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THE DIGITAL PERFORMANCE AND COMPETITIVENESS OF PUBLIC SECTOR INSTITUTIONS IN SOUTHEAST ASIA

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Abstract

Digital competitiveness relies on the interplay between innovative ecosystems, multifaceted digital tools, and robust institutional frameworks. As nations undergo digital transformation, public authorities must adopt policies that promote digital inclusion, cyber resilience, and cross-border digital exchange. However, these efforts are often uneven, creating disparities that challenge competitive parties, particularly among developing countries. This paper examines the digital performance and competitiveness of public sector institutions in Southeast Asia, a region characterized by economic dynamism and increasing global relevance. Grounded in institutional theory and digital diffusion theory, the paper assesses digital governance using internationally recognized indices. Employing panel data from 2003 to 2022, the econometric analysis identifies institutional quality and demographic factors as key drivers of E-government performance in the region. The findings extend theoretical insights by demonstrating the conditional impact of macroeconomic factors and political stability on digital adoption. This paper also advances the understanding of structural determinants of digital competitiveness and provides actionable insights for policymakers. Recommendations focus on institutional reforms to enhance transparency, public trust, and political stability to ensure sustainable digital transformation and global competitiveness.

Keywords: *digital performance, competitiveness, public institutions, Southeast Asia*

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1 INTRODUCTION

In the global economic landscape, emerging Asian economies are distinctive with their robust recovery trajectories. Notably, the South Asia region achieved an impressive average growth rate of 6.3% in 2022 and 6.8% in 2023 (World Bank, 2025). Central to this upward trajectory is a competitive edge sharpened by their digital transformation, which has been most pronounced in regions that acutely felt the pandemic's sting. The development of digital health solutions and multifaceted digital tools, crafted by an alliance of public and private entities, not only provided a buffer against the pandemic but has also forged a path towards the post-pandemic future.

The digital era is not merely defined by technological advancements but also by the institutional and economic structures that shape the adoption and diffusion of these technologies. As nations navigate this transformative period, public authorities must create policies that address digital inclusion, cyber resilience, and cross-border digital exchange (OECD, 2020). These policies are critical to maintaining the competitive stance of these countries in the global market. However, the extent to which digitalization enhances government performance depends not only on the availability of technology but also on the institutional framework that governs its implementation and adoption (see, e.g., Pérez-Morote et al., 2020; Ionescu et al. 2022).

Despite substantial investments in digital infrastructure, disparities remain in how governments leverage digital tools to enhance public service delivery and governance efficiency. This paper builds on institutional and digital diffusion theories to investigate the determinants of digital performance and competitiveness in public sector institutions in the Southeast Asian region. Institutional theory suggests that government effectiveness, regulatory quality, and trust in institutions significantly impact the success of digital transformation. Meanwhile, digital diffusion theory highlights the role of macroeconomic conditions, demographic factors, and technological infrastructure in shaping E-government development (see, e.g., DiMaggio & Powell, 1983; North, 1990; Zhang et al., 2014; Liva et al., 2020). By incorporating such theoretical frameworks, this study seeks to contribute to a broader understanding of the institutional and economic factors that drive digital governance in developing economies.

This study aims to address two key questions:

1. How do institutional and economic factors influence the digital performance and competitiveness of public institutions (E-government) in Southeast Asia?
2. To what extent do these factors align with predictions from institutional and digital diffusion theories?

This study extends existing literature by moving beyond descriptive comparisons and case studies, offering a theoretically grounded examination of E-government performance in the region and an original econometric analysis. Using panel data econometric techniques, we empirically assess the role of macroeconomic, institutional, and demographic factors in shaping digital governance outcomes. Our findings contribute to the ongoing discourse on digital transformation by demonstrating the extent to which institutional effectiveness, regulatory frameworks, and governance structures impact E-government performance in developing economies.

The remainder of this paper is structured as follows: Section 2 provides a review of relevant literature, outlining key theoretical perspectives on digital governance and the factors influencing E-government development. Section 3 presents an assessment of E-government performance in the Southeast Asian region based on internationally recognized digital performance indicators. Section 4 details the empirical methodology and data analysis, while Section 5 discusses the results. Finally, Section 6 concludes with a summary of key findings, theoretical contributions, and policy recommendations for enhancing digital governance in developing economies.

2 LITERATURE REVIEW

According to Sorbe et al. (2019), a range of government policies are required to support the diffusion and efficient use of digital technologies. Institutional frameworks, regulatory effectiveness, and governance structures play a fundamental role in the successful adoption of digital transformation strategies. This implies that governments should undergo digital transformation through proper policies to enable a well-balanced market digitalization. These policies include:

- Implementation of regulatory frameworks that support investment in broadband and pro-active reforms to increase competition in telecommunication sectors to enable cheaper and broader access to high-speed internet.

- Increased participation in training, with a focus on low-skilled workers, and its quality, as well as promotion of good cognitive, organizational, and managerial skills.
- Reallocation of labor and capital across firms and industries through a reduction of administrative burdens on start-ups, facilitating job transition and improving the efficiency of insolvency regimes.
- Reduction of the financial constraints for young innovative firms and encouraging the development of venture capital markets.
- Enhancing competition in digital markets through reduction of barriers to cross-border digital trade, taking into account the strong network effects and central importance of data characterizing certain digital activities.
- Strengthening institutional quality and governance mechanisms to ensure long-term sustainability and resilience of digital government initiatives.

While digital technologies bring significant opportunities for economic growth and productivity enhancement, their impact varies widely depending on the institutional and governance frameworks of each country (Gal et al., 2019). Thus, digital transformation is not merely a technological shift, but a fundamental restructuring of how public institutions function and interact with citizens.

Liva et al. (2020) performed a literature review covering studies of the past decade. Their results confirm the complexity of the barriers and preconditions for a successful digital government transformation which are often technology unrelated. This is because the introduction of new technologies by governments is always mediated by organizational, institutional, legal, ethical, and social factors. Thus, the effectiveness of digital government strategies depends on the alignment between policy objectives and institutional capacities (Sanina et al., 2023).

The importance of government digital transformation (GDT) has also been shown empirically by several studies such as, e.g., de Vries et al. (2016) and Sanina et al. (2023). These studies have demonstrated the importance of GDT in developing, reshaping, or transforming the public sector in terms of socio-economic efficiency. More specifically, Sanina et al. (2023) highlight that governance quality and regulatory stability significantly influence the effectiveness of digital government initiatives, aligning with institutional theory predictions. Other studies emphasize the necessity of institutional adaptability and regulatory flexibility in ensuring the long-term effectiveness of E-government policies (Nanos, 2019; Xavier, 2021).

One of the critical factors required for a successful digital transformation is documented to be a governance structure for executing policies. Research has also shown a positive relationship between the use of E-government in public administration and political trust, as well as trust in public institutions. Namely, Lissitsa (2021) found that the use of E-government and social media in the Middle East was positively related to political trust, which aligns with digital diffusion theory's emphasis on the socio-political context of technological adoption. Also, the digital governance landscape in Southeast Asia has evolved rapidly in response to global economic and technological changes. Studies by Mondejar et al. (2021) and Xavier (2021) emphasized the contribution of digital reforms in the public services of several countries in Southeast Asia, pointing to the great challenges created with regards to the social and economic prosperity of this region.

In this respect, a meta-analysis of the relevant literature by Zhang et al. (2014) identified three categories of factors influencing the diffusion of E-governments: a) technological factors, b) organizational factors, and c) institutional, policy, and culture environment (see also Arduini et al., 2010; Zhao et al., 2014; Ionescu et al., 2022). Other competencies and contextual factors

associated with technology development and diffusion are macro-economic indicators (unemployment rates, investment, competition), demographic factors (population age and size, urbanization), education, and tourism among others (Baldersheim & Ogard, 2008; Arduini et al., 2010; Dang Nguyen et al., 2013; Attour & Chaupain-Guillot, 2020).

In view of the previous analysis and despite heavy investments into the development of E-government services by public institutions, the adoption rates by citizens remain relatively low, which reinforces the need to examine deeper the institutional and socioeconomic determinants of digital governance (Pérez-Morote et al., 2020). By integrating insights from institutional and digital diffusion theories (North, 1990; Rogers, 1995), this paper provides a framework for assessing the effectiveness of digital government initiatives in Southeast Asia, which is missing from existing literature.

Research Questions and contribution

Building on the gaps identified in the literature, this study formulates the following research questions:

- **RQ1:** How do institutional and economic factors influence the digital performance and competitiveness of public institutions (E-government) in Southeast Asia?
- **RQ2:** To what extent do these factors align with predictions from institutional and digital diffusion theories?

To answer the above questions, the following hypotheses are formulated**:**

- **H1:** Institutional quality positively influences E-government performance in Southeast Asian countries.
- **H2:** Regulatory effectiveness enhances digital competitiveness by increasing public trust and adoption of E-government services.
- **H3:** Countries with greater political stability exhibit higher E-government performance due to consistent and long-term policy commitments.
- **H4:** Macroeconomic and demographic factors, such as income, unemployment rate, and urbanization, mediate the relationship between digital policy initiatives and E-government performance.

This paper moves beyond the descriptive and repetitive case studies that dominate the existing literature on digital governance in developing countries (de Vries et al., 2016; Liva et al., 2020). By explicitly grounding the research in institutional theory and digital diffusion theory, this paper provides a robust theoretical and empirical framework for understanding the drivers of E-government performance. Unlike previous studies that often focus solely on benchmarking indicators or documenting policy initiatives, this paper integrates institutional quality, regulatory effectiveness, and macroeconomic conditions as key explanatory factors. This alignment allows for a deeper exploration of the structural and systemic determinants of digital competitiveness, offering insights that extend beyond the Southeast Asian context to contribute to broader theoretical debates in governance and technology adoption.

3 GOVERNMENT DIGITAL PERFORMANCE INDICATORS

To answer the research question posed above, we first investigate and compare government digital performance among the countries of Southeast Asia. For that purpose, we collected the

following indicators (a) the E-Government Development Index, abbreviated as EGDI, which is compiled by the United Nations (UN), (b) the SMS Policy Indicators compiled by the OECD, (c) the Global Competitiveness Indicators compiled by the World Economic Forum, (d) the IMD World Digital Competitiveness Ranking, and (e) the OECD Digital Government Index.

(a) E-Government Development Index (EGDI)

This index has been compiled by the United Nations to examine the level of E-government development in its member states. It is a composite index that provides an assessment of the website development patterns in a country. It also incorporates access characteristics, such as the infrastructure and educational levels, to reflect how a country uses information technologies to promote access and inclusion of its people.

The EGDI consists of the weighted average of three independent subcomponents, that are classified as follows:

- *The Online Services Index (OSI)*
- *The Telecommunications Infrastructure Index (TII)*
- *The Human capital Index (HCI)*

As indicated by the report of the United Nations (2022), the EGDI is not designed to capture E-government development in an absolute sense but, rather, it aims to provide a performance rating of national governments relative to one another. Its methodology is based on a comprehensive survey of the online presence of all 193 United Nations member states, which assesses national websites and how E-government policies and strategies are applied in general and in specific sectors for delivery of essential services. The survey results are tabulated and combined with a set of indicators embodying a country's capacity to participate in the information society, without which E-government development efforts are of limited immediate use.

The EGDI represents a weighted average of three normalized scores on the three most important dimensions of E-government. The indices are a composite measure that can be extracted and analyzed independently. The EGDI values range between 0 and 1, and countries are grouped into four categories that are mathematically defined as follows: 1) countries with very high EGDI (range of values from 0.75 to 1.00 inclusive), 2) countries with high EGDI (range of values from 0.50 to 0.7499 inclusive), 3) countries with middle EGDI (range of values from 0.25 to 0.4999 inclusive), and 4) countries with low EGDI (range of values from 0.00 to 0.2499 inclusive). Among all 193 countries included in the 2022 survey, Denmark ranked first with a value of EGDI equal to 0.9717, followed by Finland and the Republic of Korea with values 0.9533 and 0.9529 respectively.

Focusing on the Southeast Asia region, the scores of the relevant countries in terms of the global 2022 EGDI are displayed in Fig. 1. First in the ranking comes Singapore, which seems to be the leader in the region. Malaysia and Thailand come next with very high EGDI values (above 0.75), followed by Brunei and Indonesia with values around 0.70. High EGDI values (0.50 to 0.7499) are also found in Vietnam, the Philippines, and Cambodia. The rest of the countries are characterized as middle EGDI countries with values between 0.3764 and 0.4994.

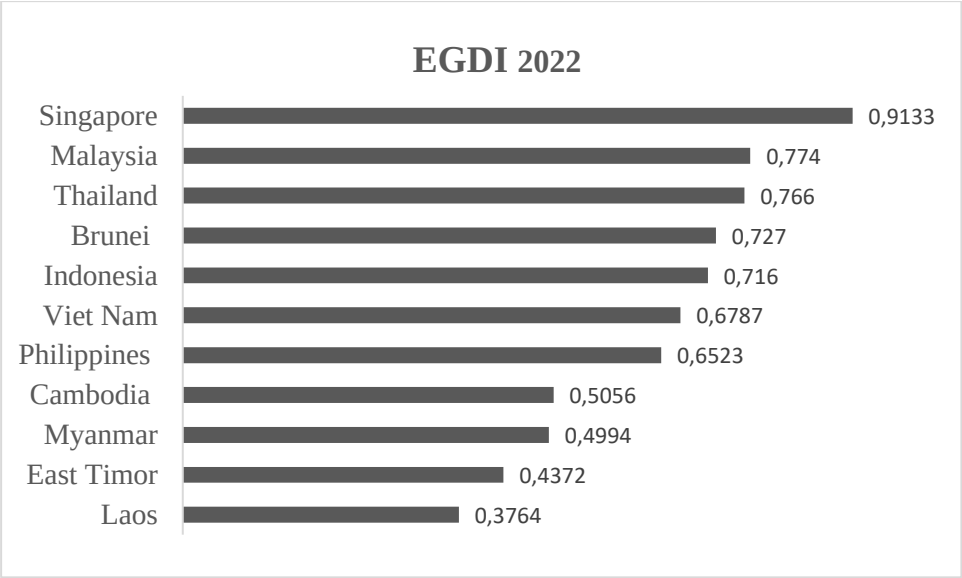

Fig. 1 – The ranking of East-Asian economies in global E-Government development in 2022. Source: United Nations, E-Government Survey 2022.

To better understand the dynamics of the East-Asian region in terms of EGDI, Tab. 1 presents the relative position of each country in 2010 as compared to 2022 in the world ranking. Among all 193 countries included in the evaluation of EGDI, Singapore was found in the 11th position in 2010 and 12th in 2022, which indicates that it is classified among the best-performing countries in the world. Furthermore, Singapore's performance presents a huge gap from the rest of the countries in the region, which rank substantially lower (with one exception, Malaysia, that ranked 32nd in 2010). Remarkable progress can be seen in the case of Indonesia, which improved its rank by 32 places in 2022 as compared to 2010. Thailand also improved its rank by 21 places since 2010, in contrast to Malaysia that moved down 21 places (from the 32nd rank in 2010 to the 53rd rank in 2022) in the global ranking.

Tab. 1 – The E-Government Development Index (EGDI) for 2022. Source: United Nations E-Government Survey, 2022.

COUNTRY	**Rank 2010**	**Rank 2022**	**EGDI 2022**	**Rank Change**
Brunei	68	68	0.7270	-
Cambodia	140	127	0.5056	13
Indonesia	109	77	0.7160	32
Laos	151	159	0.3764	-8
Malaysia	32	53	0.7740	-21
Myanmar	141	134	0.4994	7
Philippines	78	89	0.6523	-11
Singapore	11	12	0.9133	-1
Thailand	76	55	0.7660	21
East Timor	162	147	0.4372	15
Viet Nam	90	86	0.6787	4

Table 2 displays the 2022 ranking of EGDI by subcomponent**.** In the third column, EPI denotes E-participation of the government and captures the following services: availability of social networking facilities, report corruption by public servants or institutions, functionality of live chat support, option of feedback to improve useability and/or accessibility of E-services, online tools to obtain raw inputs for policy deliberation, announcements of any upcoming public engagement or E-participation activities, evidence of any outcome of E-consultations that result in new policy regulations/decisions/services, open government datasets, among others.

Thus, the EPI is a multidimensional framework that is composed of three core components: (i) E-information: enabling participation by providing citizens with public information and access to information without or upon demand, (ii) E-consultation: engaging citizens in contributions to and deliberation on public policies and services, and (iii) E-decision-making: empowering citizens through co-design of policy options and co-production of service components and delivery modalities. According to the U.N. E-government 2022 survey, government efforts to actively engage the public in E-consultations and other forms of E-participation remain somewhat limited.

The online service index (OSI) is a tool that was designed to support evidence-based data and provide them via an online E-government service provision across the 193 member states. The questions on which the assessment is based are categorized into five discrete thematic areas that constitute five subindices: technology (TEC), institutional framework (IF), content provision (CP), services provision (SP), and E-participation (EPI), all of which result in the OSI index, which is calculated using the normalized values of each of the five subindices.

The telecommunication infrastructure index (TII) is computed taking the arithmetic average of four indicators: 1) the estimated number of internet users per 100 inhabitants, 2) the number of mobile subscribers per 100 inhabitants; 3) the number of fixed broadband subscriptions per 100 inhabitants, and 4) the number of wireless broadband subscriptions per 100 inhabitants. The primary source of data is the International Communication Union (ICU), and the data was extracted in February 2022.

Tab. 2 – The EGDI index by components for survey year 2022. Source: United Nations, E-Government Survey 2022.

COUNTRY	**EDGI**	**EPI**	**OSI**	**TII**	**HCI**
Brunei	0.7270	0.4773	0.5871	0.8372	0.6903
Cambodia	0.5056	0.2841	0.3073	0.5605	0.5468
Indonesia	0.7160	0.7159	0.7644	0.6397	0.7645
Laos	0.3764	0.2614	0.3005	0.2820	0.5380
Malysia	0.7740	0.6818	0.7630	0.7945	0.7629
Myanmar	0.4994	0.3068	0.3931	0.6082	0.5546
Philippines	0.6523	0.4886	0.6303	0.5638	0.7438
Singapore	0.9133	0.9773	0.9620	0.8758	0.9021
Thailand	0.7660	0.7841	0.7763	0.7338	0.7879
East Timor	0.4372	0.4773	0.4181	0.3640	0.5829
Viet Nam	0.6787	0.5341	0.6484	0.6973	0.7567

The last column displays the index of human capital (HCI), which includes four sub-components: (i) the adult literacy rate; (ii) the combined primary, secondary, and tertiary gross enrolment ratio; (iii) the expected years of schooling, and (iv) the average years of schooling. The data for HCI components was extracted from UNESCO-UIS in October 2021.

The ranking in Table 2 indicates that Singapore ranks first in all subcomponents as well. Among the rest of countries, Thailand ranks higher in the first three subindices (EPI, OSI, and HCI), while Brunei is ahead of the others in the telecommunication infrastructure (TII). A more robust analysis will be performed in sections 4 and 5 using all of the above indices.

(b) The ASEAN SME Policy Index assessment

Another source for our assessment is the OECD/ERIA (2018) on SMEs policy initiatives in the countries included in the Association of Southeast Asian Nations (ASEAN). These are Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Viet Nam. The sector of SMEs is dominant in the ASEAN area as indicated by a share of 97-99% of enterprise population representing enterprises of micro, small, or medium size enterprises. The SME Policy Index covers all areas of policy and follows as its main objectives (i) the promotion of technology, innovation, and productivity; (ii) an increased access to services such as finance; (iii) an enhancement of market access and internationalization; (iv) an enhancement of the regulatory and policy framework; and (v) the development of human capital and promotion of entrepreneurship. This policy framework was launched at the summit of ASEAN Business and Investment held in 2015 and has a time horizon until 2025. Here, we will focus on those actions mostly related to government digital performance, namely E-commerce and E-governance, which are covered by the assessment.

An increasingly important sector of the digital economy in Southeast Asia is E-commerce. Table 3 presents the scores of E-commerce use in 2018 among the ASEAN countries. The criterion of E-commerce in the rankings considers several factors that are related to the availability of E-trading platforms such as the online marketplaces, E-payments, logistic facilities, etc. They also include government programs to facilitate access to these platforms, as well as the availability of sophisticated legal and regulatory to govern E-commerce activities. Table 3 displays the 2018 ranking of E-commerce use among the ASEAN economies with respect to planning and design, implementation, and monitoring and evaluation, and total ranking. The overall scores indicate that the region performs moderately well with a median score of 4.44.

More specifically, in the pillar of planning and design, Malaysia, Singapore, and Thailand attained the highest score (6). These countries have clear legal instruments in place to govern E-commerce, E-payments, and consumer protection. In the pillar of implementation, only Singapore hit the highest score (6), while Indonesia and Thailand are ranked second (each with a score of 5.58). These scores indicate the implementation of targeted E-commerce programs for the SMEs on a national level. Notably, we make reference to the Smart Online SMEs program in Thailand and the SMEs Go Digital initiative in Singapore and Indonesia. In Malaysia, a digital free trade zone was launched in partnership with Alibaba in 2017. A similar ranking holds for the third criterion, i.e., monitoring and evaluation (Malaysia Digital Economy Corporation, 2021).

Tab. 3 – Scores of E-commerce use among ASEAN member states. Source: OECD/ERIA (2018)

	BRN	KHM	IDN	LAO	MYS	MMR	PHL	SGP	THA	VNM	Med.	StD.
Planning and design	4.74	2.24	5.58	3.90	6.00	3.50	5.58	6.00	6.00	5.16	**5.37**	**1.21**
Implementation	3.77	2.33	5.89	2.54	5.32	1.44	4.98	6.00	5.89	3.53	**4.37**	**1.59**
Monitoring and evaluation	1.55	1.00	4.87	1.00	4.88	1.00	4.32	6.00	4.30	2.10	**3.20**	**1.85**
Total sub-dimension score	3.66	2.03	5.57	2.71	5.47	2.07	5.06	6.00	5.61	3.82	**4.44**	**1.46**

Symbols: BRN = Brunei, KHM = Cambodia, IDN = Indonesia, LAO = Laos, MYS = Malaysia, MMR = Myanmar, PHL = the Philippines, SGP = Singapore, THA = Thailand, and VNM = Viet Nam.

Note: Scores range from 1 to 6 with 6 being the highest score.

Table 4 reports the scores of E-government facilities as a sub-criterion of government digital effectiveness. Digital government services can greatly facilitate the ease of interacting and exchanging information between public institutions and enterprises. More emphatically, the micro and small size enterprises may save substantial time and resources when access to digital government services is implemented. The first row of Table 4 refers to the planning and design of E-government services where the score is relatively high (median = 4.94). This can be explained by the fact that most of these economies have already achieved a good level of IT infrastructure, high levels of internet, and mobile-phone penetration. In fact, this sub-dimension includes several E-government services which are highly relevant for the MSEs' digital transformation, for instance online platforms for tax filing, pension and social security contributions, adoption of electronic signature or electronic ID among others. The scores in the second row indicate to what extent these platforms are efficiently operated and properly integrated with the other E-government services. Implementation, for example, may refer to whether enterprises must submit information to other government bodies, which may increase the burden of compliance on the SMEs. The last row refers to ways of monitoring and evaluation, for instance, whether the government collects satisfaction surveys and whether the feedback from these surveys is embedded in the platforms for improvement and enhancement.

Tab. 4 – The scores of E-government services among ASEAN member states. Source: OECD/ERIA (2018)

	BRN	KHM	IDN	LAO	MYS	MMR	PHL	SGP	THA	VNM	Median	StD.
Planning and design	6.00	1.83	5.15	1.41	4.74	1.00	5.16	6.00	5.15	3.49	**4.94**	**1.82**
Implementation	5.33	1.28	2.66	1.55	3.49	1.00	2.93	6.00	3.21	1.83	**2.79**	**1.59**
Monitoring and evaluation	6.00	1.00	4.30	1.00	5.15	1.00	2.65	6.00	3.48	1.00	**3.06**	**2.01**
Total sub-dimension score	5.70	1.41	3.86	1.39	4.26	1.00	3.65	6.00	3.94	2.24	**3.76**	**1.69**

Symbols: BRN = Brunei, KHM = Cambodia, IDN = Indonesia, LAO = Laos, MYS = Malaysia, MMR = Myanmar, PHL = the Philippines, SGP = Singapore, THA = Thailand, and VNM = Viet Nam.

Note: Scores range from 1 to 6 with 6 being the highest score.

According to the scores displayed in Table 4, E-government services are at an excellent level in Singapore (at all three criteria) and Brunei (at two out of three criteria), a relatively good level in Indonesia, Malaysia, the Philippines, and Thailand regarding planning and design as well as monitoring and evaluation, but very low in implementation, except for Malaysia. Although the median E-government services score in the Southeast region indicates a fair level

(3.76 in 2018), a large dispersion of scores can be observed across the economies. Based on the total score per country, Singapore ranks top, followed by Brunei, Malaysia, Thailand, Indonesia, and the Philippines. Very low performance is indicated for the rest of the countries.

(c) ***Global Competitiveness Indicators - World Economic Forum***

The global competitiveness report of the World Economic Forum (2020) studies countries' preparedness for the post-pandemic recovery. It highlights that the COVID-19 pandemic should act as a catalyst for countries to take on digitalization reforms, motivate businesses to adopt digital business models and boost investment in ICT and the development of digital skills.

Research suggests that, with the investment in digital and technological development, the technology frontier will significantly move forward (Gal et al., 2019). However, it is important that, at the same time, economies invest in the development of human capital and legal framework since an economy's productivity depends on how efficiently and effectively, and to what extent, businesses and citizens adopt these tools. It is also imperative that legal frameworks are designed to reflect the developments in the field of digital technology and that proper frameworks for digital business models are developed. The data show that some countries, e.g., South Korea and Japan, already widely use ICT tools (table 5). Nevertheless, the reform of business organizational models to support the revival of these economies has not been satisfactory. The results show that, among the Southeast Asian countries, only Singapore and Malaysia are ranked among the best performing countries in the global competitiveness report. Both Singapore and Malaysia scored quite high on the readiness of the digital legal framework, suggesting that the legal framework adapts relatively fast to digital business models such as E-commerce, fintech or sharing economy in these two countries.

Tab. 5 – Best performing countries in the adoption of ICT, digital skills, digital legal framework, and flexible work arrangements. Source: World Economic Forum, Global Competitiveness Indicators, 2020

	ICT Adoption	**score**	**Digital Skills**	**score**	**Digital legal framework**	**score**	**Flexible work arrangements**	**score**
1	South Korea	93.7	Finland	84.3	USA	78.0	Netherlands	82.7
2	UAE	92.3	Sweden	79.5	Luxembourg	77.4	New Zealand	77.7
3	Hong Kong	90.2	Estonia	77.9	Singapore	76.5	Switzerland	75.8
4	Sweden	89.7	Iceland	77.6	UAE	72.5	Estonia	75.0
5	Japan	88.3	Netherlands	77.3	Malaysia	70.0	USA	74.2
6	Singapore	88.1	Singapore	77.3	Estonia	69.3	Luxemburg	73.6
7	Iceland	87.8	Israel	76.5	Sweden	67.9	China	73.6
8	Norway	84.7	Denmark	74.7	Finland	67.7	Australia	72.9
9	Qatar	83.9	Soudi Arabia	74.1	Germany	67.3	Finland	72.5
10	Lithuania	83.8	South Korea	73.0	Netherlands	65.5	Denmark	72.4

(d) The IMD World Competitiveness Ranking

This ranking is assessed by the IMD World Competitiveness Center. The 2022 ranking (IMD World Competitiveness Ranking 2022) covers 63 countries and evaluates the preparedness of countries to adopt new digital technologies that would enable the transformation of existing

business models, government practices, and in general, the wider society. Only 5 countries from the Southeast Asian region were included in the 2022 global ranking of 63 countries, of which Singapore ranked 4th (improved by one place compared to the previous ranking), Malaysia ranked 31st (down by four places compared to the previous ranking), Thailand 40th (down by two places compared to the previous ranking), Indonesia 51st (improved by two places compared to the previous ranking), and the Philippines 56th (also improved by two places compared to the previous ranking).

Globalization, digital technology advancements, and the COVID-19 pandemic contributed to increased interconnectedness across economies and moved more business and personal interactions online, which also spurred the increase of cyber-attacks. The IMD World Digital Competitiveness Ranking 2022 shows that cybersecurity measures represent an important element for all sectors, both public and private. If economies aim at becoming digitally competitive, they need to have services and tools in place to protect their digital infrastructure from cyber-attacks. Furthermore, the protection of the infrastructure will further encourage an uptake and use of digital resources. Also, if governments want their citizens to take up the E-government services and digital technology tools, they need to ensure the safety of the digital systems and transparency of institutions providing digital services, especially when it comes to data usage (IMD, 2022). In addition, the privacy of digital and E-government service users must be protected by law and appropriate cybersecurity tools.

(e) The OECD Digital Government Index

The OECD Digital Government Index (DGI) measures and monitors the implementation of the recommendation of the Council on Digital Government Strategies (OECD, 2014). Adigital government is perceived as one that uses digital technology and services to create value and is an integral part of government's modernization approaches. These approaches should create an environment where government institutions, NGOs, businesses, and citizens have open access to data and services, enabling interactions with the government and among them.

The DGI assesses the extent and coherent implementation of digital government policies. The total DGI scores range from 0 (lowest score) to 1 (highest score). The index comprises the following six dimensions, which are based on the OECD digital government policy frameworks (OECD, 2020):

- Digital by design refers to a whole-of-government plan and approach for the use of digital technologies.
- The data-driven public sector refers to a country's data governance structures, infrastructure, and standards which it can use to benefit from the value of data.
- Government as a platform refers to policy frameworks for the use of digital technologies.
- Open by default refers to the openness and accessibility of data, information, and processes.
- User-driven refers to governments' adoption of tools that are in the public's interest and fulfil their demands and needs.
- Proactiveness assesses the delivery of data and services from the governments to the public, without formal requests for them and anticipating the demand for them.

Figure 2 shows the performance of selected OECD countries that took part in the survey. The average score reached by the OECD countries was 0.5, with the United Kingdom, South Korea,

Colombia, Japan, and Denmark as top performers. These countries have comprehensive digital government plans and strategies in place, developed institutional arrangements that suggest a better implementation of the digital government reforms (OECD, 2021; OECD, 2023).

The data show that, on average, OECD countries perform best with regards to the "open by default" dimension. On the other hand, on average, the countries performed worst in the "data driven public sector" and "proactiveness" dimensions. These results suggest that countries can improve in the usage of the data as an important public asset. It can help them to predict stakeholders' needs and avoid burdening them with excessive data access and delivery measures.

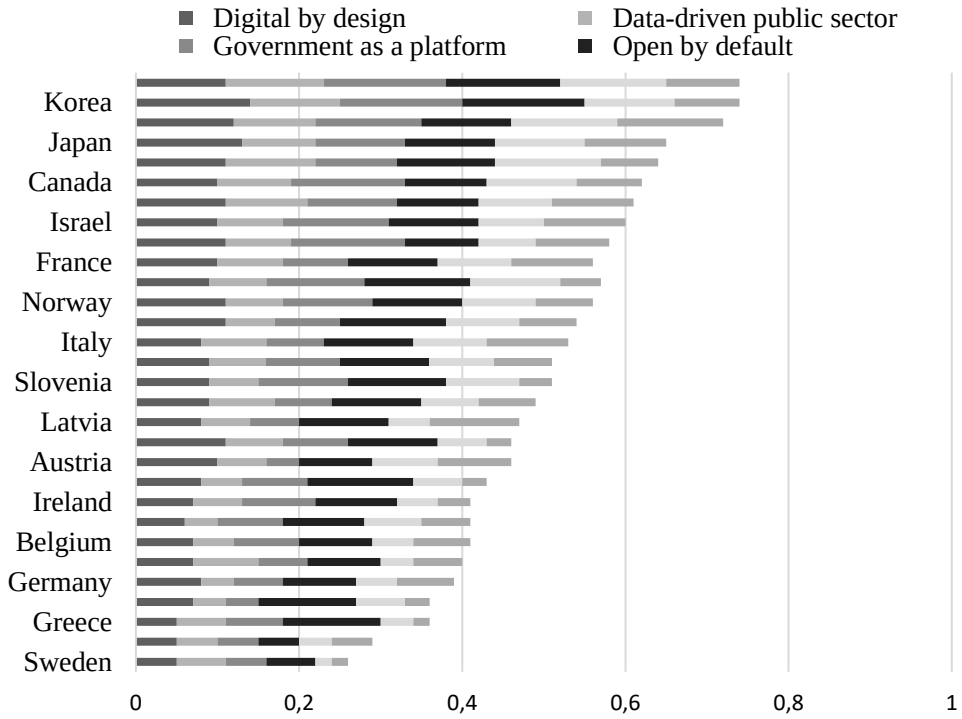

Fig. 2 –Ranking of OECD countries in terms of DGI scores Source: OECD Digital Government Index (2021).

Note: Those OECD countries that did not provide feedback on the questionnaire (such as Poland, Hungary, and Slovakia) are not included in this list.

In terms of strategy, the OECD recommends that countries implement the following measures to support the digital transition of governments from citizen-centric to citizen-driven approaches, i.e., the state, in which the citizens and businesses determine their needs together with the government:

- Utilisation of technology for better government accountability, inclusiveness and partnerships with citizens.
- Transformation of the culture in the public sector to a data-drive one.
- Technology use across public policy areas and levels of government in a coherent manner.
- Improvement of the ties between digital government and public agendas.
- Utilisation of a risk management approach to address digital security and privacy issues.
- Development of business cases to sustain the funding and success of digital technology projects.

- Strengthening of institutional management and monitoring capacities.
- Evaluation of existing assets to guide the procurement of digital technologies.
- Legal and regulatory frameworks reviewing to secure that digital opportunities are timely seized.

4 ECONOMETRIC METHODOLOGY AND DATA

This study employs a panel data econometric approach to examine the relationship between institutional and economic factors and E-government performance. The methodological framework is grounded in institutional theory and digital diffusion theory, which emphasize the role of governance structures, regulatory quality, and institutional trust in shaping technological adoption and digital transformation (see, e.g., North, 1990; DiMaggio & Powell, 1983; Zhang et al., 2014).

Theoretical Justification for Model Specification

The econometric model is designed to test hypotheses H1-H4 set out in section 2. Specifically, institutional theory predicts that variables such as institutional quality, regulatory effectiveness, and political stability will have a significant positive impact on E-government performance, reflecting the importance of governance structures in digital adoption (North, 1990). Countries with stable regulatory environments and effective institutional frameworks are more likely to experience sustained digital adoption in the public sector (DiMaggio & Powell, 1983).

Digital diffusion theory complements this view, arguing that technological adoption depends on institutional readiness, whereas digital infrastructure alone is insufficient without governance mechanisms that facilitate its uptake (Rogers, 1995). It also emphasizes the role of macroeconomic factors (e.g., GDP per capita) and demographic factors (e.g., urbanization rates) as drivers of digital technology diffusion (Zhao et al., 2014; Attour & Chaupain-Guillot, 2020; Ionescou et al., 2022). By incorporating these variables into the model, the study evaluates their direct and interaction effects on digital competitiveness, providing empirical evidence to validate theoretical expectations.

Thus, this study hypothesizes that digital government performance is influenced by three categories of variables that reflect:

Institutional quality (law, political stability, regulatory environment) as per institutional theory.

Macroeconomic environment (GDP per capita, unemployment rate, investment in ICT), that conditions technological diffusion (digital diffusion theory).

Demographic and socioeconomic characteristics (urbanization, population, education), influencing the extent of digital inclusion.

In line with the theoretical structure and related empirical practices (e.g., Attour & Chaupain-Guillot, 2020; Wandaogo, 2022), we specify the following model:

$$Y_{it} = a_i + \beta_1 Institutions_{it} + \beta_2 Macroecon_{it} + \beta_3 Demographic_{it} + \varepsilon_{it} \quad (1)$$

where i denotes an individual country and t denotes time; parameters a_i represent the country fixed effects which are unobservable, while parameters β_i symbolize the regression coefficients.

The dependent variable Y_{it} is the E-government development index as measured by the composite measure egdi but also its sub-components (see Fig. 3 and Tab. 6 below). A descriptive analysis of these indices per country was provided in section 3(a) earlier.

Three categories of explanatory variables are included in model (1); namely, *Institutions* represents institutional factors, including rule of law, regulatory effectiveness, and political stability*; Macroecon* denotes the set of macroeconomic factors assumed to influence the dependent variable such as GDP per capita and economic competitiveness indices; *Demographic* covers factors related to population and urbanization; the term α_i accounts for unobserved, time-invariant heterogeneity across countries (e.g., country-specific factors such as culture, history, or geographic location). Institutional theory emphasizes differences in governance structures across countries, which may be time-invariant but significantly impact E-government performance.

The fixed effects (FE) model is employed to control for unobserved, time-invariant factors (α_i) specific to each country, which may influence E-government performance. This approach is preferred over random effects or pooled OLS because it accounts for a potential correlation between these unobserved factors and the explanatory variables, thus ensuring unbiased and consistent estimates. By focusing on within-country variations over time, the FE model provides more accurate insights into how changes in institutional quality, economic factors, and demographic characteristics influence digital governance. The appropriateness of the FE model is supported by the Hausman test, which confirms its suitability over RE in the presence of endogeneity.

Data and variable analysis

Figure 3 displays the evolution of the composite index egdi over the period under study for each country in the sample. It is noticeable that three discrete paths can be identified over the years in terms of egdi performance. Singapore is leading the way with a considerable gap from the second group of countries that follows a fast-growing path (Brunei, Malysia, Indonesia, Philippines Thailand, and Vietnam). The third group (Cambodia, Laos, and Myanmar) grows at a relatively slow pace which, nevertheless, has accelerated significantly in the most recent years.

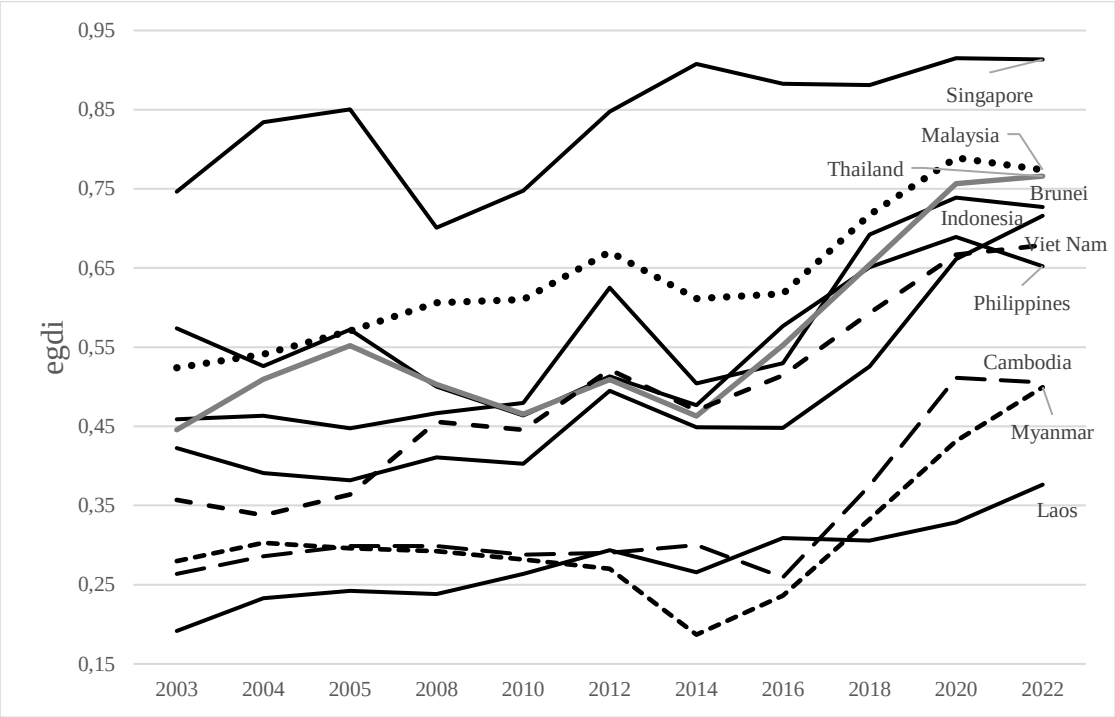

Fig. 3 – The evolution of egdi in the Southeast Asian region. Source: Graph constructed using egdi data from the UN E-government surveys

Table 6 presents the list of all dependent and explanatory variables to be used in the econometric estimations of model (1). At the top stands the main dependent variable, i.e., the composite E-government development index (egdi) followed by its four sub-components (epi, osi, hci, and tii), which will also be used as alternative dependent variables in the model estimations. The second part of table 6 displays the list of factors that were previously identified in the paper as the main influencing factors of E-government performance. The last column of the table includes the data sources.

Tab. 6 – The list of variables with definitions and sources.

A: Dependent variable	**Symbol**	**Source**[1]
E-Government Development Index	egdi	UN E-government surveys
E-participation Index	epi	UN E-government surveys
Online Services Index	osi	UN E-government surveys
Human Capital Index	hci	UN E-government surveys
Telecommunications Infrastructure Index	tii	UN E-government surveys
B: Influencing factors/Explanatory variables		
Macroeconomic		
GDP per capita (constant 2015 US$)	gdpcs	World Bank and OECD NA
Unemployment, total (% of total labor force)	ur	World Bank, WDI
Gross Capital Formation (% of GDP)	gcf	World Bank and OECD NA

Institutional		
Rule of Law[2]	law	World Bank, WDI
Political instability[3]	ps	World Bank, WDI
Regulatory Quality: Percentile Rank[4]	regul	World Bank, WDI
Demographic		
Urban population (% of total population)	urban	UN Population Division
Population ages 65 and above (% of total population)	pop65on	World Bank, WDI
Population density (people per sq. km of land area)	popdens	World Bank, WDI
Schooling	sch	World Bank, WDI

NOTES
1. The surveys were conducted in the years 2003, 2004, 2005, 2008, 2010, 2012, 2014, 2016, 2018, 2020 and 2022.
2. It captures the extent to which agents have confidence in and abide by the societal rules. The estimates range from -2.5 to 2.5 in units of the standard normal distribution.
3.The value of 0 corresponds to the lowest rank, while the value of 100 to the highest.
4. It captures perceptions of the ability of the government to formulate and implement sound policies and regulations that promote private sector development.

Model (1) was estimated using a panel data set comprising all existing years of UN E-government surveys conducted (11 years) and all Southeast Asia countries except for East Timor, which was excluded due to the large number of missing values in some independent variables (10 countries). Table 7 presents the descriptive statistics (mean, median and standard error) of all the E-government digital indicators. Separate regressions were run for each dependent variable and results are reported in Tables 8-11.

Tab. 7 – Mean values, median, and standard errors of E-government digital indices. Source: Own computations.

country	egdi	epi	osi	tii	hci
Brunei	.5575491	.2619127	.4304073	.4259209	.8174145
	.50424	.17142	.3622	.35119	.82525
	.1153344	.2341156	.1806918	.2292111	.0628297
Cambodia	.3342527	.1764055	.22164	.18396	.5986027
	.2989	.1742	.19732	.08141	.59967
	.0911623	.1101867	.1193764	.2125149	.0763412
Indonesia	.4820882	.3583645	.4426464	.2411582	.7630918
	.44784	.28571	.36232	.18966	.79
	.111572	.2345222	.1671784	.2096861	.0622228
Laos	.2770673	.1132482	.1456582	.1126182	.5739673
	.26588	.12857	.14173	.09976	.5539
	.0518989	.1149092	.0940134	.1042657	.0689009
Malaysia	.6392555	.4996836	.6859191	.4548655	.7767391
	.61152	.52941	.67716	.43975	.76911
	.0886379	.2842618	.1351066	.1819398	.0582049
Myanmar	.3100155	.0876373	.1550582	.1346064	.6414236
	.2922	.04761	.15384	.00449	.70642
	.086952	.1078142	.0847086	.2268861	.1159506
ıilippines	.5631473	.5015282	.6245827	.2529255	.8121245
	.57211	.4886	.6303	.20822	.83414
	.0756102	.2349413	.1456561	.1921672	.0883313
Singapore	.8387736	.8447418	.8947264	.7434809	.8785418
	.8503	.91525	.96911	.69229	.87
	.0747933	.1733359	.1484309	.1145594	.0288549
Thailand	.5615154	.4199327	.5570182	.3262109	.8016845
	.50956	.3158	.53281	.23608	.7903
	.1139518	.2582257	.1493912	.2338245	.0733007
Viet Nam	.4913773	.3624464	.4319	.30683	.7358427
	.47045	.49019	.42483	.37145	.74336
	.1180019	.2902805	.2033504	.2363294	.0916892
Total	.5055042	.3625901	.4589556	.3182576	.7399433
	.49975	.271955	.442875	.267785	.7586
	.1854459	.2976762	.270209	.2613962	.1212891

From the data in table 7, we see that there is considerable variation among the countries in their performance across different social, governmental, and environmental metrics. Singapore consistently shows high scores, indicating strong performance across all indices. Meanwhile, countries like Cambodia and Laos show room for significant improvement in several areas.

5 RESULTS

The tables that follow display the parameter estimates of model (1) with the dependent variable of each indicator and the set of independent variables described in table 6. In all tables, the estimates in columns (1) - (2) are derived from the pooled OLS estimations with robust standard errors to correct for possible heteroskedasticity that may result from the cross-sectional part of the panel. Columns (3) - (5) report the fixed effects (FE) estimates with robust standard errors as well. The values in parenthesis report the significance levels (p-values) in all cases.

Table 8 presents the estimates when using as dependent variable Y the overall composite index (Y = egdi) and two institutional variables: *law* which captures perceptions of the extent to which agents have confidence in and abide by the societal rules, and *regul* which captures perceptions

of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.

Tab. 8 – Regression estimates of model (1) with dependent variable Y = egdi. Source: Own computations.

	(1) egdi	(2) egdi	(3) egdi	(4) egdi	(5) egdi
gdpcs	9.33e-14	9.92e-14	1.17e-13	2.23e-13	7.39e-14
	(0.066)	(0.056)	(0.592)	(0.251)	(0.631)
ur	-0.00858	-0.00873	0.0103	0.00895	0.00787
	(0.098)	(0.113)	(0.226)	(0.287)	(0.348)
gfc	-0.000695	-0.000941	0.00140	0.00104	0.000501
	(0.723)	(0.624)	(0.632)	(0.721)	(0.862)
law	0.110*	0.113**	0.163*	0.176**	0.152*
	(0.047)	(0.005)	(0.013)	(0.006)	(0.013)
regul	0.000770		-0.00169	-0.00258	
	(0.533)		(0.448)	(0.208)	
urban	0.00235	0.00255	0.0123**	0.0104**	0.0122***
	(0.096)	(0.082)	(0.004)	(0.006)	(0.001)
popdens	-0.00000544		0.0000342		
	(0.405)		(0.315)		
_cons	0.406**	0.437***	-0.137	0.0287	-0.147
	(0.001)	(0.000)	(0.629)	(0.901)	(0.427)
N	72	72	72	72	72
R-sq	0.796	0.792	0.548	0.540	0.527
adj. R-sq	0.774	0.777	0.417	0.417	0.411
rmse	0.0805	0.0800	0.0622	0.0622	0.0626

p-values in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Note: Columns (1) - (2) show pooled OLS regression estimates, while (3)-(5) FE estimates.

The pooled OLS estimates in columns (1) and (2) indicate a highly significant impact of *law* on the digital performance of E-government. It is of particular interest that *law* retains its significance even at the presence of *regul* in column (1), which nevertheless exerts no statistically significant impact on *egdi.* The impact from per capita output (*gdpccs*) is positive and statistically significant at the level of 6%. The other two variables used as controls for the macro-economic environment, i.e., the unemployment rate (*ur*) and investment as a percentage of GDP (*gcf*), are statistically insignificant. The variables that reflect demographic characteristics (*urban* and *popdens*) are not statistically significant. The overall diagnostics of the regressions are quite satisfactory and show high explanatory power of the model (R-sq).

Regression estimates in columns (3) - (5) derive from the panel data FE estimator that accounts for possible heterogeneity among the countries in the sample and is common when dealing with panel data. It is noticeable that the FE estimates differentiate substantially from the pooled sample estimates, indicating that heterogeneity issues are in place, which are treated using the FE estimators. It is remarkable that the institutional variable *law* keeps its high significance across all regressions, while the coefficients of demographic variables *urban* and *popdens*

turned out to be significant as well. These results support hypothesis H1 that institutional quality positively influences E-government performance in Southeast Asia but also, hypothesis H4 about the mediating role of the macroeconomic and demographic environment in shaping this relationship. In contrast, hypothesis H2 about the positive impact of the regulatory environment on egdi shows no support by the data due to lack of adequate statistical significance.

Tab. 9 – Regression estimates of model (1) with dependent variable Y = epi. Source: Own computations.

	(1) epi	(2) epi	(3) epi	(4) epi	(5) epi
gdpcs	3.06e-13*	3.01e-13**	2.23e-13	4.31e-13	2.23e-13
	(0.012)	(0.009)	(0.550)	(0.436)	(0.566)
ur	-0.0264	-0.0272	0.0339	0.0402	0.0339
	(0.089)	(0.079)	(0.107)	(0.064)	(0.112)
gfc	-0.00368	-0.00434	-0.000772	0.00162	-0.000772
	(0.510)	(0.347)	(0.952)	(0.826)	(0.916)
law	0.0868	0.113	0.389	0.434**	0.389*
	(0.600)	(0.333)	(0.050)	(0.009)	(0.012)
regul	0.000528			-0.00567	
	(0.884)			(0.313)	
urban	0.00460	0.00496	0.0388**	0.0377***	0.0388***
	(0.285)	(0.277)	(0.001)	(0.001)	(0.000)
popdens	0.0000101			0.0000757	
	(0.597)			(0.376)	
_cons	0.235	0.278	-1.744*	-1.589*	-1.744***
	(0.537)	(0.271)	(0.014)	(0.029)	(0.000)
N	72	72	72	72	72
R-sq	0.501	0.498	0.598	0.619	0.598
adj. R-sq	0.446	0.460	0.567	0.508	0.499
rmse	0.218	0.215	0.147	0.157	0.158

p-values in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 9 presents the results with dependent variable the sub-component of E-participation index (Y = epi). The pooled sample regression estimates in columns (1) and (2) indicate a highly significant impact on EPI from per capita output and an absence of impact from any other factor. In contrast, the FE estimates in columns (3)-(5) indicate a strong impact from both, the institutional variable *law* as well as the demographic factor *urban* (at 5% and 1% level of significance respectively). A similar analysis results from Table 10, which displays the estimates using as dependent variable the sub-component of online service index (Y = osi). Hence, the empirical evidence regarding the e-participation index and the online services index is supportive of hypotheses H1 and H4, but not of hypothesis H2, similar to what was obtained in the case of the overall index egdi.

Tab. 10 – Regression estimates of model (1) with dependent variable Y = osi. Source: Own computations.

	(1) osi	(2) osi	(3) osi	(4) osi	(5) osi
gdpcs	2.06e-13*	2.24e-13**	1.41e-13	2.39e-13	2.60e-14
	(0.016)	(0.010)	(0.737)	(0.517)	(0.929)
ur	-0.0115	-0.0113	0.0243	0.0231	0.0215
	(0.208)	(0.261)	(0.139)	(0.152)	(0.178)
gfc	-0.00633	-0.00644	0.00273	0.00240	0.00163
	(0.082)	(0.064)	(0.627)	(0.666)	(0.766)
law	0.177	0.164*	0.365**	0.377**	0.342**
	(0.095)	(0.024)	(0.004)	(0.002)	(0.004)
regul	0.00145		-0.00286	-0.00369	
	(0.552)		(0.503)	(0.345)	
urban	0.00271	0.00292	0.0169*	0.0152*	0.0177**
	(0.290)	(0.296)	(0.036)	(0.034)	(0.009)
popdens	-0.0000201		0.0000317		
	(0.095)		(0.627)		
_cons	0.475	0.520**	-0.403	-0.250	-0.501
	(0.053)	(0.002)	(0.460)	(0.571)	(0.157)
N	72	72	72	72	72
R-sq	0.680	0.664	0.444	0.442	0.433
adj. R-sq	0.645	0.639	0.283	0.293	0.294
rmse	0.150	0.152	0.120	0.119	0.119

p-values in parentheses
* p<0.05, ** p<0.01, *** p<0.001

The estimates when using as dependent variable the telecommunications infrastructure index (Y = tii) are reported in table 11. The pooled sample regression estimates (1) and (2) indicate a statistically significant impact from the unemployment rate (negative) and the investment as percentage of GDP (positive), but no impact from any institutional or demographic variable on tii. These results are in support of hypothesis H4, indicating the dominance of the infrastructure effect (e.g., gross physical capital investment like ICT) and the importance of market conditions required for the telecommunications development of government services.

The FE estimates in columns (3) - (5) indicate a weaker impact from unemployment but no impact from investment. The institutional variable *law* and demographic factor *urban* remain significant. Finally, table 12 describes the results when using the human capital index as dependent variable (Y = hci). The estimates are similar in significance with those of the index tii (Table 11) and again, in support of hypotheses H1 and H4.

Tab. 11 – Regression estimates of model (1) with dependent variable Y = tii. Source: Own computations.

	(1) tii	(2) tii	(3) tii	(4) tii	(5) tii
gdpcs	-1.52e-16	-4.09e-16	3.97e-13	5.71e-13	2.27e-13
	(0.999)	(0.997)	(0.288)	(0.085)	(0.390)
ur	-0.0297*	-0.0304*	0.00568	0.00340	0.000902
	(0.014)	(0.012)	(0.693)	(0.811)	(0.950)
gfc	0.00956*	0.00888*	0.00436	0.00375	0.00251
	(0.027)	(0.028)	(0.381)	(0.446)	(0.612)
law	0.0574	0.0799	0.255*	0.276*	0.219*
	(0.580)	(0.359)	(0.021)	(0.011)	(0.036)
regul	0.000917		-0.00448	-0.00596	
	(0.680)		(0.237)	(0.088)	
urban	0.00570	0.00611	0.0262***	0.0232***	0.0272***
	(0.099)	(0.064)	(0.000)	(0.000)	(0.000)
popdens	0.00000427		0.0000566		
	(0.748)		(0.326)		
_cons	-0.166	-0.111	-1.078*	-0.803*	-1.210***
	(0.455)	(0.545)	(0.028)	(0.043)	(0.000)
N	72	72	72	72	72
R-sq	0.652	0.650	0.676	0.670	0.652
adj. R-sq	0.613	0.624	0.581	0.581	0.567
rmse	0.154	0.152	0.106	0.106	0.107

p-values in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Tab. 12 – Regression estimates of model (1) with dependent variable Y = epi. Source: Own computations.

	(1) hci	(2) hci	(3) hci	(4) hci	(5) hci
gdpcs	7.35e-14	7.35e-14	-1.93e-13	-1.48e-13	-3.25e-14
	(0.101)	(0.106)	(0.336)	(0.399)	(0.814)
ur	0.0153*	0.0154*	0.000548	-0.0000452	0.000790
	(0.042)	(0.034)	(0.943)	(0.995)	(0.917)
gfc	-0.00530*	-0.00526*	-0.00294	-0.00310	-0.00268
	(0.013)	(0.017)	(0.273)	(0.241)	(0.305)
law	0.0937	0.0925	-0.133*	-0.127*	-0.108*
	(0.103)	(0.053)	(0.026)	(0.028)	(0.049)
regul	-0.0000494		0.00238	0.00199	
	(0.968)		(0.243)	(0.282)	
urban	-0.00134	-0.00136	-0.00631	-0.00710*	-0.00844**
	(0.504)	(0.480)	(0.097)	(0.037)	(0.009)
popdens	-0.000000216		0.0000147		
	(0.970)		(0.633)		
_cons	0.907***	0.904***	1.065***	1.136***	1.272***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
N	72	72	72	72	72
R-sq	0.377	0.377	0.457	0.454	0.443
adj. R-sq	0.309	0.330	0.299	0.308	0.306
rmse	0.0914	0.0900	0.0567	0.0564	0.0564

p-values in parentheses
* p<0.05, ** p<0.01, *** p<0.001

The estimates reported in Tables 8-12 may be subject to sample bias given the large number of missing values in the panel of countries considered, which are developing, and the database is incomplete for several variables. To alleviate the problem and increase credibility in our estimates, we re-estimated the model by dropping variables that restricted the sample, like the unemployment rate that was statistically insignificant. In addition, we tested for the robustness of the effect of *law* by including the variable of political instability (*ps*) on one hand and omitting the urbanization variable on the other, to avoid multicollinearity with the *population density* variable and *law*, which may introduce bias in the estimates.

This robustness analysis is presented in table 13, which reports panel FE estimates with robust standard errors for each E-government digital performance index. The sample size has increased substantially, from 72 observations to 94, while the main result of a positive and significant impact from *law* on E-government development performance remains valid. It can also be noticed that per capita output has turned out as significant in all but the last regression (5). The new variable of political instability (*ps*) has the right (negative) size and is statistically significant at the level of 6% -8% in the cases of egdi, epi and osi. These results reinforce the previous evidence that supports hypotheses H1 and H4. In addition, we have weak evidence in support of hypothesis H3, which indicates the importance of political stability for the E-government digital performance in the region of Southeast Asia.

Tab. 13 – Robustness checks. Source: Own computations.

	(1) egdi	(2) epi	(3) osi	(4) tii	(5) hci
gdpcs	3.90e-13*	1.14e-12	4.81e-13	9.91e-13*	-3.00e-13
	(0.031)	(0.054)	(0.071)	(0.049)	(0.199)
gcfn	0.00232	0.00419	0.00512	0.00380	-0.00203
	(0.430)	(0.543)	(0.257)	(0.517)	(0.294)
law	0.173*	0.514*	0.377**	0.283*	-0.142
	(0.011)	(0.011)	(0.009)	(0.010)	(0.142)
ps	-0.00208	-0.00766	-0.00461	-0.00189	0.000266
	(0.071)	(0.077)	(0.057)	(0.467)	(0.866)
popdens	0.00000748	0.00000847	0.000000555	-0.00000670	0.0000289
	(0.696)	(0.897)	(0.986)	(0.892)	(0.247)
_cons	0.464***	0.403	0.479*	0.106	0.810***
	(0.001)	(0.214)	(0.024)	(0.640)	(0.000)
N	94	94	94	94	94
R-sq	0.425	0.486	0.410	0.490	0.364
adj. R-sq	0.393	0.456	0.376	0.461	0.328
rmse	0.0628	0.154	0.110	0.120	0.0597

p-values in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Finally, we also experimented with other variables related to political factors, schooling and education, tourism activity, and competition as suggested in the literature (Lee et al., 2011; Dang Nguyen et al., 2013; Arduini et al., 2010; Attour & Chaupain-Guillot, 2020). However, the number of observations after considering the missing values in the panel data set was quite limited for robust panel data estimates.

The previously analyzed estimation results confirm the predictions of institutional theory, demonstrating that institutional quality as expressed by the rule of law and political stability have a positive and statistically significant impact on E-government performance across

Southeast Asian countries. This finding underscores the importance of governance structures in facilitating digital adoption, aligning with prior works such as North (1990) and DiMaggio and Powell (1983). The findings extend these insights by illustrating how governance quality can mediate digital adoption processes in developing regional contexts.

Regulatory environment, as captured by the perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development, was not found to influence significantly the E-government digital performance in Southeast Asian. This result could be attributed to measurement issues and a lack of more concrete indicators such as the indicators of regulatory policy and governance compiled by the OECD. However, these indicators are only available for OECD countries.

The empirical analysis further supports digital diffusion theory, showing that macroeconomic factors and demographic variables, in particular GDP per capita, investment, unemployment rate, and urbanization can be significant drivers of some indices of E-government development. Moreover, the results highlight that political stability moderates the relationship between digital infrastructure and adoption rates, suggesting that a supportive governance environment is crucial for maximizing the benefits of digital diffusion.

This study goes beyond prior works that often focus on descriptive comparisons or repetitive case studies of E-government performance. By incorporating theoretical insights from institutional and digital diffusion theories, it reveals structural determinants of digital competitiveness that have not been fully explored in the context of Southeast Asia. These results contribute to the global discourse on digital governance by offering actionable insights into the role of governance, macroeconomic, and demographic factors in shaping digital transformation.

6 CONCLUSIONS

The gathered evidence emphasizes the transformative power of E-governance for reinforcing digital competitiveness. The introduction of E-government services emerges as an efficient strategy for governments to augment communication methods, publicize these services, and accentuate their benefits. The progress in digital public service delivery can greatly enhance trust in public entities. The extensive adoption of E-government services can stimulate an environment of transparency, efficiency, and inclusivity, all of which being critical in maintaining competitiveness in the global markets.

Countries in the Southeast Asian region have been navigating through a digital overhaul of their public sectors. As they progress in developing E-governance, our research points out that significant work lies ahead. The assessment of the digital performance and competitiveness of public authorities in this region showed huge disparities that could potentially hinder competitive parity and call for additional measures to alleviate them.

To this end, an econometric analysis was carried out to assess empirically the impact of factors from various theoretical contexts, such as macroeconomic, institutional, and demographic, on government digital performance. Based on a panel data set from 10 Southeast Asian nations over 11 time periods, the econometric analysis provided robust evidence for the significance of institutional trust and compliance, with a lesser importance on political stability, for enhancing digital performance in public institutions. Demographic elements like urbanization rates also emerged as significant. In macroeconomic terms, the level of development (reflected by GDP per capita) is pertinent, whereas unemployment rates showed minimal relevance. Despite the data constraints, we have implemented as thorough robustness checks as possible.

To obtain a deeper grasp of digitalization in public sectors and the status of E-government in these nations, further research is necessary. Utilizing the OECD methodology to create an

OECD digital government index for these nations could bring benefits and provide essential insights into the efficacy and scope of their digital governance initiatives. This, in turn, could drive more precise and impactful policy measures. By aligning the promotion of E-governance with these research insights, Southeast Asian countries could use the digital technology to refine public service provision, increase citizen participation and engagement, solidify trust in their democratic frameworks and ultimately enhance their competitiveness.

This study adds value to the theoretical development of digital transformation by explaining how institutional quality and political stability affect E-government performance. Based on institutional theory, the findings support the argument that governance structures are key drivers of digital adoption outcomes, as suggested by North (1990) and DiMaggio and Powell (1983). Furthermore, the study builds on digital diffusion theory by revealing that economic and demographic factors are not the sole determinants of digital adoption, but their influence is modulated by the institutional environment. Thus, integrating these theoretical perspectives, this study goes beyond the traditional descriptive analysis of E-government performance and proposes an explanatory model of the structural determinants of digital competitiveness.

In contrast to previous studies that are often based on case studies or policy intervention reviews, our findings provide generalizable insights into the institutional underpinnings of digital governance in developing regions. Policymakers should address institutional reforms that decrease corruption, increase transparency, and increase trust in public sector digital initiatives. Furthermore, since political stability plays the moderating role, digital transformation must be a long-term process, which implies the continuity of regulatory arrangements and inclusive governance. Further research should include comparative studies between different regional unions (e.g., ASEAN, EU, or APEC) and longitudinal studies to reveal the changing role of institutions in digital adoption.

References

1. Arduini, D., et al. (2010). Technology adoption and innovation in public services: The case of E-government in Italy. *Information Economics and Policy*, *22*(3), 257-275. https://doi.org/10.1016/j.infoecopol.2009.12.007
2. Attour, A., & Chaupain-Guillot, S. (2020). Digital innovations in public administrations: Technological or policy innovation diffusion? *Journal of Innovation Economics and Management*, *31*(1), 195-219. https://doi.org/10.3917/jie.pr1.0061
3. Baldersheim, H., & Øgard, M. (2008). Innovation in E-government: Analysis of municipal web pages in Nordic countries. *Information Polity*, *13*(3/4), 125-137. https://doi.org/10.3233/IP-2008-0133
4. Dang Nguyen, G., Dejean, S., & Souquet, A. (2013). Les internautes moteurs des processus d'adoption et développement de l'e-gouvernement: Une étude sur les communes bretonnes, *Politiques & Management Public*, *30*(1), 29-49.
5. De Vries, H., Bekkers, V., & Tummers, L. (2016). Innovation in the public sector: A systematic review and future research agenda. *Public Administration*, *94*(1), 146-166. https://doi. org/10.1111/padm.12209
6. DiMaggio, P. J., & Powell, W. W. (1983). The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields. *American Sociological Review*, *48*(2), 147-160.
7. Gal, P., et al. (2019). Digitalisation and productivity: In search of the holy grail – Firm-level empirical evidence from EU countries, OECD Economics Department Working Papers, No. 1533. https://doi.org/10.1787/5080f4b6-en
8. IMD World Competitiveness Center (2022). *IMD world digital competitiveness ranking 2022*. https://worldcompetitiveness.imd.org.

9. Ionescu, A. M., et al. (2022). The impact of innovation framework conditions on corporate digital technology integration: Institutions as facilitators for sustainable digital transformation. *Journal of Business Economics and Management*, *23*(5), 1037-1059. https://doi.org/10.3846/jbem.2022.17039
10. Lee, C. P., Chang, K., & Berry, F. S. (2011). Testing the development and diffusion of E-government and E-democracy: A global perspective. *Public Administration Review*, *71*(3), 444-454. https://doi.org/10.1111/j.1540-6210.2011.02228.x
11. Lissitsa, S. (2021). Effects of digital use on trust in political institutions among ethnic minority and hegemonic group–A case study. *Technology in Society*, *66*, 101633. https://doi.org/10.1016/j.techsoc.2021.101633
12. Liva, G., et al. (2020). Exploring digital government transformation: A literature review. In Y. K. Charalabidis, et al. (Eds.), *ICEGOV '20: Proceedings of the 13th International Conference on Theory and Practice of Electronic Governance* (pp. 502-509). Association for Computing Machinery. https://doi.org/10.1145/3428502.3428578
13. Malaysia Digital Economy Corporation (2021). *Malaysia digital economy blueprint 2021-2025*. https://mdec.my/wp-content/uploads/2021/02/DE-Blueprint-2021-2025-FA-WEB.pdf
14. Mondejar, R., Chu, C. W., & Gogatz, A. (2021). The effects of Covid-19 on digitalization in Southeast Asia: A crisis within a crisis. *Asia Global Papers*, (4), 1-45. https://www.asiaglobalinstitute.hku.hk/storage/app/media/AsiaGlobal%20Papers/the-effects-of-covid-19-on-digitalization-in-southeast-asia-a-crisis-within-a-crisis.pdf
15. Nanos, I., Papaioannou, E., Androutsou, E., & Manthou, V. (2019). The role of cloud computing and citizens relationship management in digital government transformation. *International Journal of Internet Marketing and Advertising*, *13*(2), 120-136. DOI: 10.1504/IJIMA.2019.099495
16. North, D. (1990). Institutions and their consequences for economic performance. In K. Cook & M. Levi (Eds.), *The limits of rationality* (pp. 383-401). University of Chicago Press.
17. OECD (2014). *Recommendation of the council on digital government strategies*. https://www.oecd.org/gov/digital-government/Recommendation-digital-government-strategies.pdf.
18. OECD/ERIA (2018). *SME policy index: ASEAN 2018: Boosting competitiveness and inclusive growth*. OECD Publishing. https://doi.org/10.1787/9789264305328-en
19. OECD (2020). The OECD digital government policy framework: Six dimensions of a digital government, *OECD Public Governance Policy Papers*, (2). https://doi.org/10.1787/f64fed2a-en
20. OECD (2021). *Government at a glance 2021*. OECD Publishing. https://doi.org/10.1787/1c258f55-en
21. OECD (2023). *Open government data*. https://www.oecd.org/gov/digital-government/open-government-data.htm
22. Pérez-Morote, R., Pontones-Rosa, C., & Núñez-Chicharro, M. (2020). The effects of e-government evaluation, trust and the digital divide in the levels of e-government use in European countries. *Technological Forecasting and Social Change*, *154*, 119973. https://doi.org/10.1016/j.techfore.2020.119973
23. Rogers, E. M. (1995). Lessons for guidelines from the diffusion of innovations. *Joint Commission Journal on Quality Improvement*, *21*(7), 324-328.
24. Sanina, A., Balashov, A., & Rubtcova, M. (2023). The socio-economic efficiency of digital government transformation. *International Journal of Public Administration*, *46*(1), 85-96. https://doi.org/10.1080/01900692.2021.1988637

25. Sorbe, S., Gal, P., Nicoletti, G., & Timiliotis, C. (2019). Digital dividend: Policies to harness the productivity potential of digital technologies. OECD Economic Policy Paper No. 26. https://doi.org/10.1787/273176bc-en
26. United Nations (2022). *E-government survey 2022. The future of digital government*. https://publicadministration.un.org/en/ publicadministration.un.org/egovkb/
27. Wandaogo, A-A. (2022). Does digitalization improve government effectiveness? Evidence from developing and developed countries. *Applied Economics*, *54*(33), 3840-3860. DOI: 10.1080/00036846.2021.2016590.
28. World Bank (2025). World Bank Group, Open Data https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2023&locations=8S&name_desc=false&start=1961
29. World Economic Forum (2020). *Global competitiveness report special edition 2020: How countries are performing on the road to recovery*. https://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2020.pdf
30. Xavier, J. A. (2021). Digitalizing public service delivery, Malaysia, in Choi, J. and J. A. Xavier (eds) *Digitalization of Public Service Delivery in Asia*, Asian Productivity Organization (APO), *101-124*.
31. Zhang, H., Xu, X. & J. Xiao (2014). Diffusion of e-government: A literature review and directions for future directions, *Government Information Quarterly 31*, 631-636. http://dx.doi.org/10.1016/j.giq.2013.10.013
32. Zhao, F., Shen, K. N., Collier, A. (2014). Effects of national culture on E-Government diffusion – A global study of 55 countries. *Information & Management*, *51*(8), 1005-1016. https://doi.org/10.1016/j.im.2014.06.004

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