internet skills improve the ability to use ICT and establish social needs. We, therefore, hypothesised thus:

H10: Citizens' access to ICT moderates the positive and significant relationship between the actual use of e-government and the public value of e-government

H11: Citizens' access to ICT moderates the positive and significant relationship between the user satisfaction with e-government and the public value of e-government.

## METHODS

The study's data stemmed from a survey of e-government users in Nigeria through a self-administered questionnaire between April and July 2019. The questionnaires were distributed randomly among the staff of six federal universities in Nigeria. The university environment was deemed appropriate for the study population because it houses the most experienced and frequent users of e-government and ICT skilled people like graduate students and staff with a high level of education, computer and internet literacy, and usage (Scott et al., 2016). In addition, experience from previous studies also showed that the university environment stakeholders shared similar

characteristics with e-government users (Carter & Bélanger, 2005; Reddick, 2005; Scott et al., 2016).

The first round of pretest was done through a content validation process by six experts to evaluate the adequacy of the items and constructs in the survey. Then, a pilot study followed this process through fifty respondents, about 11% of the final respondents. Thus, Forty eight responses were recorded. The result of the pilot study showed that all constructs have reliability scores above 0.7 thresholds. Finally, a thought aloud process followed the pilot study. Seven participants commented on the instrument, and their comments were used to improve the final instrument.

The survey collected information on demographic details such as gender, age, level of education, income state, and access to ICT. In addition, the respondents' experience was required to examine a set of a selected eight G2C services of government agencies through their websites and other option. The services include e-passport application and renewal, electronic voters' card, driving license and road tax, health insurance, loan applications and electronic national identity cards. The services were pulled from the Federal Government of Nigeria one-stop website "<https://services.gov.ng/>" and selected because of their high usage and popularity. In addition, they rank high among the G2C MDAs in the 2018 MDAs website ranking in Nigeria (Bureau of Public Service Reforms, 2019).

The G\*power software was used to estimate the minimum sample size with a predictive power of 0.95 (Alzahrani et al., 2019). Calculations indicated that the required sample size, with a maximum of three predictors, was 129 with an effect size of 0.15. Four hundred fifty questionnaires were distributed, out of which 369 were returned, correctly filled out and usable. We entered the data collected in the Statistical Packages for Social Sciences (SPSS Version 24) for initial data creation, screening, coding and preliminary analysis. Similarly, due to the complex nature of the conceptual model (Figure 2), SmartPLS 3.3.2 was used for Structural Equation Modelling-Partial Least Squares (SEM-PLS) for the confirmatory factor analysis (Ringle et al., 2015). Structural Equation Modelling (SEM) is one of the most commonly accepted statistical analyses used to study quantitative data to evaluate measurement and structural models (Hair et al., 2014).

A two-stage analysis of structural equation modelling was done, starting with the measurement model and later the structural model (Hair et al., 2013). We assessed the measurement model's indicator reliability, internal consistency, convergent validity, and discriminant validity in the first stage. First, indicator reliability was assessed using items loadings  $\geq 0.708$  (Hair et al., 2019). Next, the internal consistency and convergent validity were examined using the composite reliability (CR) and average variance extracted (AVE),

respectively. Values are accepted when CR and AVE  $\geq 0.7$  and  $0.5$ , respectively. Finally, the discriminant validity was also assessed using the heterotrait-monotrait ratio of correlations (HTMT); values are expected to be  $HTMT \leq 0.9$  (Gold et al., 2001). For the structural model, we examined the variance inflation factor (VIF), path coefficient, significance levels, effect sizes ( $f^2$ ) and coefficient of determinations ( $R^2$ ). First, the VIF was examined to determine the level of collinearity among the constructs, where  $VIF \leq 3.3$  (Diamantopoulos & Siguaw, 2006). Next, the path coefficient and significance levels were assessed, and hypotheses were accepted where  $p$  values  $< 0.05$  and  $t$  value  $> 1.645$  (Hair et al., 2019).

### Scale and Measurement of Variables

The survey included items used for the measurement of various constructs adopted for the study. The Likert scale adopted was the agreement scale of 1 to 5 (Strongly Disagree to Strongly Agree), as shown in Table 2. To measure the quality dimensions (information quality, system quality and service quality) and actual use, DeLone and McLean (2003), Urbach and Müller (2012) survey items were adopted. Satisfaction with e-government service was measured using the (Spreng et al., 1996) measurement items. Finally, the public value of e-government representing net benefits was measured using five constructs and their respective items adapted from Deng et al. (2018) and Scott et al. (2016) public values of e-government measurement items.

## RESULTS

### Common Method Bias Test

The only instrument used to collect data in this study was a survey questionnaire. Therefore, following Kock and Lynn (2012) recommendation, we checked the common method bias using full collinearity test. All constructs were regressed against a random variable. If the variance inflation factor (VIF) is less than or equal to 3.3, there is no bias in the single data source. As shown in Table 1, the analysis yielded a VIF lower than 3.3. Therefore, common method bias is not a problem in our study.

### Profile of Respondents

This survey generated responses from 246 males and 123 females. Similarly, 165 of the respondents had a Master's degree, 101 had a PhD degree, 86 had a Bachelor's degree, 10 respondents had Ordinary National Diploma (OND) and National Certificate of Education (NCE). At the same time, 7 were secondary school certificate holders. More so, 24 respondents are below 21 years of age. The majority of the respondents were between 21 to 35 and 36 to 45 years, sharing 128 responses. Eighty-nine respondents were between the ages of 46 to 60. In addition, 186 of the total respondents last used e-government within the last three (3) months, 90 and 93 of the respondents used

it in the last six (6) months and beyond six months, respectively. The response indicates that the experience of the respondents is useful to validate the response from the questionnaire.

### Measurement Model

The measurement model was evaluated by assessing the loadings, average variance extracted (AVE), and composite reliability (CR) of the constructs, as suggested by (Hair Jr. et al., 2010). More specifically, the following three criteria fulfilment was assessed: all indicator loadings should be greater than 0.5, and for each construct, the CR and AVE should be greater than 0.7 and 0.5, respectively. Both indicator loadings and CRs were greater than 0.5 and 0.7, respectively, as seen in Table 2, and the AVE was also above 0.50. For the reliability and convergent validity of the model, the three requirements were confirmed.

Discriminant validity was also tested to assess the degree to which constructs vary from each other in the same model (Henseler et al., 2015). The Heterotrait-Monotrait ratio (HTMT) criterion was used to assess the validity of discriminants for this analysis. The constructs are different if the HTMT value is below 0.85. As seen in Table 3, the HTMT values are lower than 0.85, so the discriminant validity was confirmed.

Table 1  
Full collinearity analysis

IFQ	SVQ	SYQ	SAT	USE	COM	COS	PAR	PER	WIN
1.34	1.73	1.56	2.21	2.19	2.26	1.45	2.36	1.70	1.36

Table 2  
*Constructs, Items, Loadings, AVE and Construct Reliability*

<b>Constructs</b>	<b>Items &amp; Description</b>	<b>Sources</b>	<b>Loadings</b>	<b>CR</b>	<b>AVE</b>
Access to ICT	ACCS1- I have access to personal mobile devices	Verba et al. (1995)	0.953	0.795	0.667
	ACCS2- I have access to personal internet		0.652		
Information Quality	INFQ1- Information on the government website is easy to understand	Delone & McLean (2003); Urbach & Müller (2012)	0.828	0.887	0.613
	INFQ2- Information on the government website is up to date		0.770		
	INFQ3- Information on the government website is accurate		0.809		
	INFQ4- Information on the government website is relevant		0.838		
	INFQ5- Information on the government website is complete		0.655		
Service Quality	SVQT2- Service delivered on the government website is reliable		0.877	0.904	0.615
	SVQT3- Service delivered on the government website is tangible		0.793		
	SVQT4- Service delivered on the government website is responsive		0.688		
	SVQT5- Service delivered on the government website is dependable		0.851		
	SVQT6- Service delivered on the government website is timely		0.865		
	System Quality		SYQT1- The e-government website is secure		
SYQT2- The e-government website is well organised		0.855			
SYQT3- The e-government website is easy to navigate		0.882			
SYQT4- The e-government website is easy to use		0.785			
SYQT5- The e-government website address is simple and easy to remember		0.769			
Actual Use	USE1- I use the e-government website for information searching		0.836	0.887	0.662
	USE2- I use the e-government website for payment		0.825		
	USE3- I use e-government to interact with government online		0.797		
	USE4- I use the e-government platform to request for services from the government		0.737		
	USE5- Overall, I prefer to use e-government websites to carryout business with the government		0.733		

Table 2 (continue)

Constructs	Items & Description	Sources	Loadings	CR	AVE
Communication	COMM1- Using e-government is an effective way of communicating with government agencies.	Deng et al. (2018); Scott et al. (2016)	0.899	0.929	0.813
	COMM2- Using e-government is a valuable way of communicating with government agencies		0.913		
	COMM3- Using e-government is an efficient way of communicating with government agencies		0.894		
Cost Savings	COSTT1- Using e-government saves me money		0.819	0.854	0.661
	COSTT2- Using e-government reduces the cost of assessing services.		0.795		
	COSTT3- I value the cost savings from using e-government		0.824		
Participation	PART1- E-government makes me get informed of upcoming policies for inputs		0.721	0.897	0.687
	PART2- E-government allows opportunities for me to participate in public discussions		0.875		
	PART3- E-government allows my views for consideration in decision making		0.854		
	PART4- E-government allows me to have avenue to post issues for public consideration		0.857		
Personalisation	PERS1- I am able to personalise the services offered to me on government websites		0.799	0.883	0.716
	PERS2- I value the personalised services on government websites		0.906		
	PERS3- I can tailor messages to my own requirements on government websites		0.831		
Well Informedness	WINF1- E-government helps to increase my understanding of government issues		0.844	0.882	0.713
	WINF2- E-government enables me to build up knowledge about issues important to me		0.858		
	WINF3- I am better informed because of using e-government		0.832		
User Satisfaction	SATF1- I feel more satisfied with the performance of the e-government website	Spreng et al. (1996)	0.735	0.891	0.673
	SATF2- I feel more fulfilled with the experience of using e-government		0.858		
	SATF3- I am satisfied with the quality of information		0.852		
	SATF4- I am satisfied with the quality of e-service delivery		0.83		

\*ACCS3 and SVQT1 were deleted due to lower loadings



Table 3

*Discriminant validity*

	1	2	3	4	5	6	7	8	9	10	11
1											
2	0.145										
3	0.125	0.511									
4	0.368	0.332	0.415								
5	0.126	0.368	0.176	0.225							
6	0.203	0.532	0.732	0.544	0.286						
7	0.138	0.531	0.646	0.257	0.271	0.567					
8	0.149	0.802	0.485	0.322	0.479	0.803	0.416				
9	0.082	0.698	0.504	0.251	0.296	0.424	0.787	0.649			
10	0.153	0.525	0.340	0.303	0.537	0.322	0.338	0.592	0.474		
11	0.072	0.248	0.211	0.296	0.805	0.401	0.424	0.296	0.225	0.330	

1= Access to ICT 2 = Actual Use 3 = Communication 4= Cost Savings 5 = Info Quality 6 = Participation 7 = Personalization 8= User Satisfaction 9 = Service Quality 10 = System Quality 11 = Well Informedness

### Structural Model

The primary endogenous construct (public value of e-government) is a higher-order construct (HOC) with five other sub-constructs (Communication, cost-cutting, personalisation, participation, and well informedness) modelled based on the reflective-reflective type. Therefore, a disjoint two-stage approach was used to reduce the number of structural paths by extracting the latent variable scores (LVS) of the lower order constructs (LOC) (Sarstedt et al., 2019). After that, based on Hair et al. (2019) suggestion, we reported the path-coefficients and t-statistics for all paths using a subsample of 5000 bootstraps. Finally, based on Hahn et al. (2017) recommendation, we used a combination of p-values, confidence intervals, and effect sizes to assess the hypotheses' statistical and substantive relevance, as shown in Table 4 and Figure 3.

Information quality has a positive and significant relationship with actual use ( $\beta = 0.100$ ,  $p$ -value  $< 0.050$ ) and user satisfaction ( $\beta = 0.157$ ,  $p$ -value  $< 0.050$ ), therefore hypotheses H1 and H4 are supported. Service quality has a positive and significant effect on both actual use ( $\beta = 0.484$ ,  $p$ -value  $< 0.001$ ) and user satisfaction ( $\beta = 0.185$ ,  $p$ -value  $< 0.001$ ). Therefore, hypotheses H2 and H5 are supported. System quality has a positive and significant influence on both actual use ( $\beta = 0.226$ ,  $p$ -value  $< 0.001$ ) and user satisfaction ( $\beta = 0.152$ ,  $p$ -value  $< 0.001$ ). Therefore, hypotheses H3 and H6 are supported. The support for hypothesis H7 and H8 can be confirmed as actual use has positive and significant effect on both user satisfaction ( $\beta = 0.449$ ,  $p$ -value  $< 0.001$ ) and the public value of e-government ( $\beta = 0.219$ ,  $p$ -value  $< 0.001$ ). The support for H9 can also be confirmed as user satisfaction has a positive and significant effect on the

Table 4  
Hypothesis testing

Hypo	Relationships	Std Beta	Std Error	t-value	p-value	BCILL	BCIUL	f <sup>2</sup>
H1	Information quality->actual use	0.100	0.057	1.759	0.042	0.003	0.176	0.014
H2	Service quality->actual use	0.484	0.045	10.800	0.000	0.418	0.551	0.336
H3	System quality->actual use	0.226	0.045	4.981	0.000	0.147	0.295	0.063
H4	Information quality->user satisfaction	0.157	0.049	3.221	0.001	0.091	0.244	0.043
H5	Service quality-> user satisfaction	0.185	0.050	3.663	0.000	0.083	0.232	0.047
H6	System quality->user satisfaction	0.152	0.047	3.198	0.001	0.072	0.210	0.034
H7	Actual use-> user satisfaction	0.449	0.052	8.649	0.000	0.318	0.505	0.255
H8	Actual use->public value	0.219	0.060	3.656	0.000	0.088	0.285	0.043
H9	User satisfaction-> public value	0.443	0.069	6.431	0.000	0.331	0.526	0.176
H10	Actual use*Access -> Public Value	0.093	0.038	2.467	0.009	0.032	0.142	
H11	User satisfaction*Access -> Public Value	0.097	0.049	1.963	0.028	0.019	0.156	

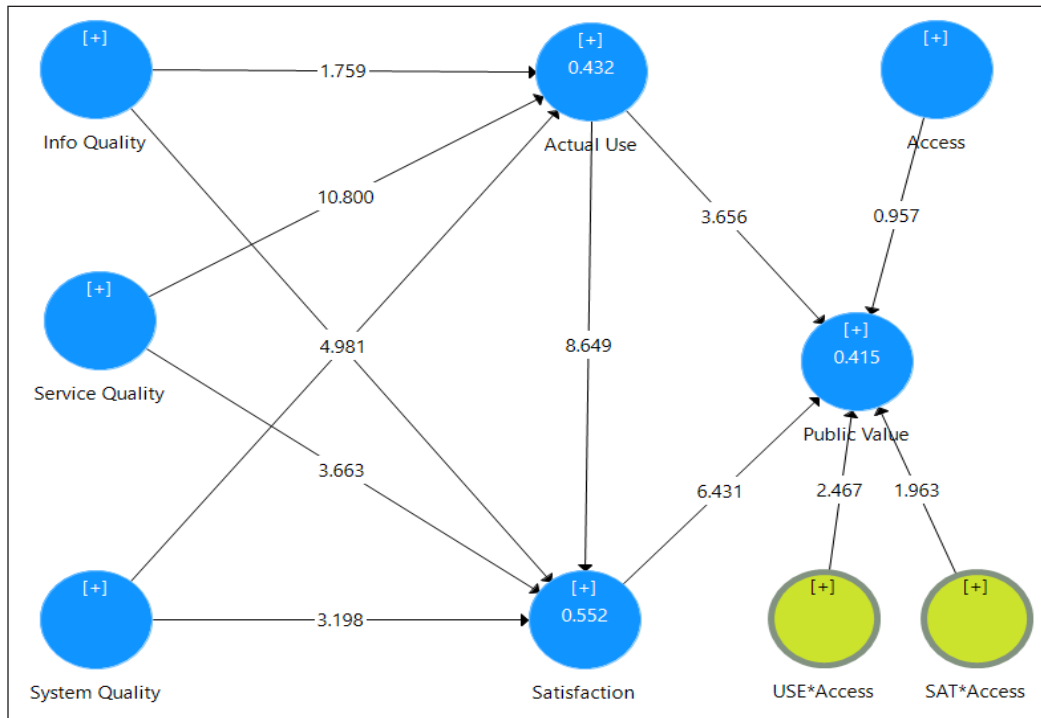


Figure 3. Result of the structural model

public value of e-government ( $\beta = 0.443$ ,  $p$ -value  $< 0.001$ ). The moderating effect of access to ICT positively and significantly impacts the relationship between actual use of e-government ( $\beta = 0.093$ ,  $p$ -value  $< 0.050$ ) and the public value of e-government, therefore, hypothesis H10 is supported. However, the moderating effect of access to ICT does not impact on the relationship between user satisfaction ( $\beta = 0.097$ ,  $p$ -value  $< 0.050$ ) and the public value of e-government.

The model's explanatory power can be confirmed based on the  $R^2$  values of 0.75, 0.50 and 0.25, which signify substantial, moderate and small, respectively (Hair et al., 2019). Based on the result of this study, the following  $R^2$  values can be confirmed Actual use = 0.432; user satisfaction = 0.552 and Public value of e-government = 0.451. Therefore, the  $R^2$  value can be accepted for the model's in-sample prediction based on the key endogenous constructs' values.

## DISCUSSIONS

The findings show that information quality, system quality, and service quality significantly influence actual use and user satisfaction with e-government. This result aligns with other studies' findings where the system quality was significant using e-government and user satisfaction. Seddon (1997) noted that enhancing an IS's characteristics would increase the use and satisfaction of such a project. DeLone and McLean (2016) have indicated that responsiveness, accuracy, reliability, and flexibility are the characteristics

of an IS that can induce e-government. Also, web interface, speed of response to queries, payment speed, data security, and user information will be a basis for the citizens' use of e-government. In this study, service quality refers to service features such as tangibility, responsiveness, empathy, assurance and efficiency of services and their providers. Y.-S. Wang and Liao (2008), and Wangpipatwong et al. (2009) stressed the importance of quality of service in the e-government ecosystem, where it is expected to influence the use of e-government and its components. Similarly, this result demonstrates the sense of fulfilment the citizens will have when interacting with e-government seamlessly (Shim & Jo, 2020). These findings confirm the importance of providing accurate, easy to understand, up-to-date and reliable information, seamless ability to pay for services online, and tangibility of services for the e-service users.

Similarly, access to ICT positively and significantly moderates the relationships between the two exogenous constructs (actual use and user satisfaction) and the public value of e-government. This finding helps to understand the significant interaction effect on citizens' access to ICT to increase the positive relationship between the actual usage of e-government, user satisfaction with e-government and the creation of the public values of e-government. This outcome is further evident in the slope analysis (Figures 4 and 5), where the positive moderating effect between the interaction term and the endogenous constructs high

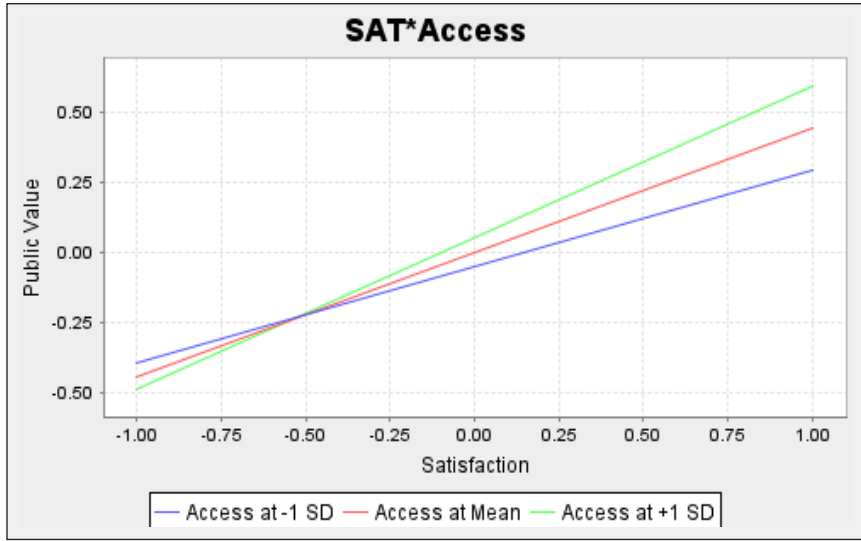


Figure 4. Moderation analysis slope (SAT\*Access -> Public Value of E-government)

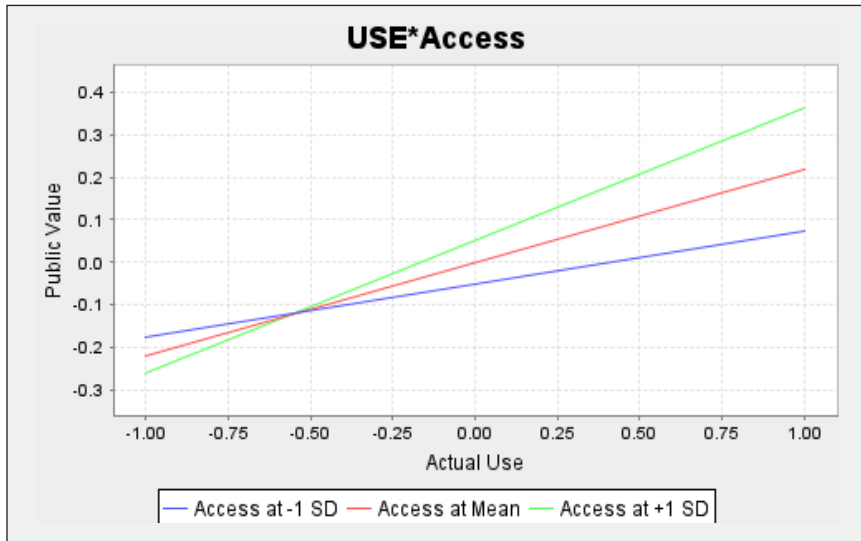


Figure 5. Moderation analysis slope (USE\*Access -> Public Value of E-government)

moderator lines' are steeper. This analysis indicates that the relationships between the actual use of e-government and the public value of e-government become stronger with the interaction effect of citizens' access to ICT, likewise, for user satisfaction with e-government.

This relationship's importance will be evident in creating public values such as effective communications between citizens and the MDAs, cost savings, well informedness about government policies, public participation when citizens have more access to ICT through mobile devices

and affordable internet. Similarly, this result confirms that citizens with more access to ICT, especially the internet and computer, will use e-government more and consequently have more values of e-government compared with citizens without access (Oni et al., 2017). The affordability of computers and the internet is the primary determinant in this regard. The development of ICT of any country, which includes citizens access to ICT, is an enabler of e-government development (Adam, 2020). E-government has been reported to be marginally failing worldwide due to the citizens' inability to access ICT through direct ownership or shared in public places (Anthopoulos et al., 2016). The issue of limited access to ICT has occurred repeatedly as an enabler broadening the digital divide problem, particularly in developing countries (Rana et al., 2013).

## CONCLUSIONS

This study assessed the efficacy of the DeLone and McLean IS success model for examining the performance of e-government in a developing country by contributing further to the development of the model. Also, it tested citizens' access to ICT as a construct to moderate the relationship between the actual use of e-government, citizen satisfaction and the public value of e-government. The rationale to include access to ICT was informed due to the wide digital divide level in a country with lower infrastructural and digital literacy for citizens to access ICT for e-government purposes. The expectation is that broader

access to ICT by the citizens will contribute to the government's e-government programme's overall performance. PLS-SEM was employed for data analysis to simultaneously assess the relationships among the constructs in the conceptual model. The efficacy of the citizens' access to ICT was demonstrated, suggesting the importance of broader access to ICT for citizens' to use e-government services.

This study provided implications for both theory and policy. Theoretically, the public value theory was applied to measure the net benefits of e-government. This method tilts e-government success research to a range of non-financial indicators away from conventional and financial measures. Access to ICT is an essential factor in e-government development. This study tested its interaction effect in determining its effect between actual use and the public value of e-government and user satisfaction and the public value of e-government. Using citizens' access to ICT as a moderator in the study was envisaged as part of this study's contributions to DeLone and MacLean IS's theoretical development and the public value theory, especially concerning the public value of ICT.

This study also provides policy implications. Public sector administrators and implementers are expected to learn and take advantage of the e-service benefits and shortcomings and discuss citizens' demands to strengthen the system. This research would allow them to determine essential quality variables, in this case, the public value framework and the service qualities.

The fact that the quality of e-government websites currently does not fulfil people's needs, especially in a developing country like Nigeria, is one of the main challenges facing e-government success. Therefore, this study suggests that further efforts need to be made to increase the quality of e-services to satisfy citizens' demands. Furthermore, system breakdowns and downtimes undermine the consistency of the expectations of the system and services. Therefore, system operators would consider investing more resources in updating the ageing technical systems to reduce these technical failures and raise usage and satisfaction standards.

The overall level of technological competence, acceptance and usage, and even literacy among government agencies' workers and people are still relatively low. This study further reiterates the government's need to bridge the digital divide gap. The gap may have removed some people from the digital community and digital resources due to loss or lack of ICT capacity and connectivity. It is also a wake-up call for the government to step up efforts to develop ICT teaching and expertise by instilling ICT in schools' curriculum at all stages. It would provide public administrators with a more robust, realistic, comprehensive and citizen-oriented guide to disseminating e-services and easy access to ICT to improve service delivery and achieve the overall objective of promoting good governance.

There are some limitations to generalising the findings from this study.

First, the use of the targeted sample and the resulting small sample size are the drawbacks of the research that may affect the relationship between the variables. While it is impossible to estimate the total number of e-government users in Nigeria, the amount of the survey taken relative to the level of Teledensity indicates that the analysis has a limited sample size. Second, Nigeria is an example of a developing country where the introduction of e-government has not yet fully evolved (United Nations, 2018). Third, given the complexity of the bureaucratic and institutional system and population dynamics, other variables of interest outside the study model, particularly the impact of government bureaucracy and responsiveness on success, cannot be adequately accounted for in the analytical model.

However, despite the drawbacks, future research could concentrate on a more general and varied population with a broader sample size to further examine the success of e-government in other developing countries. Similarly, as other constructs can help explore the success of e-government in Nigeria, future studies can use these constructs, such as digital literacy, self-efficacy, and other individual characteristics, to further pursue an in-depth analysis of e-government performance.

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