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Using Panel Data Analysis to Uncover Drivers of E-Participation Progress:
A Global Insight and Regional Perspectives

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ABSTRACT

This paper examines and uncovers the key drivers of e-participation progress or growth over the years, globally and regionally. The authors used fixed-effects regression model on a panel data of variables gathered by reputable world organizations for an 8-year period – one of the largest examined to date. They tested a research model including GDP per capita, ICT infrastructure, secondary education enrolment, technological knowledge creation and outputs, and six governance indicators: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. At the global level, the results indicate that e-participation progress is positively influenced by voice and accountability, GDP per capita, and ICT infrastructure. Analyses based upon six geographical regions of the world and countries' income-level classifications (i.e., low, low-middle, high-middle, high) show that determinants of e-participation progress vary by geographical and income-level contexts.

KEYWORDS

E-Participation, GDP Per Capita, Governance Indicators, ICT Infrastructure, Knowledge Creation, Panel Data, Region, Secondary Education Enrolment

INTRODUCTION

To make governing more accountable, accessible, effective, and transparent, governments across the world utilize the internet and other information and communication technologies (ICT) to enhance the quality and range of public services provided to citizens and other stakeholders (Olphert and Damodaran, 2007; Krishnan et al., 2013; Porwol et al., 2016; Das et al., 2017; Ashaye and Irani, 2019). The pertinence of ICT infrastructure to network readiness and societal progress has been previously discussed (Ifinedo and Usoro, 2009; Shin, 2010). The expansion of social media, open standards, and open source applications has revolutionized civil society participation and engagement in public administration (Porwol et al., 2016, 2018). Prior research has discussed e-government diffusion and maturity across the world (e.g., Azad et al., 2010; Lee et al., 2011; Ifinedo and Singh, 2011; Zhao et al., 2014; Das et al., 2017). While e-government broadly describes the use of IT as providing public services to citizens in a country or region, it is different from e-participation, a concept that is

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described "as the process of engaging citizens through ICTs in policy, decision-making, and service design and delivery in order to make it participatory, inclusive, and deliberative" (UNDESA, 2013). Macintosh (2004) described e-participation as the use of information and communication technologies to broaden and deepen political participation by enabling citizens to connect with one another and with their elected representatives. E-government is not the same as e-participation (Lee et al., 2011; Gulati et al., 2014). Governments could use IT resources to reach out to citizens and govern them; this reality differs from e-participation, which encapsulates the interaction between civil society and a government's decision- and policy-making processes (Sæbø et al., 2008; Krishnan et al, 2013; 2017). As noted in UNPAN's (2018) report, e-participation emphasizes citizen engagement in governance and "can serve as a catalyst for citizen engagement and in achieving the objectives of the 2030 Agenda" (p. 33). In fact, active participation and citizen engagement can be exercised through e-participation (Phang and Kankanhalli, 2008).

Research on e-participation is still evolving and our current study intends to add to the growing body of work focused on drivers of e-participation progress across the world. According to Krishnan et al. (2017), e-participation research can be classified into three streams: a) studies that are conceptual in nature (e.g., Phang and Kankanhalli, 2008; Sæbø et al., 2008; Porwol et al., 2016); b) studies that examine the demand-side of e-participation (i.e., citizens' perspective) rather than the supply-side (i.e., governments' perspective) with data sourced from a particular country or geographical region (e.g., Lau et al., 2008; Fedotova et al., 2012); c) studies that benchmark e-participation initiatives (e.g., Holgersson and Karlsson, 2014; Zolotov et al., 2018). Another area of interest is studies that examine e-participation progress globally and compare development across national contexts (Åström et al., 2012; Gulati et al., 2014; Krishnan et al, 2017). Our study is designed to contribute to growing the aspect of research focused on global and regional perspectives. Many previous studies have used cross-sectional data for analysis. For example, Gulati et al. (2014) used cross-national data to compare e-participation development across national contexts at a particular point in time. It is worth noting there are weaknesses in the use of cross-sectional data for such studies as the development or evolution of e-participation cannot be identified in a cross-sectional study (Wooldridge, 2010). Panel data or longitudinal data analysis that uses measurements of the same phenomenon over time tends to produce better insights (Gujarati and Porter, 2009; Wooldridge, 2010; Das et al., 2017). Indeed, Das et al. (2017) provided examples where certain variables were found to be significant only in cross-sectional analysis and not in panel data analysis.

Our study is relevant and important for a variety of reasons. First, the inclusion of a larger sample of data sets of e-participation and influencing factors for an 8-year period is among the first of its kind in the area. Second, the choice of a panel data analysis offers more beneficial insights than efforts using a single period of data or limited data range (e.g., Åström et al., 2012; Gulati et al., 2014; Krishnan et al, 2017). Third, given that researchers such as Zhao et al. (2014) and Åström et al. (2012) underscored the importance of environmental factors such as cultural norms and economic globalization on e-participation diffusion at the global level, we believe regional perspectives and income-level classification will increase knowledge of roles of contextual factors. Fourth, from a practical point of view, governments' understanding of key determinants of e-participation growth, over time, will enable them to provide their citizens with appropriate resources and strategies in the areas of e-information, e-consultation and e-decision making.

Consistent with previous studies (e.g., Ifinedo, 2012; Lakka et al. 2013; Das et al., 2017; Krishnan et al, 2017) that examined factors likely to impact the growth of e-government and e-participation over time, we chose parameters related to governance, economic factor, education, innovative capacity, and ICT infrastructure for this study. Specifically, our study is designed to provide answers to the following questions: *Over time, what factors influence e-participation development or progress across the world? How do the drivers of e-participation compare across regions?* Both geographical location and income-level classification of countries were used to represent world regions.

The rest of the paper is organized as follows. We begin by presenting the study's underpinning theoretical frameworks and explaining the notion of the e-participation index (EPI). Afterward, the drivers of e-participation and related hypotheses are presented, followed by the research methodology. The paper concludes by discussing its findings, implications, limitations, and avenues for further research.

THEORETICAL UNDERPINNINGS AND E-PARTICIPATION INDEX

Theoretical Frameworks

This study draws from new growth theory (NGT), the national institutions perspective (NIP), and contingency theories (CTs). NGT seeks to provide reasons for technological progress, diffusion of knowledge, and creativity (Romer, 1994) as it posits that continuous technological progress and advancement results when the combined effects of relevant exogenous factors are relatively high. Past studies confirmed that countries with adequate capabilities and endowments often have high e-government payoffs (e.g., Srivastava and Teo, 2007; Lakka et al., 2013). NIP refers to customs, behavior patterns, and administrative structures, among others, that are required for societal growth (North, 1990). Namely, for a society to effectively employ IT for governance, in general, and e-participation, in particular, that society, first and foremost, must have internal values and structures that fundamentally support such initiatives. The theoretical framework of CTs posits that organizational effectiveness is dependent upon congruency or fit among factors such as people, technology, structure, and so forth (e.g., Lawrence and Lorsch, 1967; Donaldson, 2001). Researchers using CTs, including e-government researchers (e.g., Ifinedo, 2012; Lakka et al., 2013; Zhao et al., 2014, Das et al., 2017), suggested that contingency factors, such as national wealth, effective governance, human capita, ICT infrastructure, and technologically knowledge creation/outputs, matter for the successful diffusion of e-government initiatives. In brief, the three aforementioned theoretical frameworks are pertinent to our inquiry and offer a guiding conceptualization for the study's proposed research framework.

E-Participation Index (EPI)

UNPAN (2018) indicates that the e-participation index (EPI) framework consists of a three-level model of participation that includes the following: (a) e-information – this refers to how citizens are provided information on the internet; (b) e-consultation – this deals with organizing public consultations online; and (c) e-decision-making – this relates to how well citizens are directly involved in decision processes in their countries.

UNPAN's surveys qualitatively assess the availability of tools used for e-participation on national government portals for each of the three levels. Examples of assessed e-participation features include the availability of online tools to seek public opinion and other input for policy making, evidence of citizen engagements in consultation/communication on key issues, and evidence of government partnership/collaboration with civil society and the private sector to provide services. Overall, EPI measures the usefulness of these features and the extent to which they have been deployed by a government (Åström et al., 2012). According to a UNPAN (2018, p. 211) report, the "comparative ranking of countries [on EPI] is for illustrative purposes and only serves as an indicator of the broad trends in promoting citizen engagement." Moreover, EPI "offers insight into how different countries are using online tools in promoting interaction between the government and its citizens, as well as among the citizens, for the benefit of all" (ditto).

Drivers of E-Participation Progress and Hypotheses Formulation

Governance

According to Kauffmann et al. (2010, p. 4), "governance consists of the traditions and institutions by which authority in a country is exercised." Krishnan et al (2017, p. 301) described governance as "the

collection of processes and institutions that creates the conditions for ordered rule and collective action in a country." Prior research on e-government and e-participation (e.g., Lakka et al., 2013; Gulati et al., 2014; Krishnan et al, 2017; Das et al., 2017) used Kauffmann et al.'s six indicators of governance: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption. Perhaps due to the presence of high correlations (above 0.70) among the variables, these researchers instead used a single, aggregated factor to represent governance. On the contrary, we decided to use each of the governance indicators to increase knowledge of the effect of each on the study's dependent variable. That noted, in tune with the dictates of NIP, NGT, and CTs, we postulate that countries with appropriate structures, resources, values, and internal capabilities will experience higher levels of progress in their e-participation initiatives over time compared to those lacking such endowments.

Voice and Accountability

Voice and accountability captures "perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media" (Kauffmann et al., 2010, p. 4). Countries promoting civil liberties, free media, and accountability, report success in embedding digital technologies in the social process of governing their citizens (Freedom House, 2010; Das et al., 2017). However, others have not conclusively demonstrated that accountability enhances e-governance processes (Wong and Welch, 2004). Regardless, research has shown that less accountable governments impede e-government efforts in their contexts (Ciborra and Navarra, 2003; Azad et al. 2010). Possibly, e-participation could be limited to only e-information processes in contexts where citizens do not have a voice and higher levels features related to e-consultation and e-decision making may not be well supported (Katchanovski and La Porte, 2005; Åström et al., 2012). However, prior studies suggest that voice and accountability are associated with e-government development (e.g., Halachmi and Greiling, 2014). Therefore, we propose:

H1a: A country's voice and accountability are positively associated with its e-participation progress, over time.

Political Stability

Political stability captures "perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means" (Kauffmann et al., 2010, p. 4). Politicians' beliefs, styles of administration, and pressure exerted by interest groups, are among key factors that increase e-participation (García-Sánchez et al., 2011). As countries with unstable political climates are in flux, they may experience more challenges in encouraging and instituting needed governance tools including e-participation (Åström et al., 2012; Katchanovski and La Porte, 2005). Moreover, unstable governments are less likely to elicit citizens' trust with regard to using technologies to improve citizens' interactions and perceptions of responsiveness (Tolbert and Mossberger, 2006). Norris (2001) suggested that the use of technologies for development and governance tends to be slow in politically unstable countries. Therefore, we propose:

H1b: A country's political stability is positively associated with its e-participation progress, over time.

Government Effectiveness

Government effectiveness captures "perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies" (Kauffmann et al., 2010, p. 4). The premise of e-participation implementation by national

authorities is to facilitate effective and efficient governance (West, 2004; UNPAN, 2018). Studies demonstrated that effective governments tend to provide an environment conducive to ICT-led initiatives (Srivastava and Teo, 2007; Krishnan and Teo, 2012; Lakka et al., 2014). Thus, efficient governments will be more likely to deploy tools and features that encourage total e-participation for its citizens. In contrast, ineffective governments' expectations of IT usage in governance may not extend beyond basic information publishing (mainly for propaganda purposes) (Katchanovski and La Porte, 2005; Tolbert and Mossberger, 2006). Srivastava and Teo (2007) and Lakka et al. (2014) reported the existence of a positive association between government efficiency and e-government development. Therefore, we propose:

H1c: A country's government effectiveness is positively associated with its e-participation progress, over time.

Regulatory Quality

Regulatory quality captures "perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development" (Kauffmann et al., 2010, p. 4). It is reasonable to expect citizens' and other stakeholder's views toward regulatory quality (and to some extent, legislative professionalism) to be favorable where governments adequately inform, consult, and involve various stakeholders in governance. Absence of such participatory engagements could lead to distrust of e-government efforts (Tolbert and Mossberger, 2006; McNeal et al., 2003). In fact, McNeal et al. (2003) implied that quality concerns and professionalism drive reliance on digital government initiatives and encourage extensive use of e-government tools. Lakka et al. (2014) showed that regulation increased e-government growth across countries over time. The foregoing information permits us to suggest that regulatory quality bodes well for e-participation. Therefore, we propose:

H1d: A country's regulatory quality is positively associated with its e-participation progress, over time.

Rule of Law

Rule of law captures "perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular, the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence" (Kauffmann et al., 2010, p. 4). In order for features encompassing e-information sharing, e-consultation, and e-decision-making to be successful, governments adopting e-participation need their citizens to have confidence in the legitimacy of their institutions and accept their authority. Rule of law is one mechanism through which such can be achieved (Shih et al., 2005) as it allows citizens' views and actions to be taken seriously (Krishnan et al., 2017). Rule of law minimizes barriers to e-government participation (Meso et al. 2006) and positively influences the progress of e-government maturity in Eastern Europe (Ifinedo, 2012). Others have demonstrated that countries with a less strict rule of law may not be enthused with providing features, such as e-consultation or e-decision making, on their websites that would encourage citizen engagement and empowerment (Welch and Wong, 2004; Kovačić, 2005; Krishnan et al., 2017). Therefore, we propose:

H1e: A country's rule of law is positively associated with its e-participation progress, over time.

Control of Corruption

Control of corruption captures "perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by

elites and private interests" (Kauffmann et al., 2010, p. 4). In less transparent governments where corruption is rampant, officials may use government services for personal gain instead of public benefit (Jain, 2001). Features supporting the process of e-information, e-consulting, and e-decision making are more likely to face greater challenges in more corrupt environments. In contrast, less corrupt societies may be more amenable to supporting and instituting participative public sector governance structures to empower their citizens. Krishnan et al. (2013) found a significant and positive relationship between the control of corruption and e-government maturity or progress. Likewise, other studies (e.g., Lee et al., 2011; Azad et al., 2010; Bertort et al., 2010, Armstrong, 2011) showed that higher levels of transparency (i.e., less corruption) are positively linked to e-government growth in a country. Therefore, we propose:

H1f: A country's control of corruption is positively associated with its e-participation progress, over time.

Economic Factor

Economic factor refers to a country's level of wealth; this can be captured by GDP per capita, GNI or GDP. The implementation of e-participation tools and equipment requires financial resources (e.g., Norris, 2001). McNeal et al. (2003) believed that economic prosperity strengthens governmental and societal resources that help e-government to flourish. Thus, the availability of wealth is a key factor. Henrikson (2006) noted that more economically endowed countries have the financial means to invest in technologies that can improve public sector processes and support government functions. Less affluent nations may not have the resources to commit to expanding the scope of quality features provided on their government websites (Srivastava and Teo, 2010; Ifinedo, 2012). The positive association between economic factors (i.e., GDP and GDP per capita) and the development of e-governance has been confirmed in prior studies (e.g., Norris, 2001; Ifinedo and Singh, 2011; Åström et al., 2012; Das et al., 2017). For example, Das et al. (2017) found that GDP per capita is significantly associated with e-government maturity, over time. Åström et al. (2012) found economic globalization to be the strongest predictor of e-participation initiatives in certain countries. Therefore, we propose:

H2: A country's economic factor (i.e., GDP per capita) is positively associated with its e-participation progress, over time.

Human Capital: Secondary Level Enrolment

Human capital refers to the extent to which individuals in a country are literate and have attained an adequate level of education. This includes primary, secondary, and tertiary levels of education (UNESCO, 1997). In this study, secondary level enrolment is used as a proxy of human capita as this basic level of education is sufficient for providing a foundation for lifelong learning and human development (The World Bank Group, 2019). Indeed, Burn and Robins (2003) argued that e-government development depends on learning and knowledge capabilities. We concur with arguments made that poorer quality, intermediate level educational attainment can seriously inhibit the growth of an information society (Caselli and Coleman, 2001; Norris, 2001). Moreover, fundamental knowledge and literacy are important for the development of e-government (e.g., Siau and Long, 2009; Lee et al., 2011; Lakka et al., 2014). Ifinedo (2012) suggested that advanced e-government tools, such as e-consultation and e-decision making, are demanded and better appreciated by individuals possessing an adequate level of education. Therefore, we propose:

H3: A country's human capital (i.e., secondary level enrolment) is positively associated with its e-participation progress, over time.

Technology: ICT Infrastructure

ICT infrastructure refers to technical equipment, such as computers, the internet, mobile devices, and other telecommunication facilities available in a country. The internet saves time and provides access to government information and services in a more efficient way (Fernández-i-Marín, 2011). ICT infrastructure not only improves the quality of services provided, but it also provides better opportunities for citizens to participate in democratic institutions and processes (Siau and Long 2009; Lakka et al., 2014). Thus, the spread of ICT infrastructure in a country has a strong bearing on the extent to which e-government services diffuse in that country (Norris, 2001; Srivastava and Teo, 2010). Namely, countries with better ICT infrastructure derive greater e-participation opportunities compared to those lacking in such resources (Åström et al., 2012; Jho and Song, 2015). Gulati at al. (2014) showed that investments in ICT help strengthen e-participation. Relatedly, internet penetration has augured well for e-participation (e.g., Fernández-i-Marín, 2011). On the whole, past studies (e.g., Krishnan et al. 2017; Astrom et al. 2012) have found a statistically significant effect between ICT infrastructure and e-participation development. Therefore, we propose:

H4a: A country's ICT infrastructure is positively associated with its e-participation progress, over time.

Technological Knowledge Creation and Outputs

Technological knowledge creation and outputs refers to amounts of knowledge in specific advanced areas produced in a country (INSEAD, 2018). Given that e-government and e-participation are innovative, the performance of nations in this aspect could educate on how prepared a country is regarding producing advanced features that enhance e-participation. Ability to innovate is a key consideration for countries' technological development (Nelson, 1993; Weber and Kauffman, 2011; INSEAD, 2018). It is possible that the ability to continue to make changes needed to advance governance processes related to information dissemination, consultation, and empowerment, depends on how innovative a country or society is. Thus, those with more technical endowment will experience favorable outcomes. Past research indicates that nations with more capabilities to create knowledge and utilize IT resources to support creativity tend to be more successful with innovative achievements and effectively use digital governance technologies better than countries lacking in such endowments (Tolbert et al., 2008; Nelson, 1993; Kergroach, 2019; Weber and Kauffman, 2011; INSEAD, 2018). Therefore, we propose:

H4b: A country's innovative capacity related to technical knowledge creation is positively associated with its e-participation progress, over time.

Figure 1 depicts the study's conceptual model with hypotheses tested with a fixed-effect model.

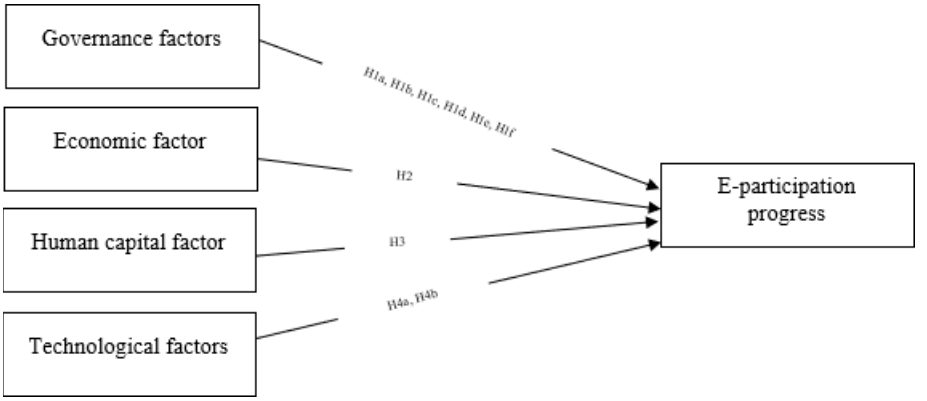
Research Methodology

In line with the foregoing discussion, the study's conceptualization or base model can be written as follows:

$$\text{e-participation} = f(\text{governance factors, economic factor, human capita factor, technological factors}) \quad (1)$$

Suppose Y is e-participation index and we have $i = 1 \ldots k$, n countries and $t = 1 \ldots T$ time periods, our fixed-effects estimation would be written as follows:

Figure 1. The research model



$$Y_{it} = \beta_0 + \beta_{it}\,(vca) + \beta_{it}\,(pol) + \beta_{it}\,(gef) + \beta_{it}\,(reg) + \beta_{it}\,(rla) + \beta_{it}\,(cco) + \beta_{it}\,(\text{In GDP per capita}) + \beta_{it}\,(sec) + \beta_{it}\,(ici) + \beta_{it}\,(tkc) + U_{it} \quad (2)$$

with intercept (β_0), the slope coefficients (β_{it}) and the error term (u_{it}) where:

vca = voice and accountability
pol = political stability
gef = government effectiveness
reg = regulatory quality
rla = rule of law
cco = control of corruption
sec = secondary level enrolment
ici = ICT infrastructure
tck = technological knowledge creation/outputs

As previously noted, we chose panel data in lieu of cross-sectional data because the former allows dynamic relationships between dependent variables and predictor(s) to be revealed over time; the latter contains data captured at *one* point in time and as such, changes occurring across periods are not accommodated (Wooldridge, 2010; Baltagi, 2014). One of the commonly used methods to assess the effects of one parameter on another is Ordinary Least Square (OLS) regression. OLS is clearly inappropriate for panel data analysis because of some of its assumptions, e.g., there is homoscedasticity and no autocorrelation (Studenmund, 2006; Gujarati and Porter, 2009). Apparently, observations in our data are more likely to be correlated as prior studies in the area have shown (Das et al., 2017). However, the pooled OLS can run panel data. Thus, panel data analysis can use any of the following estimation models: pooled OLS, random-effects, fixed-effects, and mixed-effects model (containing both fixed effects and random effects). Both random-effects and fixed-effects are more efficient than pooled OLS, especially when time constant attributes (e.g., geography or culture) are present (Gujarati and Porter, 2009; Baltagi, 2014). The mixed-effects model was not considered for the fact that it contains assumptions in the random-effects model, which assumes that individual-specific effects are uncorrelated with the independent variable(s) (Baltagi, 2014). The fixed-effects model presumes that the individual-specific effects are correlated with the independent variable (Gujarati and Porter, 2009). As argued, we expect correlations among our study's parameters.

To determine the most appropriate estimation model, from the pooled OLS, random-effects, and fixed-effects, to use for our data, the following tests were conducted: Breusch and Pagan, Hausman

specification, and Mundlak tests (Baltagi, 2014). Stata 15 was used for analysis. The Breusch and Pagan Lagrangian Multiplier (LM) test (Breusch and Pagan, 1980) for random-effects model, $\chi^2 = 61.46$, $p < 0.0000$ indicates that the pooled OLS is inadequate for the data and focus should be on either the random or fixed effects models. In deciding which to choose, between the random- and fixed-effects models, the Hausman specification test, $\chi^2 = 71.21$, $p < 0.0000$ suggests that the unobserved time-invariant component is related to the regressor. Hence, the fixed-effects model appeared more suitable. As a consequence, the fixed-effects model was chosen as the study's estimation technique.

We checked for the presence of heteroskedasticity and serial correlation in our base model. The modified Wald test for group-wise heteroskedasticity for the fixed effect regression model test, χ^2 of 4295.22, $p < 0.0000$ indicates the presence of heteroskedasticity. Baltagi (2014) suggests the assessment of cross-sectional dependence, a problem in macro panels arising from long time series (usually over 20-30 years). Incidentally, our data panel has a shorter time span: 8 years. The Breusch-Pagan LM test of independence for assessing cross-sectional dependence correlation was used. The test, $\chi^2 = 372.20$, $p = 0.1164$) indicates our data do not have problems with cross-sectional dependence. Mundlak test (1978) is an alternative to the Hausman specification test and may be used when the errors are heteroskedastic or have intragroup correlation. As previously noted, cross-sectional dependence correlation was not a problem for the data, but heteroscedasticity was. Therefore, we run the Mundlak test that confirms the fixed-effects model to be an appropriate estimation model for the data ($\chi^2 = 49.51$, $p < 0.0000$).

Data Sources and Variables

Our study's unit of analysis is the country. Accordingly, data from 193 counties were used for the study; these were sourced from reputable and established sources, such as the United Nations (UNPAN) and the World Bank Group. Procedures followed by the sources ensure the reliability and validity of the data. Advantages of using data sourced from these bodies include completeness (almost all countries are included), uniformity of measurement items, and replication opportunities (Das et al., 2017). Importantly, comparable, prior studies have made use of data from these sources (e.g., Azad et al. 2010; Das et al., 2017; Krishnan et al. 2017; Astrom et al. 2012; Lakka et al., 2014; Gulati et al., 2014).

The study's dependent variable, e-participation index (EPI), is comprised of three components: e-information, e-consultation, and e-decision making. EPI was obtained from the UN global e-government surveys carried out for eight years (i.e., 2003, 2004, 2005, 2008, 2010, 2012, 2014 and 2016) (UNPAN; 2003, 2004, 2005, 2008, 2010, 2012, 2014, 2016). Index scores ranged from 0 (low) to 1(high). Data for the six governance components (i.e., voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption) were taken from the Worldwide Governance Indicators (2018). Countries' performance on each governance indicator ranged from -2.5 (weak quality) to +2.5 (strong quality) based on data from 2003, 2004, 2005, 2008, 2010, 2012, 2014 and 2016. For the economic factor, we used GDP per capita, which refers to the value of all goods/services produced within a country in a given year divided by the country's population for the same year; each country's data is expressed in US dollars. GDP per capita was chosen as a better proxy of wealth compared to other indicators, such as GDP or GNI because it gauges individuals' portion of national wealth. Due to large differences in the GDP per capita variable among countries, we normalized and transformed it with a logarithmic function.

We used secondary level enrolment in lieu of the comprehensive indicator of the human capital index for two reasons. First, studies that used each of three human capital variables, i.e., primary, secondary, and tertiary level enrolments to determine the extent to which each contributes to the economic growth of nations found secondary level schooling to be the predominant determinant of growth (e.g., Loening, 2005; Ogundari and Awokuse, 2018). Second, there have been mixed results regarding the impact of human capital on e-participation development. While some studies found positive associations between human capital and e-participation (Gulati et al., 2014; Krishnan et al.

2017; Jho and Song, 2015); others did not (e.g., Åström et al., 2012). The mixed results influenced our decision to use secondary level enrolment for each country. Secondary education enrolment data, which captures the percentage of the population with this level of education, was taken from data catalogs of the World Bank Group (2019) for these eight years (i.e., 2003, 2004, 2005, 2008, 2010, 2012, 2014 and 2016). The telecommunication infrastructure index (TII) was taken as a proxy variable to measure the strength of ICT diffusion in a country. TII is a composite measure consisting of five indicators: estimated internet users per 1000 inhabitants; the number of main fixed telephone lines per 1000 inhabitants; the number of mobile subscribers per 1000 inhabitants; the number of wireless broadband subscriptions per 1000 inhabitants; and the number of fixed broadband subscriptions per 1000 inhabitants. The primary data is available from the International Telecommunication Union (ITU); however, the data used for the study was taken from the UN Public Administration Network (UNPAN) e-government surveys for years 2003, 2004, 2005, 2008, 2010, 2012, 2014 and 2016 (UNPAN; 2003, 2004, 2005, 2008, 2010, 2012, 2014, 2016). A weighted index ranging from 0 (low) to 1(high) was used to gauge each country's performance. The Global Innovation Index (GII) is produced by INSEAD. GII consists of multifaceted dimensions, but the variable of relevance to our study is technical knowledge creation (i.e., published technical materials in specific fields in a country). Country rankings for select nations covering years 2008, 2010, 2012, 2014, and 2016 obtained from (INSEAD, 208) were used for data analysis.

For the purpose of our study, we analyzed the determinants of e-participation progress in six regions of the world and across income levels: low income, low-middle, high-middle income, and high-income countries. Table 1 shows the countries selected for each geographical location. We chose an equal number (i.e., 16) for each region for illustration purposes. Table 2 shows the descriptive statistics for the data (all 193 countries) and for selected countries, e.g., geographical regions, over the years. Figure 2 displays e-participation across regions (averages). Unsurprisingly, the average of the e-participation index, over the years, is the highest for Western Europe and lowest for sub-Sahara Africa (e.g., Meso et al., 2006; UNPAN, 2018). Figure 3 shows e-participation (averages) over the years for countries categorized by income levels. High-income countries had more favorable e-participation outcomes compared to low-income countries.

The correlation matrix, including all independent and dependent variables, is shown in Table 3. Clearly, the results suggest the presence of multicollinearity among the governance indicators. The variance inflation factor (VIF) obtained in our check of multicollinearity ranged between 6.5 and 12.1 for the problematic variables. It is recommended that measures with high VIFs be removed from a model (Studenmund, 2006); accordingly, we removed such and re-ran the analysis. As no marked changes were observed in the base model's results, we decided to include all independent variables in the research model.

Results

The regression coefficients (β) or slopes and the constant or intercept of the base model are presented in Table 4. Results for the six regions and income-level classifications are shown in Table 5 and Table 6. Here, we will highlight uncovered global insights; discussion on regional and countries' income-level classifications will be presented later. Information on heteroscedasticity and heterogeneity can be gleaned from robust standard errors provided in the tables. On the whole, the results show significant heterogeneity among countries with regard to their starting points (constant) and slope (rate of change over time) in relation to their progress or accomplishments with e-participation. Aggregately, the information suggests that the rate of progress is slower in countries already having higher levels of e-participation accomplishments (negative constant) (Das et al., 2017).

Our data supported H1a ($\beta = 0.168$, $p < 0.01$), H2 ($\beta = 0.572$, $p < 0.01$), H3 ($\beta = 0.004$, $p < 0.01$), and H4a ($\beta = 0.881$, $p < 0.01$); however, predictions related to H1b ($\beta = 0.004$, not significant (ns)), H1c ($\beta = 0.072$, ns), H1d ($\beta = -0.040$, ns), H1e ($\beta = 0.013$, ns), H1f ($\beta = -0.063$, ns), and H4b ($\beta = -0.000$, ns) were unsupported. For the supported hypotheses, over the years, the global data suggests

Table 1. Selected for each geographical location

Western Europe	Eastern Europe	Sub-Saharan Africa	Latin America	Southern/South East Asia	Middle East
Belgium	Belarus	Angola	Argentina	Afghanistan	Algeria
Denmark	Bulgaria	Botswana	Bolivia	Bangladesh	Bahrain
Finland	Croatia	Cameroon	Brazil	Bhutan	Egypt
France	Czech Republic	Cape Verde	Chile	Cambodia	Iraq
Germany	Estonia	Chad	Colombia	India	Jordan
Greece	Georgia	Cote d'Ivoire	Costa Rica	Indonesia	Kuwait
Iceland	Hungary	Ethiopia	Cuba	Iran	Lebanon
Ireland	Latvia	Gabon	Ecuador	Lao	Libya
Italy	Lithuania	Ghana	Guatemala	Malaysia	Morocco
Luxembourg	Poland	Kenya	Honduras	Nepal	Oman
Netherlands	Republic of Moldova	Lesotho	Mexico	Pakistan	Qatar
Norway	Romania	Mauritius	Nicaragua	Philippines	Saudi Arabia
Portugal	Russian Federation	Nigeria	Paraguay	Singapore	Syria
Spain	Slovakia	Senegal	Peru	Sri Lanka	Tunisia
Sweden	Slovenia	South Africa	Uruguay	Thailand	United Arab Emirates
UK	Ukraine	Zambia	Venezuela	Vietnam	Yemen

that an increase of one (1) unit of the variable of voice and accountability in a country leads to 0.168 growth or progress in its e-participation development. An increase of one unit of GDP per capita for a country would result in an 0.572 growth for its e-participation effort. An incremental development in secondary education enrolment in a country leads to a 0.004 growth in its e-participation initiative. A country's e-participation score is improved by 0.881 by an addition of one unit of ICT infrastructure.

DISCUSSION

With the exception of voice and accountability, our data did not show that governance indicators were influential in driving e-participation progress globally. This finding is not in agreement with observations in studies (e.g., Das et al., 2017) suggesting that governance indicators are less influential in enhancing progress with e-government maturity across nations. By isolating the impacts of each governance indicator, something that was not done in some previous studies, we found voice and accountability to be a critical governance factor that accelerates e-participation development across the world. That is, countries more receptive of encouraging citizens' freedoms to participate in governance or access to free media are the ones that have moved up the ladder of e-participation progress. The unsupported hypotheses related to other governance indicators somewhat affirms empirical evidence indicating that governance indicators, such as government effectiveness and rule of law, are not necessarily impetuses for achieving success with e-participatory governance (e.g., Das et al., 2017). As is the case, non-democratic governments (e.g., Bahrain, Kazakhstan) have successfully used e-government mechanisms to maintain status quos and achieve other objectives (Åström et al.,

Table 2. Descriptive statistics for the data (193 countries) and regional aggregates

Variable	Global			Western Europe		Eastern Europe		SSA		Latin America		Southern/South East Asia		Middle East	
	N	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
E-Participation Index	1536	0.239	0.260	0.523	0.268	0.330	0.232	0.138	0.149	0.341	0.249	0.254	0.241	0.227	0.251
Accountability	1539	-0.047	1.007	1.385	0.240	0.389	0.763	0.279	0.763	0.001	0.706	0.632	0.616	-1.002	0.461
Political Stability	1536	-0.066	0.999	0.841	0.477	0.314	0.685	-0.370	0.949	-0.328	0.701	0.739	1.069	-0.544	1.113
Government Effectiveness	1515	-0.071	0.989	1.543	0.496	0.295	0.663	0.441	0.642	-0.258	0.590	0.158	0.828	-0.228	0.726
Regulatory Quality	1515	-0.082	0.987	1.422	0.378	0.494	0.726	0.384	0.603	-0.217	0.763	0.388	0.813	-0.245	0.755
Rule of Law	1535	-0.075	0.991	1.532	0.471	0.203	0.705	-0.420	0.723	-0.485	0.733	-0.378	0.780	-0.222	0.739
Control of Corruption	1518	-0.074	0.997	1.595	0.682	0.062	0.618	0.425	0.738	-0.241	0.747	0.419	0.892	-0.260	0.762
Log of GDP per capita (constant 2010 US$)	1491	8.498	1.505	10.710	0.387	9.070	0.758	7.598	0.937	8.594	0.690	7.621	1.170	9.067	1.199
School enrollment, secondary (% gross)	630	85.427	27.014	114.261	16.788	97.393	8.035	53.947	25.776	86.576	15.973	63.794	22.137	80.427	18.047
Telecommunication Infrastructure Index	1533	0.255	0.241	0.663	0.141	0.389	0.172	0.102	0.103	0.208	0.131	0.162	0.183	0.244	0.181
Knowledge creation (Rank)	663	83.0453	172.7418	20.438	14.433	46.697	22.094	93.111	24.776	94.400	27.378	74.636	32.879	84.333	29.805

Figure 2. E-participation patterns across regions

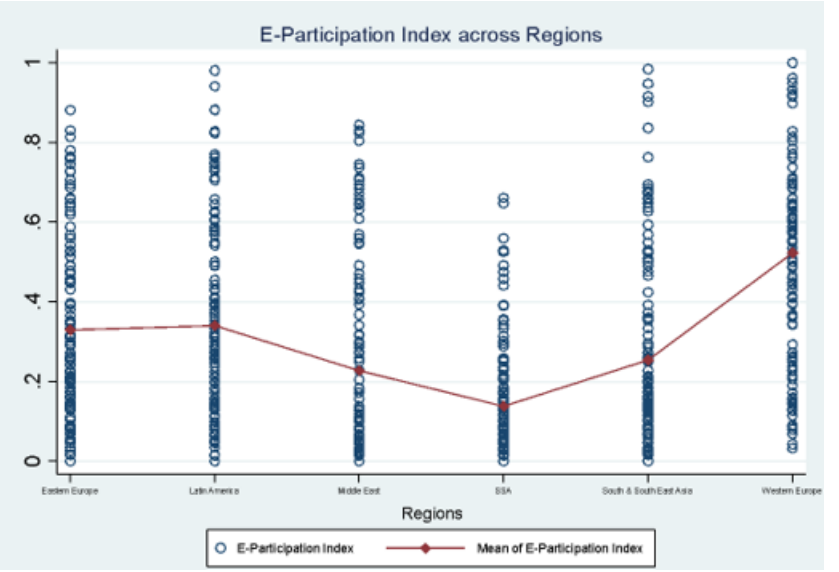
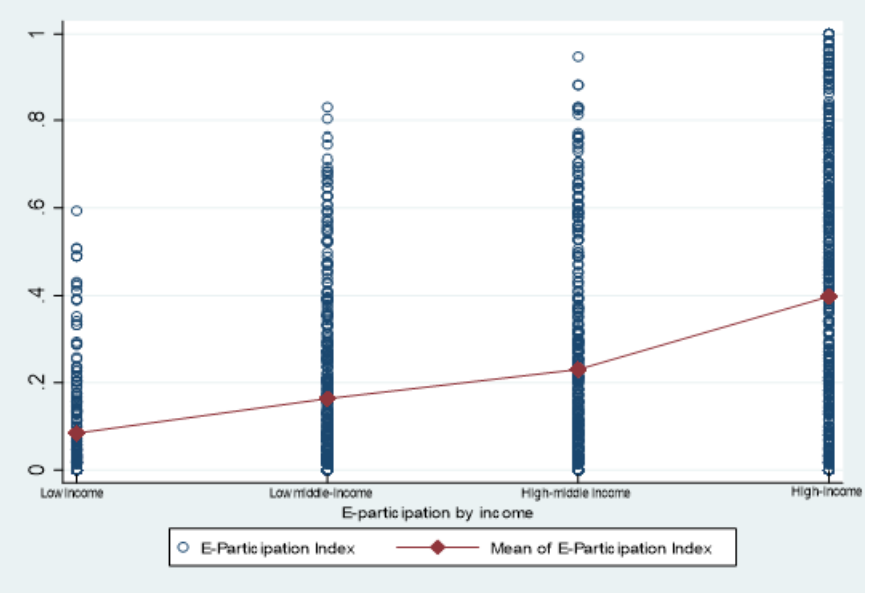


Figure 3. E-participation progress by income levels



2012; Gulati et al., 2014). Thus, rule of law, political stability, control of corruption, and government effectiveness are not salient drivers of e-participation progress across the world.

A country's capability to produce highly technical knowledge mattered less in stimulating the progress of e-participation across countries. Our data suggest that highly sophisticated technical knowledge outputs are unrelated to e-participation growth across countries. That is, regardless of how highly or lowly ranked a country is on this indicator, its e-participation progress is unimpeded

Table 3. Correlation matrix

Variable	E-Participation Index	Accountability	Political Stability	Government Effectiveness	Regulatory Quality	Rule of Law	Control of Corruption	Log of GDP per capita	School Enrollment, Secondary (% gross)	Telecommunication Infrastructure Index	Technological Knowledge Creation (Rank)
E-Participation Index	1										
Accountability	0.3701	1									
Political Stability	0.3195	0.6401	1								
Government Effectiveness	0.5593	0.7457	0.7292	1							
Regulatory Quality	0.5321	0.769	0.7052	0.9313	1						
Rule of Law	0.5291	0.7756	0.7559	0.9586	0.9299	1					
Control of Corruption	0.4979	0.7539	0.7499	0.9391	0.8855	0.9583	1				
Log of GDP per capita	0.545	0.6172	0.6605	0.8509	0.8037	0.8096	0.7927	1			
School enrollment, secondary (% gross)	0.5479	0.5611	0.5728	0.7135	0.6671	0.6546	0.6316	0.8166	1		
Telecommunication Infrastructure Index	0.6905	0.6274	0.6182	0.8394	0.7923	0.8111	0.7818	0.8663	0.5982	1	
Knowledge creation (Rank)	-0.1446	-0.1272	-0.1219	-0.1717	-0.1271	-0.1822	-0.1615	-0.1521	-0.0955	-0.1368	1

Table 4. Stata results for the analysis

Variable	E-Participation Index
Accountability	0.1680***
	(0.0601)
Political Stability	0.0039
	(0.0294)
Government Effectiveness	0.0715
	(0.0990)
Regulatory Quality	-0.0398
	(0.0767)
Rule of Law	0.0126
	(0.0933)
Control of Corruption	-0.0624
	(0.0711)
Log of GDP per capita	0.5716***
	(0.1433)
School enrollment, secondary (% gross)	0.0042***
	(0.0012)
Telecommunication Infrastructure Index	0.8810***
	(0.1101)
Knowledge creation (Rank)	-0.0004
	(0.0005)
Constant	-5.4058***
	(1.2212)
Observations	517
R-squared	0.431
Number of id	139

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

by such endowments. This finding is at odds with results reported in Ifinedo (2012) and espoused thinking in INSEAD (2018). Our data shows that economic factors (i.e., GDP per capita) play a major role in accelerating e-participation progress over the years. This suggests that countries with favorable economic endowments fared better relative to those lacking such resources (please see Figure 3). Governments and populations with financial means to procure necessary equipment and advanced tools needed to engage in e-participation have achieved higher levels of growth. This finding is consistent with results reported in similar studies (e.g., Ifinedo and Singh, 2011; Lakka et al., 2014; Zhao et al., 2014; Gulati et al, 2014; Das et al., 2017). The data showed that what is needed to sustain e-participation growth over the years across countries is not high technical knowledge but basic education in the form of secondary-level education capable of laying foundations for lifelong learning and human development. Our data suggest that where such is available, it is sufficient to

Table 5. Results for the regions

	Eastern Europe	Latin	Middle East	Sub-Sahara Africa	Southern & South Asia	Western Europe
Accountability	0.4172	0.0222	0.2426	-0.0664	0.3129	0.3377
	(0.3970)	(0.3483)	(0.1429)	(0.2095)	(0.2781)	(0.6668)
Political Stability	-0.0610	-0.0462	-0.2376***	0.0995	0.1796	-0.2747
	(0.0587)	(0.1101)	(0.0615)	(0.1248)	(0.1190)	(0.1826)
Government Effectiveness	0.1866	-0.2527	0.3267	0.1588	-0.0933	0.4236
	(0.2384)	(0.2698)	(0.3771)	(0.1544)	(0.2311)	(0.2683)
Regulatory Quality	-0.6132**	-0.0742	0.2740	-0.2788*	0.1597	0.1633
	(0.2347)	(0.2734)	(0.1554)	(0.1313)	(0.3182)	(0.1958)
Rule of Law	0.0566	0.2432	-0.0796	-0.1294	0.2586	-0.5773*
	(0.4266)	(0.2156)	(0.1570)	(0.3332)	(0.2276)	(0.2874)
Control of Corruption	0.1515	0.1054	0.1116	0.2625*	-0.1951	-0.4092*
	(0.1890)	(0.1622)	(0.1785)	(0.1360)	(0.1860)	(0.1994)
Log of GDP per capita	0.9963**	1.3823**	-0.7072	0.9517***	0.8110**	0.5878*
	(0.3716)	(0.5763)	(0.4411)	(0.2325)	(0.2830)	(0.3348)
School enrollment, secondary (% gross)	0.0098	0.0047	0.0035	-0.0026	0.0084	0.0051**
	(0.0059)	(0.0042)	(0.0070)	(0.0049)	(0.0048)	(0.0021)
Telecommunication Infrastructure Index	0.4020	0.8738*	1.0871***	1.4349*	-0.3639	1.1396***
	(0.4277)	(0.4111)	(0.2227)	(0.6995)	(0.5298)	(0.3243)
Knowledge creation (Rank)	-0.0001	-0.0018	0.0001	0.0001	-0.0023***	-0.0019
	(0.0022)	(0.0011)	(0.0016)	(0.0019)	(0.0007)	(0.0056)
Constant	-9.9280***	-12.0498**	6.3059	-7.1190***	-6.0407**	-6.6192*
	(3.2462)	(4.9035)	(3.7387)	(1.6762)	(2.0301)	(3.4408)
Observations	72	67	41	41	47	79
R-squared	0.590	0.659	0.709	0.735	0.801	0.383
Number of id	16	15	13	13	14	16

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

improve e-participatory governance among citizens. The result is consistent with findings reported in similar studies (e.g., Siau and Long, 2009; Lakka et al., 2014). The data shows that this level of basic education paints a better picture of the impact of human resource knowledge on e-participation than the comprehensive variable of "human capita". We are not suggesting that tertiary level education is unimportant for achieving success with e-participation projects.

Our analysis shows that the availability of ICT infrastructure is a predominant factor that increases the growth of e-participation internationally. In fact, some researchers have implied that a country can achieve good e-governance performance not only with improving public sector processes but also

Table 6. Results for countries (income levels)

	Low Income Countries	Low Middle-Income Countries	High Middle-Income Countries	High-Income Countries
Accountability	0.2156	0.3633*	0.2720***	0.0268
	(0.1550)	(0.1831)	(0.0759)	(0.2170)
Political Stability	0.0129	-0.0061	0.0710	-0.1343
	(0.0728)	(0.0367)	(0.0680)	(0.1123)
Government Effectiveness	-0.0363	-0.0764	0.0711	0.2411
	(0.3309)	(0.1437)	(0.1858)	(0.1786)
Regulatory Quality	-0.0120	-0.2422**	0.0152	-0.0475
	(0.2904)	(0.1110)	(0.1440)	(0.1293)
Rule of Law	0.0225	0.2616	0.0760	-0.0800
	(0.2948)	(0.2048)	(0.1829)	(0.1698)
Control of Corruption	-0.1061	0.0571	0.0005	-0.1374
	(0.1591)	(0.1228)	(0.1374)	(0.1331)
Log of GDP per capita	0.4566	0.9721***	0.6413*	0.8489***
	(0.5431)	(0.2393)	(0.3564)	(0.2420)
School enrollment, secondary (% gross)	0.0089*	-0.0006	0.0029	0.0054***
	(0.0045)	(0.0027)	(0.0023)	(0.0020)
Telecommunication Infrastructure Index	-0.3264	0.2294	0.8997***	0.8074***
	(0.7198)	(0.2480)	(0.1454)	(0.1686)
Knowledge creation (Rank)	-0.0011	-0.0010*	-0.0011	0.0006
	(0.0012)	(0.0005)	(0.0010)	(0.0010)
Constant	-2.9578	-6.9101***	-5.7060*	-9.2457***
	(3.3390)	(1.8011)	(3.0245)	(2.4839)
Observations	58	113	136	210
R-squared	0.310	0.622	0.566	0.352
Number of id	21	40	41	50

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

investing in ICT infrastructure (e.g., Andersen and Henrikson, 2006; Gulati et al., 2014). Our study lends credence to findings reported by others who underscored the pertinence of ICT infrastructure for e-government maturity and e-participation growth over the years, globally (e.g., Siau and Long, 2009; Lakka et al., 2014; Ifinedo, 2012; Åström et al., 2012; Das et al., 2017).

Perspectives From the Six Regions

Data for the six regions shows that in Eastern Europe, *regulatory quality* and *GDP per capita* are the two variables that specifically explained e-participation progress in the region. Namely, there is a negative association between regulatory quality and e-participation to suggest that governments with less capability to formulate and implement sound policies and/or promote private sector development have achieved relative progress with their e-participation agenda over the years compared to authorities having more favorable conditions. We did not investigate why this is so; nonetheless, the result is not at odds with findings reported elsewhere (Åström et al., 2012). The importance of economic factor in promoting e-government growth in Eastern Europe provides support for findings reported by Ifinedo (2012) and others for the region (Katchanovski, and La Porte, 2005). For Latin American countries, we found that *GDP per capita* and *ICT infrastructure* are the two most influential factors in the model. These variables are among factors highlighted as determinants of e-government adoption in that region (e.g., Lau et al., 2008). In the Middle East, the two variables driving e-progress growth are *political stability* and *ICT infrastructure*. With respect to political stability, the result concurs with observations reported by Åström et al. (2012) who found that the level of democratization was negatively related to changes in e-participation in non-democratic countries.

For sub-Saharan African (SSA) countries, the variables explaining progress are *regulatory quality, control of corruption, ICT infrastructure,* and *GDP per capita*. These factors have been noted as key enablers of e-governance growth on the African continent (Meso et al., 2006). Similar to the foregoing result for Middle Eastern countries, the data indicates that e-participation progress in SSA has been higher in countries with less regulatory qualities. In South and Southern Asian countries, *GDP per capita* and *knowledge creation* determine e-participation progress. Financial resources were important for this region as well; the data seems to indicate that countries in the region with increased capability to produce technical knowledge improved their e-participation efforts over the years compared to countries lacking in such. Five variables, i.e., *rule of law, control of corruption, secondary level enrolment, ICT infrastructure,* and *GDP per capita* accounted for e-participation progress in Western Europe. Surprisingly, the data shows that countries in the region with lower levels of rule of law and control of corruption issues recorded more favorable growth in e-participation initiatives compared to those with better scores on those variables. The pertinence of ICT infrastructure and GDP per capita as critical factors are further enhanced by results from the region.

Income-Level Classification Perspectives

For low-income countries, the variable explaining e-participation progress is *secondary level enrolment* in a country. In low-middle income countries, four variables including *accountability and voice, regulatory quality*, *GDP per capita*, and *technical knowledge creation* positively or negatively influenced e-participation progress. The factors of value in high-middle income countries include the following: *accountability and voice, GDP per capita,* and *ICT infrastructure.* In high-income countries, the data shows that variables related to *secondary level enrolment*, *GDP per capita,* and *ICT infrastructure* are the drivers of e-participation progress. At a glance, some of the variables, e.g., *accountability and voice, GDP per capita,* and *secondary level enrolment* found to be key drivers of e-participation progress globally are among important determinants for countries when grouped by income levels. This information indirectly accentuates the role of financial endowments in the discourse.

Contributions and Implications

This study adds to the growing body of work on e-participation research, in particular, the aspect related to comparative studies of e-participation growth across the world. While studies with global data are relevant, they do not allow the complete story about realities in differing regions (i.e., geography and income-level classification) to be told or understood. The global comparison of e-participation progress is essential for governments and non-government organizations because it will provide them

with valuable practical implications. Once properly understood, countries from a region will be able to speed up their progress by allocating more resources to critical drivers in that region. For bodies such as the UN and non-government organizations, they may be able to help countries/regions with unsatisfactory e-participation progress with additional resources and training to reduce noticeable disparities across different regions of the world. Perspectives of e-participation progress from the world's regions and by income-level classifications add more understanding in the area. This is a contribution of this endeavor. Few have studied changes in e-participation growth internationally with a panel data, as was done in this study. This methodological approach of panel data analysis enhances knowledge in the area. Several previous studies in the area (e.g., Das et al., 2017) have not used any discernible theory to guide their efforts. We used the theoretical frameworks of NGT, NIP, and CTs for this study, and found support for their applicability to e-participation research; such theories could guide other future studies.

Globally, policy-making aimed at improving e-participation should not neglect the influential roles of voice and accountability in a country, as well as the importance of basic secondary education and ICT infrastructure. The reality of sustaining citizen involvement and participation in governance over time depends on simple things, such as providing basic secondary level education to the population, ensuring that adequate ICT infrastructures are in place, and creating opportunities for citizens to afford the equipment to interact with public officials. The provision of soft loans and grants to citizens, especially for those in poorer regions of the world, could be beneficial. Efforts to encourage accountability augurs well for growth. Governments could consider engaging an ombudsman to check on their own practices, activities, and processes with regard to governance. With such in place, accountability could be positively impacted to ultimately improve e-participation growth. Continuous investments on the technological front by governments, as well as receipt of foreign investment assistance, count. Such initiatives have benefitted governments in SSA and elsewhere (UNPAN, 2018). Having said that, it may be erroneous to assume that drivers or determinants of e-participation over time are the same across contexts. Our study points out salient differences in that regard. It is also worth noting that some factors, e.g., the role of ICT infrastructure, appear to be common to more than one region. To stimulate e-participation growth or development, authorities in respective regions may need to focus attention, not only on variables identified for all countries of the world but on specific variables identified for their particular environments as well.

Limitations and Future Study

First, some of the variables provided by the reporting agencies were not consistent over the years, e.g., some of the measurement items changed over time. This might be a limitation of the study's analysis. Second, some of the variables did not include all possible items that could capture a factor or variable. For example, governance indicators could be more informative if items related to collaboration between citizens and government were captured or information on styles of administration were provided. Third, it is difficult to say with certainty that selected countries for a region precisely reflect realities or patterns for all countries in that region. Fourth, what is reported in this study only covers the 8-year period under review; as larger sample sizes are collected over coming years, it is possible that findings and conclusions made herein may change. Fifth, in formulating the hypotheses, we have assumed that each of the four factors (i.e., governance, economic, human capital, and technological) directly affects e-participation progress over time. In reality, some of the factors (e.g., technological or human capital) may interact with other input factors (e.g., economic) while at the same time influencing the dependent construct, over time. A useful method to help understand such interactions is the structural equation modeling technique. Future studies could consider using case studies to complement insights obtained from secondary data sources. Other relevant contingency factors, such as cultural norms and values, social networks, styles of administration, and leadership roles, could be added to the research framework to increase knowledge. As well, the impact of tertiary level education and citizens' ICT literacy on e-participation progress could be investigated. Other complex estimation models, the mixed-effect model could be used for future studies.

CONCLUSION

Many prior studies in the area have relied on cross-sectional data analyses to investigate the diffusion of e-participation, even when such an approach has apparent limitations. Unlike such efforts, our study used a panel data to study the drivers of e-participation globally and regionally. Our analysis at the global level found that variables related to accountability and voice, ICT infrastructure, and GDP per capita, are key determinants of e-participation progress globally, over time. Our analysis by regions and countries' income-levels indicate that drivers of progress may vary by environments. Given that the drivers of e-participation progress differ across contexts, policy-makers could factor in this reality in shaping the growth of e-participation in their contexts. Favorable outcomes will ensue for a region that knows what drives its e-participation progress over time.

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