

E-governance and sustainable human development in Asia: a dynamic institutional path perspective

Journal of Asian
Business and
Economic Studies

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Abstract

Purpose – This study demonstrates the necessary and significant role of national formal institutional frameworks in shaping the quality of e-governance in Asian countries. Moreover, it presents a robust model of e-governance as a necessary and significant driver of sustainable human development.

Design/methodology/approach – This study applied the cross-lagged panel method in path modelling and conducted competing model and necessary condition analyses to test the lagged, necessary and positive effects of formal institutions on the level of e-governance and sustainable human development in 45 Asian countries from 2012 to 2022.

Findings – Formal governance institutions have necessary direct and indirect (through e-governance development) causal effects on a country's sustainable human development.

Research limitations/implications – Future studies should explore how informal institutions such as culture, industry and government norms and practices shape the extent of e-governance development and sustainable socio-economic development in Asia and beyond over time.

Practical implications – A renewed focus on the institutional fundamentals of governance and development should be the legislative priority of policymakers and leaders of Asian countries.

Social implications – Proactive digital citizen engagement in institutional building in respective countries is critical to developing sound, human-development-centred institutional governance in Asia.

Originality/value – The study presents robust necessary condition models that offer more nuanced explanations of the institutional imperatives of enabling Asian countries to strengthen their e-governance towards sustainable human development.

Keywords e-governance, Institutions, Sustainable development, Asia, Governance quality

Paper type Research paper

Received 15 February 2024
Revised 3 June 2024
20 October 2024
21 November 2024
Accepted 22 November 2024

1. Introduction

Sustainable development has become a central focus of national socio-economic development planning in developing Asian countries (Ordonez-Ponce, 2023; Addo and Senyo, 2021; Lyulyov *et al.*, 2024). Sustainable development refers to development that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987). To achieve this goal, Asian countries have leveraged information and communications technology (ICT) (Kurniawati, 2022; Lyulyov *et al.*, 2024) as part of national e-governance (e-Gov). E-Gov refers to the strategic use of ICT to improve governance structures, systems and procedures towards promoting an inclusive, participatory, accountable, transparent and responsive government (Bannister and Connolly, 2012; Yang

JEL Classification — M16, M15, Q01, M20, 053

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The author gratefully acknowledges the insights and constructive feedback of the anonymous reviewers and the scholarly guidance of the journal's associate editor and editor-in-chief during the review process. There is no conflict of interest.



Journal of Asian Business and Economic
Studies
Vol. 32 No. 1, 2025
pp. 15-27
Emerald Publishing Limited
2515-964X
DOI 10.1108/JABES-02-2024-0076

and Rho, 2007; Kurniawati, 2022). Through e-Gov, government service delivery is expected to empower citizens by sustainably meeting their needs (Kurniawati, 2022; Lyulyov *et al.*, 2024).

Amid the plethora of studies on the drivers, enablers, antecedents, processes, instruments and outcomes of e-Gov (see MacLean and Titah, 2022; Ravšelj *et al.*, 2022), the present study addresses two critical research gaps in the literature. First, there is limited empirical research on the causal mechanisms through which e-Gov facilitates sustainable human development in Asia (Dawes, 2009; Kurniawati, 2022; Lyulyov *et al.*, 2024). Second, the institutional factors that drive e-Gov adoption in Asia are underexplored (Yildiz, 2007; Kurniawati, 2022; Myeong and Bokhari, 2023). Specifically, little is known about how a country's formal institutional framework – its formal “rules of the game” that shape the behaviour of economic agents (North, 2005) – affects the adoption of e-Gov in Asian countries (Ordóñez-Ponce, 2023; Lyulyov *et al.*, 2024). North (2005) argued that functional formal institutions (e.g. laws, regulations and policies) and informal institutions (e.g. mores, social norms and cultural practices) shape a nation's development because they encourage productive socio-economic activities towards achieving superior growth. Efficient institutions incentivise acceptable behaviours and prohibit or constrain undesirable conduct (North, 2005). By extension, efficient institutions are plausible explanations for why some countries are more successful than others in implementing e-Gov that leads to sustainable human development – an underexplored research domain.

A glaring gap in the literature is the lack of investigation into a country's formal institutional platform on which e-Gov is planned and implemented (Adam, 2020; Rizwan *et al.*, 2024; Zhang and Kimathi, 2022; Malodia *et al.*, 2021). Although many studies have highlighted the benefits of e-Gov (Addo and Senyo, 2021; Sharma *et al.*, 2021), there is little empirical evidence that explains how e-Gov contributes to sustainable development, particularly in terms of improving citizen well-being. Few robust studies have examined the institutional determinants of e-Gov beyond those relying on cross-sectional and qualitative (e.g. Rizwan *et al.*, 2024; Zhang and Kimathi, 2022), anecdotal (e.g. Sharma *et al.*, 2021; Glyptis *et al.*, 2020) and single-case data (e.g. Glyptis *et al.*, 2020) with limited generalisability. Although these studies are informative, the examination of how a country's institutional environment shapes and enables its successful implementation of e-Gov, especially in the Asian region (Kibria and Hong, 2024), remains a gap in the literature (Malodia *et al.*, 2021; Rizwan *et al.*, 2024) that the present study aims to address. Furthermore, the literature on the effects of e-Gov remains fragmented (Rizwan *et al.*, 2024; Dhaoui, 2022; MacLean and Titah, 2022). There is scant empirical evidence that offers a replicable explanation of how e-Gov contributes to sustainable human development (e.g. Addo and Senyo, 2021; Sharma *et al.*, 2021).

The above research gaps are particularly evident in Asia, where 48 countries exhibit diverse socio-economic and technological conditions. Asia includes 11 high-income nations with advanced e-Gov and some of the highest living standards globally (UN, 2022) but also some of the world's poorest countries, such as Afghanistan and Yemen (United Nations Development Programme [UNDP], 2024). The disparity in ICT is stark, for example, Singapore's median Internet download speed is approximately 284 Mbps, compared with 4 Mbps in Afghanistan (World Population Review, 2024). Such variations highlight the complex intersections of e-Gov, institutional development and sustainable development in Asia – an area that remains underexplored both theoretically and empirically (Kibria and Hong, 2024; Myeong and Bokhari, 2023; Dhaoui, 2022; Chung, 2022).

Against the above background, the present study investigates how formal institutional environments (i.e. institutions) enable countries to successfully leverage e-Gov to achieve sustainable human development goals in Asian economies. It posits that the successful adoption of e-Gov positively contributes to sustainable human development, provided it is built on and driven by a robust institutional foundation within a country. In other words, a country's institutions shape the quality of its e-Gov, which, in turn, fosters sustainable human development.

Based on the foregoing discussion, this study answers the following research questions in an Asian country context.

- (1) Are institutions necessary and significant predictors of each country's state of e-Gov? (RQ1)
- (2) Are institutions necessary and significant predictors of sustainable human development? (RQ2)
- (3) Is e-Gov a necessary and significant condition for a country's sustainable human development? (RQ3)

The study makes the following contributions to the literature. First, it examines the necessary effects of a country's governance institutions on the adoption of e-Gov over time and the subsequent effects on sustainable development. Second, it provides empirical evidence that e-Gov facilitates sustainable human development centred on enhancing human achievement, freedom and capabilities (Anand and Sen, 1994).

The study leverages a cross-lagged panel method (CLPM) and a necessary condition analytical tool to explore the causal, lagged positive effects of institutions on the adoption of e-Gov, leading to sustainable human development across Asia. This approach offers an alternative to conventional econometric methods and fills a methodological gap in the literature by revealing the necessary causal effects of institutions, providing insights for policy development aimed at fostering sustainable development.

The remainder of the paper is structured as follows. The next section presents a concise overview of the study's central focus, e-Gov. It then examines sustainable human development and explores how formal governance institutions contribute to the establishment of effective e-Gov aimed at achieving sustainable human development goals. This section concludes by presenting a conceptual model and related hypotheses. The subsequent section outlines the data and methods used in the study and presents a data analysis and results. The final section discusses the findings and concludes by giving research, policy and practical implications and recommendations.

2. Brief review of the literature

2.1 Role of e-Governance

ICT plays a vital role in government services, especially in developing countries (Kurniawati, 2022; Lyulyov *et al.*, 2024). Internet diffusion, for example, has changed how governments manage their citizens' needs. ICT deployment in government service delivery is known as e-government (Myeong and Bokhari, 2023), which, according to Gronlund and Horan (2004), is synonymous with e-Gov.

e-Gov serves four functions, namely e-organisation, which focuses on internal efficiency and effectiveness; e-service, which enhances external efficiency and effectiveness in providing services; e-partnering or working with stakeholders and e-democracy, which promotes citizen participation in government decision-making (Carrizales, 2008). E-Gov is a mechanism for stimulating national productivity towards human-centred development (Wang *et al.*, 2007; Kurniawati, 2022; Lyulyov *et al.*, 2024).

Recent studies (e.g. Malodia *et al.*, 2021; Ravšelj *et al.*, 2022; Lyulyov *et al.*, 2024) have highlighted the need to unravel the institutional contexts of e-Gov. Adam (2020) suggested that institutions shape a country's adoption of e-Govs. However, the causal mechanisms linking e-Gov and sustainable human development in developing countries remain controversial (Addo and Senyo, 2021; Glyptis *et al.*, 2020; Lyulyov *et al.*, 2024).

2.2 Sustainable human development

Sustainable development balances the economic, ecological and human elements of development (Ordóñez-Ponce, 2023; Lyulyov *et al.*, 2024). Citizen well-being is central to

sustainable human development – the focus of this study (Anand and Sen, 1994; Ordonez-Ponce, 2023; Henderson and Loreau, 2023). The UNDP's human development index (HDI) captures this concept (Anand and Sen, 1994). The elements of the HDI include the health of citizens (i.e. a long and healthy life), knowledge building (i.e. education) and a decent standard of living (Anand and Sen, 1994).

2.3 Role of formal governance institutions

National economic growth and development largely depend on the formal institutions governing national affairs (Peng, 2013; Fogel *et al.*, 2006; Tran and Dat Le, 2019; Myeong and Bokhari, 2023). Institutional theory (North, 2005; Peng, 2013) suggests that these formal institutions foster an enabling environment that supports productive socio-economic development programs (Fogel *et al.*, 2006; Nkya, 2003). Although not the focus of this study, informal institutions operate in parallel with formal institutions (North, 2005). Informal institutions encompass unwritten rules such as mores, social norms, codes of conduct and cultural practices that affect organisational and individual behaviours (North, 2005).

Formal institutions encompass the rule of law, regulatory quality and government policies, all of which support the functioning of a market economy (Myeong and Bokhari, 2023). These structures and constraints specify the local populace's rights, responsibilities and privileges and govern their interrelationships (Fogel *et al.*, 2006; Nkya, 2003; Tran and Dat Le, 2019). This strand of institutional theory (North, 2005) is similar to the sociological perspective of institutions (e.g. DiMaggio and Powell, 1983; Scott, 2008), which holds that organisations need to subscribe to the regulative or coercive, normative and mimetic (i.e. cultural or cognitive) institutions governing an ecological field (e.g. a country). Although North's (2005) perspective has an economic focus, it shares ground with the sociological views of DiMaggio and Powell (1983) and Scott (2008). Both views argue that institutional compliance affords an actor the legitimacy to carry out their behaviour or activities without fear of reprisal. North's (2005) institutional theory suggests that formal (i.e. regulative) and informal (i.e. normative and mimetic) institutions define acceptable and unacceptable behaviours, affecting organisational legitimacy and isomorphism. The present study focuses on formal institutions to address a gap in the literature (e.g. Malodia *et al.*, 2021; Chung, 2022; Epstein, 2022) concerning how a country's formal institutional framework shapes e-Gov, which in turn contributes to sustainable human development.

North (2005) suggested that institutions can constrain undesirable behaviours (of agents such as the state, organisations and individuals) by limiting their negative effect on society. Certain institutions enable or incentivise acceptable or desirable behaviours that promote social legitimacy. Lascaux (2023) extended this bifocal view of the functions of institutions by arguing that institutions (a) enable actors to pursue a range of opportunities, (b) constrain or inhibit certain activities and behaviours, (c) orient actors to follow a particular trajectory of actions and (d) enable actors to adapt to changing circumstances.

This study posits that the same formal institutions nurture sustainable human development. Sustainable development is founded on functional formal institutions, such as the rule of law, effective judicial systems, efficient regulatory systems, proactive policy and rule-making processes, a bureaucracy that is unimpeded by administrative rigidity and the accountable and transparent implementation of laws (Fogel *et al.*, 2006; Nkya, 2003; Tran and Dat Le, 2019; Ordonez-Ponce, 2023).

Institutions are likely to enable e-Gov adoption among Asian countries. Government policies and laws are needed to enable e-Gov (e.g. Sharma *et al.*, 2021; Glyptis *et al.*, 2020; Epstein, 2022). However, previous studies have largely been qualitative case studies that presented anecdotal evidence and relied on cross-sectional data with ambiguous theoretical foundations (Rizwan *et al.*, 2024; Vidasova and Dawes, 2017). Other studies have measured simple correlations between loosely defined institutions and their effects on e-Gov and economic growth (e.g. Adam, 2020; Addo and Senyo, 2021). Finally, the consequential causal

interactions among a country's institutional quality, e-Gov and sustainable human development remain fragmented and least explored despite the assumed importance of institutions in national development (Ravšelj *et al.*, 2022; MacLean and Titah, 2022; Zhang and Kimathi, 2022; Adam, 2020).

2.4 Conceptual model of the study

Figure A1 [1] presents a conceptual model based on the three research questions and the foregoing arguments. This study posits that formal governance institutions have direct positive effects on both e-Gov and the HDI (RQ1 and RQ2). Moreover, it shows that e-Gov has direct positive effects on the HDI (RQ3). Furthermore, the proposed model indicates that e-Gov is a mediator between formal governance institutions and the HDI, highlighting its enabling and facilitative role in sustainable human development.

Drawing on the foregoing discussion and conceptual model presented in Figure A1 [1], this study tests the following hypotheses.

- H1. Institutions have necessary and significant positive effects on the implementation of e-Gov in Asian countries.
- H2. Institutions have necessary and significant positive effects on the HDI in Asian countries.
- H3. e-Gov has necessary and significant positive effects on the HDI in Asian countries.

3. Data and methods

This study used longitudinal data from the United Nations e-Government Survey, World Governance Indicators and UNDP to empirically answer the research questions. Following the official geographic classification of countries of the United Nations Statistics Division (UN, 2024), this study identified a sample of 45 Asian countries for which data on the variables relevant to this study are available. Given its socio-economic, political and technological diversity, Asia provides a rich context for investigating the interplay between institutions, e-Gov and sustainable human development. The digital divide is highly evident in this region. For instance, 100% of the population uses the internet in Bahrain, in contrast with 18% in Afghanistan (World Bank, 2024). Moreover, as of 2024, 9 of the 20 countries with the highest number of Internet users, including China, India and Japan, are in Asia, whereas the citizens of North Korea, Myanmar and Cambodia continue to struggle with limited or no Internet access (Internet World Stats, 2024). The region has a rich tapestry of socio-political institutions, given that it is home to Singapore, one of the most economically free and least corrupt countries in the world, and North Korea, Burma and Afghanistan, which are three of the most repressed and corrupt countries in the world (Heritage Foundation, 2024).

3.1 Measurement

In measuring the quality of formal governance institutions in a country, this study adopted the governance quality index developed by the World Bank (Kaufmann *et al.*, 2010). Although the index has several indicators, this study followed Kostova's (1997) and Parboteeah *et al.*'s (2008, p. 798) recommendation to "use only those elements that are most relevant to the research topic". This study incorporated relevant indicators into the conceptual model to maintain simplicity and clarity. Formal governance institutions encompass four dimensions: voice and accountability, rule of law, government effectiveness and regulatory quality.

The study measured e-Gov using the e-government development index, representing the capacity of a government to use ICT in public services (UN, 2022). The e-Gov index has four sub-indices: e-participation, online service, human capital and infrastructure indices

(UN, 2022). The index ranges from 0 (representing a low level of e-Gov) to 1 (representing a high level of e-Gov).

The study adopted the HDI designed by the UNDP to capture sustainable human development. The HDI measures citizens' long and healthy life, knowledge or education and standard of living (Anand and Sen, 1994).

To account for lagged effects, the study used data from 2012 to 2022 for institutions and e-Gov and HDI data from 2012 to 2021 (the most recent available) to maximise data availability (i.e. minimise missing data). Measuring institutional changes over a period of 7–10 years enables the capture of more nuanced lagged causes and effects of a country's growth and development. Table A1 [1] presents the descriptive statistics and intercorrelations of variables used in this study.

3.2 Dynamic analysis using a cross-lagged panel method of path analysis

This study used a CLPM (Cole and Maxwell, 2003; Selig and Preacher, 2009) to measure the direction and strength of cause–effect relationships of the study's variables over two or more periods. The CLPM measures the causal effects of predictor variables at Time 1 on the outcome variables at Time 2 while accounting for lagged effects or changes over time. Following recommended procedures for the CLPM (e.g. Falkenström *et al.*, 2022; Martens and Haase, 2006), five structural models were developed and tested using a partial least squares (PLS) approach to path analysis aided by WarpPLS v8 software. The PLS approach to path analysis (Kock, 2023; Hair *et al.*, 2022) is a structural equation modelling of multiple regressions that captures interrelationships of variables using a small dataset, such as that used in the present study. This study followed the generally accepted standard PLS structural equation modelling process recommended by Hair *et al.* (2022) and PLS algorithms developed by Lohmöller (1989) and Wold (1982). This approach enabled a structural model analysis that captured the causal effects of institutions on both e-Gov and the HDI and the influence of e-Gov on the HDI, using data for Time 1 (2012) and Time 2 (2021/2022).

4. Empirical results

The first model, shown in Table A2 [1], is the baseline stability model, where T_1 and T_2 values are correlated to show the autoregressive paths and the relative stability of the variables (Martens and Haase, 2006; Kenny, 1975). The four cross-lagged models show the progressive inclusion of variables in predicting the T_2 -dependent variables and the relative strength of each variable in predicting an outcome (Martens and Haase, 2006). Table A3 [1] summarises the five models with their corresponding parameters. This process, called competing model analysis (Garrido *et al.*, 2022), enables the robust determination of sound models with sufficient predictive power.

The baseline stability model shows the significant path coefficients between T_1 and T_2 constructs with large effect sizes, suggesting substantively meaningful relationships (Cohen, 1992). The r^2 values show the power of the independent variables to explain the variations in the dependent variables in the model. The Stone–Geisser Q^2 measures how well the model and its parameter estimates reproduce the observed values (Geisser, 1974; Stone, 1974). A value of Q^2 greater than zero suggests the model's acceptable predictive validity. The average path coefficient (APC), average r -squared (ARS) value, average variance inflation factor (AVIF) and Tenenhaus goodness-of-fit global index were adopted in the current study (Kock, 2023). The APC, ARS and AVIF indicate the average strength and significance of the relationships between variables, the predictive power of exogenous variables over endogenous variables and the potential for multicollinearity, which can undermine the validity of the model (Kock, 2023). The nonlinear bivariate causality direction ratio (NLBCDR) is a measure of the extent of the hypothesised direction of the causal links in a model (Kock, 2023). An NLBCDR greater than 0.70 suggests weak evidence of potential reverse causality between variables.

Significant APC and ARS values and a low AVIF (i.e. <5) suggest a good fit between the data and model (Kock, 2023). The goodness-of-fit index, calculated as the geometric mean of the average communality and average r^2 , validates the global model (Kock, 2023). Wetzel *et al.* (2009) suggested that goodness-of-fit indices of 0.1, 0.25 and 0.36 represent small, medium and large effect sizes, respectively. The results show an acceptable fit between the data and baseline stability model. The NLBCDR values suggest weak evidence of reverse causality.

Models B, C, D and E are cross-lagged models. All these models have an acceptable fit with the data. The results suggest that institutions₁ has significant positive effects on e-Gov₂ and HDI₂. The results suggest the causal effect of institutions on e-Gov and the HDI. e-Gov₁ is positively related to HDI₂, which suggests the causal effects of e-Gov on the HDI.

To test the mediating effects of e-Gov in the relationship between institutions and the HDI, we tested Model E, showing the partial and full mediation by e-Gov. As shown in Table A3 [1], Model F is a full mediation model in which e-Gov₂ fully mediates the effects of institutions₁ on HDI₂. Model G shows e-Gov₂ partially mediating the effects of institutions₁ on HDI₂. We include the level of income (1 = low and low middle income and 2 = upper middle and high income) of each country following the World Economic Forum's and World Bank's classification of countries by gross domestic product.

The results show the significant positive effects of institutions on e-Gov and those of e-Gov on the HDI (i.e. Models F and G). Income significantly moderates the effects of e-Gov₁ on HDI₂, suggesting that e-Gov leads to a higher HDI, especially among upper-middle- and high-income countries. These results indicate that e-Gov is a partial mediator in the relationship between institutions and the HDI. Models H and I confirm these findings.

Necessary condition analysis

Necessary condition analysis (NCA) results (Dul, 2020; Dul *et al.*, 2023) are presented in Figure A2 [1] and Table A4 [1]. Figure A2 [1] presents three NCA scatterplots, showing the magnitude of constraints of institutions on e-Gov and the HDI, in addition to the effects of e-Gov on the HDI. The NCA scatterplots show a substantively empty space (upper left corners) beyond the ceiling lines, indicating the extent of the conditional effects of predictor variables (e.g. institutions) on the outcome variables (e.g. e-Gov and the HDI).

Figure A4 [1] shows that the effect sizes are significant (0.20–0.24), and on average, more than 50% of the ranges of the outcome variables (e.g. e-Gov and the HDI) are conditioned by the relevant predictor variables. For instance, the bottleneck results show that e-Gov is a necessary condition for explaining approximately 69% of the variation in the HDI. These results suggest that institutions are needed to improve e-Gov and the HDI and that e-Gov plays a crucial role in determining a country's HDI.

5. Discussion of findings

This study examines the interplay among formal governance institutions, the quality of e-Gov and sustainable human development in a sample of Asian countries. Drawing on institutional theory (North, 2005), the study posits that e-Gov mediates the positive effects of good governance institutions on sustainable human development. This argument challenges the popular notion that e-Gov *per se* is an antecedent or determinant of good governance. When a country's formal institutions support good governance, the implementation of e-Gov strengthens the country's governance capability to pursue developmental goals aimed at sustainable human development. This is evident in countries such as Singapore, Japan and South Korea, where advanced formal institutional frameworks causally drive well-developed e-Gov and a higher HDI relative to other Asian countries.

These findings present strong empirical evidence for an affirmative answer to the first research question. They show that institutions have positive, significant and necessary effects

on the effective implementation of e-Gov in Asian countries, supporting H1. This empirical result is more robust than the qualitative, rhetorical or anecdotal propositions claimed in previous studies on the role of formal institutions, such as government policies and political instruments, in enabling e-Gov implementation (e.g. Sharma *et al.*, 2021; Epstein, 2022; Glyptis *et al.*, 2020). This finding presents a counterargument to the view of Adam (2020) and Malodia *et al.* (2021) that institutional quality mediates or moderates, rather than drives, e-Gov towards national development. Adam (2020) argued that institutional quality functions as a mediating variable, shaping the potential advantages of e-Gov into developmental outcomes such as corruption control. Malodia *et al.* (2021) posited that political stability, a key feature of effective institutions, moderates the effect of e-Gov on the achievement of development goals. However, both studies asserted that a country's institutional framework is the foundation of e-Gov. The present study's findings highlight the formal role of governance institutions as a driver of e-Gov and not vice versa. Furthermore, the findings highlight the necessary causal effects of institutions on e-Gov, which is an important and novel research outcome relative to previous studies that focused solely on intervariable relationships (see Ravšelj *et al.*, 2022).

The positive causal effects of institutions on the HDI are evidence of an affirmative answer to the second research question and thus support H2. Formal institutions such as the rule of law, government efficiency and accountability are necessary preconditions of good governance, and the formal institutional landscape for good governance is a prerequisite for the national pursuit of human-centred development. This finding extends the arguments posed by previous correlational studies (e.g. Adam, 2020; Dhaoui, 2022; Rizwan *et al.*, 2024) by demonstrating that institutional quality is a necessary condition for sustainable human development.

The positive and causal effects of e-Gov on the HDI support the third and final research question and thus confirm H3. This is a novel finding in that previous study presented anecdotal and rhetorical arguments about the assumed link between the two variables (e.g. Rizwan *et al.*, 2024; Addo and Senyo, 2021). The present study extends Epstein's (2022) and Sharma *et al.*'s (2021) findings (i.e. strong correlations between e-Gov and national development outcomes) by demonstrating the necessary causal effects of e-Gov on the HDI as a proxy for sustainable human development.

The results of this study highlight the mediating role of e-Gov in the relationship between institutions and the HDI, suggesting a facilitative role of e-Gov in sustainable human development. However, this finding may be preliminary in that it might reflect a reverse causality between e-Gov and institutions. Future studies using a longer time series of panel data are thus warranted.

The results show the strong moderating effects of income in the relationship between e-Gov and the HDI. This finding is unsurprising given that advanced countries, such as Japan, Singapore and Korea, tend to lead others in e-Gov. E-Gov is a resource-hungry initiative that requires substantial capital investment in technology and human resource development across various sectors of society. Hence, higher-income countries tend to benefit more from e-Gov aimed at sustainable human development.

Finally, the CLPM and NCA results, demonstrating the necessary effects of institutions on e-Gov and the HDI and those of e-Gov on the HDI, offer more robust and replicable empirical evidence on the causal relationships of the variables hypothesised in this study (i.e. H1–H3).

6. Conclusion, recommendations and implications

Formal governance institutions enable the governments of Asian countries to deliver public services with increased efficiency, transparency and citizen engagement. These formal institutions serve as the seedbed on which e-Gov assumes its facilitative power in good governance aimed at sustainable human development. Therefore, the challenge for Asian countries is to strengthen these formal institutions. Institutional building is a prerequisite for good governance and cannot be substituted with e-Gov. In no way can e-Gov mask any

underlying governance issue that debilitates a government's efforts to improve citizen well-being. In effect, the formal institutions of good governance are the scaffolding of e-Gov.

This study has limitations that point to avenues for future research. First, future studies should explore other mechanisms by which institutions enable or constrain actors to adapt to new technologies. Extending the time-series data would help uncover the more complex cause-effect relationships of the focal variables, given that the use of two time periods in the present study is exploratory and constrained by data availability. Moreover, the study's measure of institutions of good governance is rather generic and does not capture the more nuanced articulations of institutions as society's rules of the game (North, 2005). A more extensive measurement model can be developed in future studies to capture more specific forms of formal institutions that are indigenous to developing country contexts. Furthermore, this study focuses exclusively on formal institutions. Future studies should consider informal institutions that may affect e-Gov, especially in developing Asian countries. Finally, future studies should focus on how Asian countries address artificial intelligence and its effects on institutions, e-Gov and sustainable development.

A critical policy implication of this study is that government policies on digital inclusiveness should connect people and communities, especially in developing Asian countries. The reliability of e-Gov platforms, data privacy and security and the coordination of e-government services should form part of an integrated policy framework to strengthen e-Gov as a mechanism for sustainable human development. Asian governments must enact new or review existing laws and policies supporting digital innovations for better service delivery. Proactively responding to the outcomes of periodic global or regional surveys on governance quality, e-Gov, the HDI and sustainable development goals will empower government agencies to pursue reforms. Intercountry benchmarking will facilitate comparative analysis aimed at collaborative learning and building an Asian network of knowledge to inform institutional development and e-Gov implementation. Governments in Asian countries should invest in strengthening formal institutions to establish a robust digital governance platform on which innovations in e-Gov can positively affect people's lives.

Finally, Asian countries must invest in citizen participation, engagement and empowerment in advocating for transparent governance facilitated by e-Gov through digital citizenship. e-Gov should empower citizens to participate in governance, aiming to foster social innovations that facilitate sustainable human development as Asian countries navigate the digital age.

Notes

1. Please see it on the Online [Appendix](#).

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Supplementary material

The supplementary material for this article can be found online.

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