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Do Digital Competitiveness and Government Efficiency Affect Macroeconomic? An Evidence From Asia-Pacific Countries

Ernawati[1*], Muhammad Natsir[2], Mansyur Asri[3]
[1,2]Halu Oleo University, Kendari, Indonesia
[3]STMIK Catur Sakti, Kendari, Indonesia
E-mail: [1]ernawaty@uho.ac.id, [2]drnatsir64@gmail.com, [3]mansyur.asri12@gmail.com
[*)]Corresponding Author

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Abstract

Research Originality: This research divided the dimensions of digital competitiveness into knowledge, digital policy, and IT integration. The digital competitiveness variable was estimated simultaneously with government efficiency in influencing macroeconomic performance in Asia Pacific countries. This research proved the important role of responsive digital policies and government efficiency in driving the macroeconomy.

Research Objectives: This research aimed to determine the effect of digital competitiveness and government efficiency on macroeconomic performance.

Research Methods: Data was sourced from the International Institute for Management Development (IMD) publication from 2019 to 2022 for 13 Asia Pacific countries. The digital competitiveness considered in this research is knowledge, digital policy, and IT integration variables. Data was analyzed and processed using panel data regression.

Empirical Results: The result showed that digital policy variables reduced macroeconomic performance, while government efficiency positively affected macroeconomic performance. Furthermore, the digital knowledge and IT integration variables did not significantly affect macroeconomic performance.

Implications: This research has significant implications for the development of responsive digital policies that promote macroeconomic performance. It also underscores the importance of governance by the government in controlling the high-cost economy to encourage productivity and macroeconomic performance. These implications provide valuable insights for policymakers and professionals in the field of economics and digital policy.

Keywords:
digital; government; macroeconomic; governance; policy

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INTRODUCTION

The utilization of digitalization was significant during COVID-19 despite its existence before the pandemic. Moser-Plautz and Schmidthuber (2023) reported that the pandemic increased technological means and affected various aspects of the organization, such as employee attitudes. Organizations negatively affected by the pandemic have benefited from a greater degree of digital transformation. Consequently, the pandemic affected the spirit of innovation and increased the speed of digital transformation. According to Srisathan and Naruetharadhol (2022), individuals facing challenges adapting to the digital pandemic tended to engage more in digitalization. A macro-level report from ADB (2022) showed that the digital core share of countries in the Asia Pacific increased since 2018. The value during the COVID-19 period was an average of 5.47% but has yet to match the performance in 2017 of 5.5%. Furthermore, the digital economy share in several countries experienced a decline during the COVID-19 period with contraction, such as in Korea, Singapore, Japan, India, Thailand, Fiji, Cambodia, and Kazakhstan.

The Solow and Swan model reported that production factors and technological progress influenced economic growth. This research determined the level of technological progress by an exogenous factor. The neo-classical growth model introduced total factor productivity (TFP). TFP is the ratio of output that cannot be explained by several inputs used in production, with the exception of capital and labor. This ratio explains other factors influencing economic growth besides capital and labor by determining the effect of technological processes on economic growth. The Solow-Swan model also explained that technological advances increased labor efficiency in production activities, propelling the output produced. According to The Solow and Swan model, technological progress was an exogenous variable that did not depend on other economic forces. Digital technology, as an example of technological progress, has driven the economic progress of a country. Bhandari et al. (2023)examined a panel data set of 571 US manufacturing firms and found a sloping relationship between digitization and firm performance. This relationship had a negative or relatively flat slope at low levels of digitization and an increasingly positive slope at a relatively higher level.

Furthermore, Zhang et al. (2021)measured the digital economy development index of 30 cities from 2015 to 2019 in China from the three dimensions of digital infrastructure, industry, and integration. The result showed that the variables had a significant positive effect on the total factor productivity of the area. The coefficients of influence were 0.2452, 0.0773, and 0.3458, respectively. The mediating effect of technological progress was 0.1527, with 1.70%, 9.25%, 28.89%, and 21.22% in the eastern, north-eastern, central, and western regions, respectively.

Galina and Lapiņa (2023) found that a framework of interrelationships between digital transformation, open innovation, and sustainability was developed and confirmed. This report showed that digital transformation was a supporting factor and driving force for sustainability and open innovation. At the same time, digital transformation can negatively impact the environmental dimension of sustainability. Cheng et al. (2023) reported

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a positive nonlinear U-shaped relationship, showing that the TFP of real economic firms decreased in the early stages of digital transformation and then increased after exceeding a critical threshold value. During a crisis, supply chain digitization increased cost-effectiveness, improved information and communication efficiency, and promoted supply chain resilience to achieve better performance (Zhao et al., 2023).

Previous research examined the link between digitalization and economic performance at both micro and macro levels. Digitalization was measured from applied technology or integration at the micro level (Bhandari et al., 2023; Bui & Le, 2023; Peng & Tao, 2022). The results showed that digitalization had an impact on business performance (Xie & Wang, 2023; Zhao et al., 2023); financial inclusion (Al-Smadi, 2022), promoting labor market resilience (Oikonomou et al., 2023). According to Kusumawardhani et al. (2023), digitalization had no impact on women's labor market outcomes, but previous research reported an impact on sustainability and the environment. Digital transformation was driving the sustainability transition (Chatzistamoulou, 2023). Furthermore, Mutascu et al. (2023) reported that digitalization stimulated green preferences in clean environments with distorted green information. Research conducted by Santos et al. (2023), using country-level data for the European Union from 1995 to 2019, showed the average positive net effect of ICT investment on total employment. A €100,000 increase in ICT investment shares was associated with a rise of 3.3 jobs in the European Union. However, the magnitude of the impact was heterogeneous across countries.

Adaptation to digitalization can improve government governance through e-government, thereby boosting economic performance. Castro and Lopes (2022) reported that e-government development was a positive determinant for a country's sustainable development, represented by adjusted net savings, including a country's economy, social, and environmental development. However, other research, such as Sevinc et al. (2019) and Mroczek et al. (2019), placed governance, including government institutions, as an exogenous variable.

This study's research gap was related to the empirical gap with previous studies that estimated the impact of digitalization at the micro level, namely company performance, and at the macro level, which was limited to employment and environmental variables. This research carried out a cross-country macro-level estimation approach with dependent variables in macroeconomic performance. The research gap was also related to digitalization variables, which only refer to IT infrastructure, IT Integration, and human resources, while digital policy variables still needed to be minimally studied. The novelty of this research is measuring the dimensions of digital competitiveness with three variables, namely knowledge, digital policy, and IT integration at the macroeconomic level. This dimension was different from the previously used by Park & Choi (2019), namely technological innovation capability, human resources, and the environment; and Zhang et al. (2021) used three digital dimensions, namely digital infrastructure, industry, and integration, to drive economic development in China. The latest study by Zhang (2023) uses path analysis to examine the influence of digital policies on economic development mediated by urbanization. This study estimated the three dimensions of digital competitiveness in a model for the cross-country level of Asia-Pacific countries. Estimates of digital dimensions differentiated into three variables clarified the economic strengthening needed to support macroeconomic competitiveness. Some of the contributions of this research are: (1) using digital policy variables as one of the independent variables that influence macroeconomic performance; (2) using government efficiency variables as a proxy for governance as a factor influencing economic performance; and (3) using panel data in cross-country studies in the Asia Pacific region by measuring economic variables at the macro level. This research aims to analyze the influence of digital knowledge, digital policy, IT integration, and government efficiency on macroeconomic performance in Asia-Pacific countries. This research will consider the country's digital framework and government efficiency to encourage macroeconomic performance.

METHODS

This research used secondary data published by the International Institute for Management Development (IMD) from 2019 to 2022. Based on IMD Digital Competitiveness data, fourteen countries are estimated to be included in the Asia-Pacific countries, excluding Oceania countries. However, in the study, only thirteen countries were included in the model based on data completeness considerations. These Asian-Pacific countries include Indonesia, Thailand, the Korean Republic, Japan, India, Singapore, the Philippines, Malaysia, China, Mongolia, Kazakhstan, Hong Kong SAR, and Taiwan. The digital competitiveness variables measured knowledge, policy, and IT integration. Digital policy variables encourage macroeconomics through capital allocation policies and developing an environment to support efficient and effective economic digitalization. The digital policy variable was proxied from the technological dimension, which IMD estimated with the indicators of the regulatory framework, capital, and technological framework.

In contrast, the IT integration variable was obtained from the future readiness dimension. Data on macroeconomic competitiveness and government efficiency was obtained from IMD's World Competitiveness Year Book publications. Data was analyzed using panel data regression. Equation 1 shows the research model from this study.

$$Y_{it} = \alpha + b_1X_{1it} + b_2X_{2it} + b_3X_{3it} + b_4X_{4it} + e_{jt} \quad (1)$$

Where:

Y : Macroeconomic competitiveness

X_1 : Knowledge

X_2 : Digital policy

X_3 : IT integration

X_4 : Government efficiency

Panel data regression was tested by selecting the best model between the common and the fixed effects based on the Chow test. When the probability of cross-section was < 0.05, a better model of the two was the fixed effects model. The best model between

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the random and fixed effects was selected based on the Hausman test. A probability of random cross-section < 0.05 showed that the fixed effects model was better than the random effects model. The Lagrange multiplier was carried out when the best random effect model was obtained based on the Hausman test. Estimated research data will be processed with random effects when the Breusch-Pagan cross-section and time probability are < 0.05. However, when the probability is > 0.05, panel data will be processed with common effects. Digital dimension data was obtained from the World Competitiveness publication and analyzed using panel regression.

Data on macroeconomic competitiveness and government efficiency was obtained from IMD's World Competitiveness Year Book publications. Classical assumption tests were carried out for CEM or FEM estimation (normality, multicollinearity, autocorrelation, and heteroscedasticity test) before interpreting the output of the panel data. However, the random effects model automatically addresses the problems of heteroscedasticity and autocorrelation.

RESULTS AND DISCUSSION

Table 1 shows the descriptive statistics and analysis of the variables being studied. Changes in the digital policy and IT integration variables had a negative direction, suggesting a decrease in the variables for the estimated period. Based on the Std.Dev value, the difference in digital knowledge (X_1) between countries in the Asia Pacific was very high, including government efficiency (X_4) and macroeconomic performance (Y). The variables with slight variations were IT integration (X_3) and digital policy (X_2).

Table 1. Descriptive Statistics of Research Variables

	X_1	$d(X_2)$	$d(X_3)$	X_4	Y
Mean	64.514	0.210	-0.455	62.452	62.111
Median	67.640	-1.150	-1.289	59.404	62.790
Maximum	92.031	13.341	13.692	100.000	83.415
Minimum	35.158	-11.361	-12.149	28.730	30.050
Std. Dev.	17.665	6.514	5.983	17.852	12.763
Skewness	-0.189	0.195	0.223	0.549	-0.459
Kurtosis	1.691	1.965	2.316	2.416	2.825
Jarque-Bera	3.019	1.987	1.082	2.515	1.422
Probability	0.221	0.370	0.582	0.284	0.491
Sum	2516.051	8.178	-17.754	2435.645	2422.320
Sum Sq. Dev.	11858.120	1612.378	1360.413	12110.150	6189.786

Source: Data processing

The results of the correlation test between variables (Appendix 1) showed a high relationship (> 80) between digital policy and IT integration with other variables. Thus, the estimation of digital policy and IT Integration variables uses change values. By modifying this data, the correlation between research variables <0.80 (Appendix 2).

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Table 2 shows the Chow test to determine the best model between CEM and FEM. The Chi-square cross-section probability value was 0.000, suggesting FEM is the best model. Subsequent tests were conducted to test the best model between FEM and REM. In Table 3, the random cross-section probability value was 0.246 > 0.05, showing that REM was the best model. The results of the Lagrange multiplier tests show the Breusch-Pagan probability value for both of 0.000 < 0.05. Therefore, the best model for estimating panel macroeconomic performance data was REM.

Table 2. Chow Test

Effects Test	Statistic	d.f.	Prob.
Cross-section F	16.151	(12,22)	0.000
Cross-section Chi-square	89.051	12	0.000

Source: Data processing

Table 3. Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	5.431	4	0.246

Source: Data processing

Table 4. Lagrange Multiplier Tests

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	21.473	1.144	22.617
	(0.000)	(0.285)	(0.000)

Source: Data processing

Our main estimation results highlight the crucial role of digital policy in shaping macroeconomic performance. We found that the digital policy of digital competitiveness dimension significantly affects macroeconomic performance, while knowledge and IT integration have no significant effect. This underscores the importance of digital policy in the context of macroeconomic performance. Interestingly, the influence of digital policy on macroeconomic competitiveness had a negative direction, with a change in digital policy by one index point reducing macroeconomic competitiveness by 0.302 points. On the other hand, the government efficiency variable had a significant and positive influence on macroeconomic competitiveness. This result shows that an increase in government efficiency competitiveness by one index point will increase macroeconomic performance by 0.439. In summary, our findings emphasize the significant role of digital policy and government efficiency in shaping macroeconomic outcomes.

Knowledge and IT integration have no significant effect on macroeconomic performance, which contradicts previous research, where IT integration affected macroeconomic variables. Zhang et al. (2021) showed that digital integration positively and significantly affected total factor productivity in China. The estimation results of

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Jahan & Zhou (2023) showed that digital inclusion significantly impacted employment growth during the pandemic, where every one-unit increase in the digital inclusion index in the average value of confirmed COVID-19 cases increased employment growth by 0.078%. The positive impact was significant for both high- and low-income countries. According to Hui et al. (2023), the integration of digital technology in the financial sector only positively impacted regional innovation capacity. This impact was more significant for provinces with a higher share of the total GDP of the tertiary sector and a lower level of market development.

The digital and economic competitiveness index based on GDP per capita groupings for 2022, which is more or less $20,000, is shown in Figure 1. Countries with a GDP per capita of more than $20,000 are Korea, Japan, Singapore, Hong Kong SAR, and Taiwan. Based on the grouping, there are differences in digital power and competitiveness. Countries with a GDP per capita greater than $20,000 have higher digital competitiveness than other groups. This condition was followed by the country's competitiveness, which was also higher for all indices and indicators. The highest difference in digital competitiveness was found in the IT integration aspect.

Table 5. Estimating Results of Research Variables

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	24.9795	9.2794	2.6919	0.0109
X_1	0.1505	0.1299	1.1584	0.2548
$d(X_2)$	-0.3022	0.1512	-1.9992	0.0536
$d(X_3)$	-0.1257	0.1538	-0.8173	0.4194
X_4	0.4392	0.1207	3.6380	0.0009
		Effects Specification		
			S.D.	Rho
Cross-section random			8.994363	0.8741
Idiosyncratic random			3.412749	0.1259
		Weighted Statistics		
R-squared	0.6359	Mean dependent var		13.29113
Adjusted R-squared	0.5931	S.D. dependent var		5.4615
S.E. of regression	3.4838	Sum squared resid		412.6616
F-statistic	14.847	Durbin-Watson stat		2.0906
Prob(F-statistic)	0.0000			

Source: Data processing

The results of this research, which showed the negative influence of digital policies on macroeconomic competitiveness, contradict Park & Choi (2019). The research showed that the regulatory and political environment had a positive and significant influence on economic growth. Meanwhile, the drivers and challenges of digital innovation in Africa were mainly caused by social, economic, political, and institutional factors (Arthur et al., 2024). Some previous research showed that government attention significantly promoted

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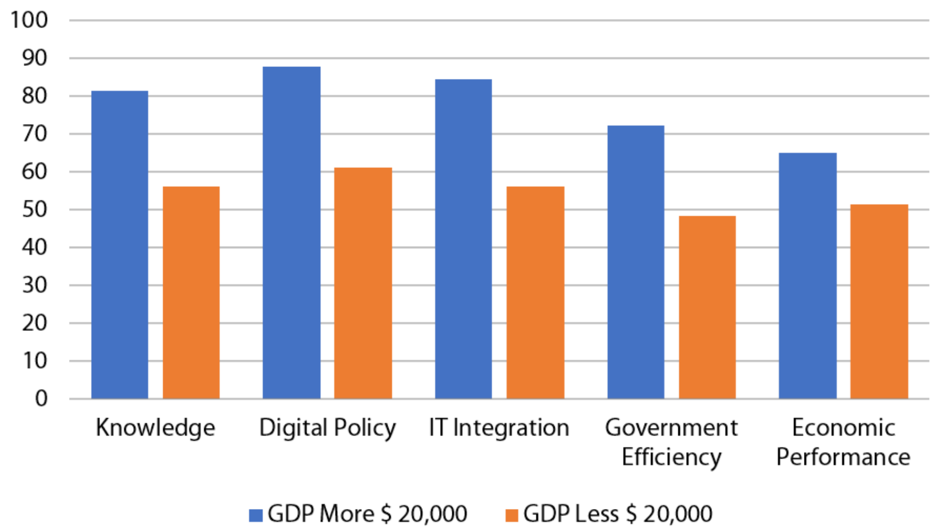
the development of the digital economy (Zhang et al., 2024). This result implied that for every unit increase in the DT policy indicator, economic development increased by 49.7% (Zhao et al., 2023). Digital policy manifested as environmental factors that influenced the allocation of capital to digital development. When viewed from the aspect of capital directed toward digital development, the results also contradict previous research. Santos et al. (2023) showed an average positive net effect of ICT investment on total employment. The policies in this research had several indicators, namely technological, regulatory, and digital frameworks. These findings have significant implications for our understanding of the digital economy and its impact on economic development.

Based on Figures 2 and Figure 3, digital competitiveness has a positive relationship with macroeconomic performance. Digital competitiveness was above average in Singapore, Korea, Hong Kong SAR, Taiwan, China, Japan, and Malaysia. Meanwhile, only Singapore, Hong Kong, Taiwan, and China are above average in terms of economic competitiveness. Mongolia and the Philippines had the lowest competitiveness, both in terms of digital aspects and economic competitiveness. Based on the digital competitiveness variable, Thailand has a higher digital policy index but lower economic performance. In contrast, Japan, which has a low digital policy index, has better economic performance.

Figure 1. Digital Competitiveness Index, Government Efficiency, and Macroeconomic Performance Based on 2022 GDP per Capita Grouping Countries in the Asia Pacific



Figures 4, 5, 6, and 7 show the digital and economic competitiveness profiles. During the research period, all the variables exhibited fluctuations. The economic performance experienced high fluctuation, specifically in 2022, shown by a sharp decline compared to the previous period in all countries. The high decline was also experienced by government efficiency. Meanwhile, the index experienced the most increase among all variables in the technological aspect. The digital policy index increased, but there was a decrease in government efficiency and economic performance. Meanwhile, knowledge and IT Integration changes in the countries studied were relatively lower.

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Figure 2. The Digital Competitiveness Index of Countries in the Asia Pacific in 2022

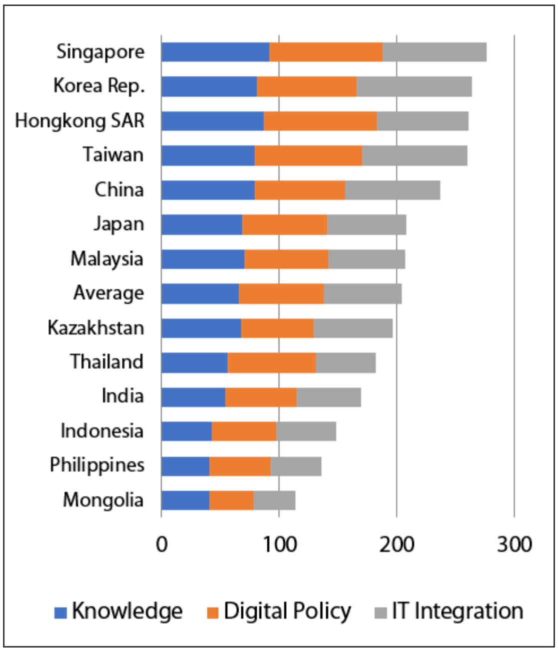


Figure 3. Economic Performance and Government Efficiency in the Asia Pacific Countries in 2022

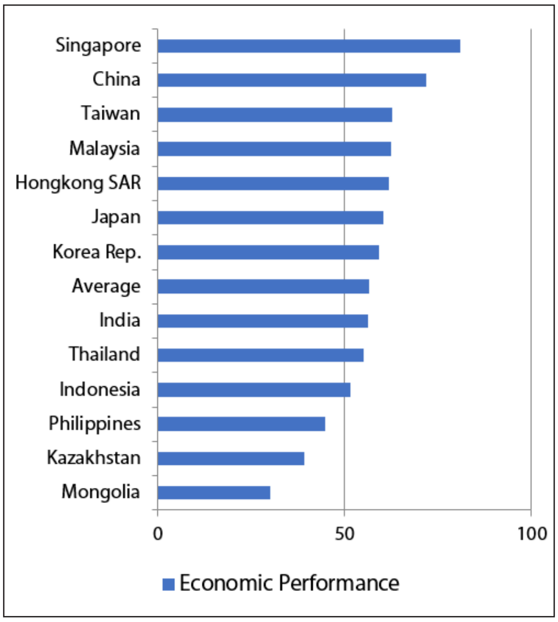


Figure 4. Index of Digital and Economic Competitiveness of Countries in Asia Pacific in 2019

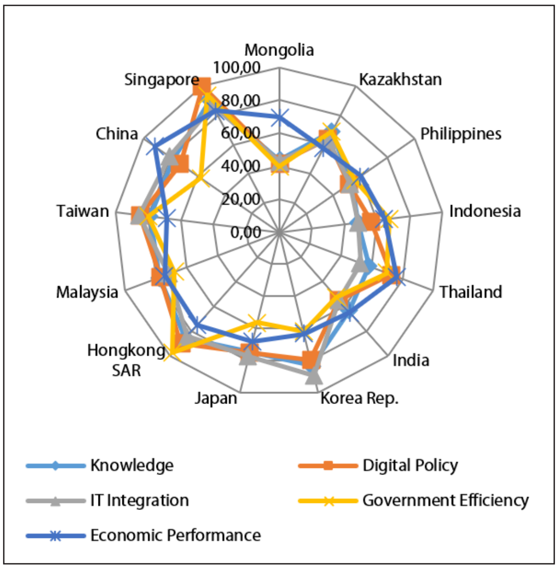
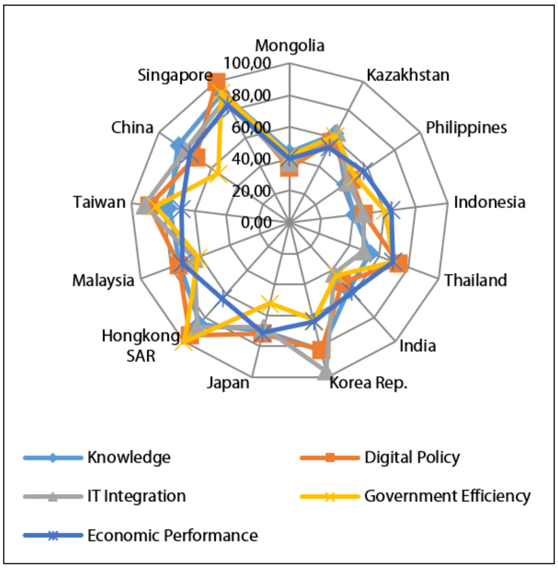


Figure 5. Index of Digital and Economic Competitiveness of Countries in Asia Pacific in 2020



The result of this research showed that the government efficiency variable had a significant and positive influence on macroeconomic competitiveness. Government efficiency was shaped by institutional (government) quality. Li and Maskin (2021) studied the influence of government quality on economic performance. In this case, government quality included government voice and accountability, political stability and absence of violence, effectiveness, regulatory quality, supremacy of quality law, and control of corruption. This is consistent with the report of Palei (2015) that the level of institutional

Figure 6. Index of Digital and Economic Competitiveness of Countries in Asia Pacific in 2021

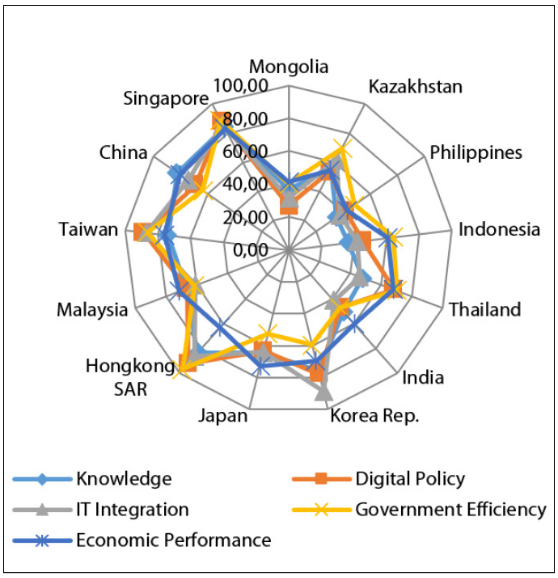
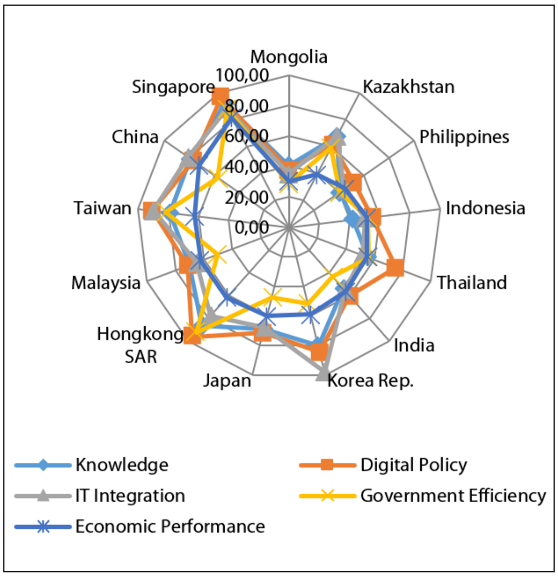


Figure 7. Index of Digital and Economic Competitiveness of Countries in Asia Pacific in 2022



development influences a nation's competitiveness. The role of institutional development in shaping a nation's competitiveness cannot be overstated. Non-feasible institutional conditions will negatively affect macroeconomic performance. Cigu et al. (2019) reported that corruption, the regulatory environment, and the shadow economy had a negative effect on economic growth**.** Li et al. (2020) tested the influence of institutional dimensions on economic growth using two variables, namely control of corruption and regulation, in 15 developing countries. The result showed that control of corruption reduced growth, but it is the quality of regulations led to an increase.

Meyer (2019) analyzed the impact of government activities on economic growth in Poland and the result showed a long-term and short-term relationship between government spending, size, effectiveness, and the level of corruption. Furthermore, the result showed that government variables caused economic growth changes. Khodapanah et al. (2022) found an inverted U relationship between GDP and corruption in Asian countries. In the early stages of economic development, activities expanded but there were no institutional changes. Therefore, a parallel increase in instances of corruption was observed alongside the progression of economic development. Further economic development was often accompanied by improvements in the quality of institutions in various areas of law, rules, and regulations. These institutions reduced corruption and increased production. In addition, a two-way relationship between corruption and economic growth was found in both developed and developing countries (Qureshi et al., 2021). The positive influence of digital competitiveness and government effectiveness showed the importance of these two variables in promoting macroeconomic competitiveness. Therefore, the urgent need to perfect digital economic policies and governance regulations is paramount for promoting development (Ma et al., 2024).

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CONCLUSION

In conclusion, a higher GDP increases countries' digital competitiveness by improving government efficiency and macroeconomic performance. Government efficiency, a manifestation of good institutions, improved macroeconomic performance. Therefore, quality government institutions produced a lower-cost economy, boosting productivity and the economy. The test result showed that only the digital policy variable was significant, while knowledge and digital integration did not significantly affect macroeconomic performance in Asia Pacific countries. Digital policy showed a negative influence on macroeconomic performance. This result showed that increased digital policy led to worse economic performance.

The negative impact of digital policy on the economy is shown in two ways: firstly, there is excessive policy intervention, thereby reducing digital competition and innovation—excessive digital intervention results in a less productive economy. Second, the digital policies of countries in the Asia Pacific are less effective in optimizing digital potential and driving economic output. Thus, this research recommends identifying and improving policy frameworks and digital support environments that damage the economy. The policy framework that is prepared must be able to provide optimal resources to support the country's productivity and competitiveness. Research findings showing the positive influence of government efficiency on macroeconomic performance imply the importance of governance in supporting efficient governance that can control a high-cost economy, thereby promoting productivity and macroeconomic performance.

REFERENCES

ADB. (2022). *Economic Insights From Input-Output Tables For Asia and The Pacific*. Tokyo: Asian Development Bank.

Al-Smadi, M. O. (2022). Examining the Relationship between Digital Finance and Financial Inclusion: Evidence from MENA Countries. *Borsa Istanbul Review*, *23*(2), 464–472. https://doi.org/10.1016/j.bir.2022.11.016.

Arthur, K. K., Bannor, R. K., Masih, J., Oppong-Kyeremeh, H., & Appiahene, P. (2024). Digital innovations: Implications for African agribusinesses. *Smart Agricultural Technology*, *7*, 100407. https://doi.org/10.1016/j.atech.2024.100407.

Bhandari, K. R., Z´amborský, P., Rantac, M., & Salo, J. (2023). Digitalization, Internationalization, and Firm Performance: A Resource-Orchestration Perspective on New OLI Advantages. *International Business Review*, *32*(4), 102135. https://doi.org/10.1016/j.ibusrev.2023.102135.

Bui, M. T., & Le, H. L. (2023). Digital Capability and Creative Capability to Boost Firm Performance and Formulate Differentiated CSR-Based Strategy. *Heliyon*, *9*(3), e14241. https://doi.org/10.1016/j.heliyon.2023.e14241.

Castro, C., & Lopes, C. (2022). Digital Government and Sustainable Development. *Journal of the Knowledge Economy*, *13*(2), 880–903. https://doi.org/10.1007/s13132-021-00749-2

Chatzistamoulou, N. (2023). Is Digital Transformation the Deus ex Machina Towards Sustainability Transition of the European SMEs? *Ecological Economics*, *206*, 107739. https://doi.org/10.1016/j.ecolecon.2023.107739.

Cheng, Y., Zhou, X., & Li, Y. (2023). The Effect of Digital Transformation on Real Economy Enterprises' Total Factor Productivity. *International Review of Economics and Finance*, *85*, 488–501. https://doi.org/10.1016/j.iref.2023.02.007.

Cigu, E., Agheorghiesei, D. T., Gavriluţă, A. F., & Toader, E. (2019). Transport Infrastructure Development, Public Performance and Long-Run Economic Growth: A Case Study for the Eu-28 Countries. *Sustainability*, *11*(1), 67. https://doi.org/10.3390/su11010067.

Fu, Y., & Zheng, Z. (2020). Volatility Modeling and The Asymmetric Effect for China's Carbon Trading Pilot Market. *Physica A: Statistical Mechanics and Its Applications*, *542*, 123401. https://doi.org/10.1016/j.physa.2019.123401.

Galina, R., & Lapiņa, I. (2023). Digital Transformation as a Catalyst for Sustainability and Open Innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, *9*(1), 100017. https://doi.org/10.1016/j.joitmc.2023.100017.

Hui, P., Zhao, H., Liu, D., & Li, Y. (2023). How Does Digital Finance Affect Regional Innovation Capacity? A Spatial Econometric Analysis. *Economic Modelling*, *122*, 106250. https://doi.org/10.1016/j.econmod.2023.106250.

Jahan, N., & Zhou, Y. (2023). Covid-19 and Digital Inclusion: Impact on Employment. *Journal of Digital Economy*, *2*, 190–203. https://doi.org/10.1016/j.jdec.2024.01.003.

Khodapanah, M., Dehghan Shabani, Z., Akbarzadeh, M. H., & Shojaeian, M. (2022). Spatial Spillover Effects of Corruption in Asian Countries: Spatial Econometric Approach. *Regional Science Policy and Practice*, *14*(4), 699–718. https://doi.org/10.1111/rsp3.12368.

Kusumawardhani, N., Pramana, R., Saputri, N. S., & Suryadarma, D. (2023). Heterogeneous Impact of Internet Availability on Female Labor Market Outcomes in An Emerging Economy: Evidence from Indonesia. *World Development*, *164*, 106182. https://doi.org/10.1016/j.worlddev.2022.106182.

Li, D. D., & Maskin, E. S. (2021). Government and Economics: An Emerging Field of Study. *Journal of Government and Economics*, *1*, 100005. https://doi.org/10.1016/j.jge.2021.100005.

Li, F., Appiah, M., & Korankye, B. (2020). Financial Development and Economic Sustainability in ECOWAS Countries: the Role of Institutional Quality. *Etikonomi*, *19*(1), 41–50. https://doi.org/10.15408/etk.v19i1.13709.

Ma, X., Feng, X., Fu, D., Tong, J., & Ji, M. (2024). How Does The Digital Economy Impact Sustainable Development? —An Empirical Study from China. *Journal of Cleaner Production*, *434*, 140079. https://doi.org/10.1016/j.jclepro.2023.140079.

Meyer, D. F. (2019). A Quantitative Assessment of The Impact of Government Activities on the Economy of Poland. *Journal of Eastern European and Central Asian Research*, *6*(2), 220–233. https://doi.org/10.15549/jeecar.v6i2.338.

Moser-Plautz, B., & Schmidthuber, L. (2023). Digital Government Transformation as An Organizational Response to the COVID-19 Pandemic. *Government Information Quarterly*, *40*(3), 101815. https://doi.org/10.1016/j.giq.2023.101815.

Mroczek, T., Skica, T., & Rodzinka, J. (2019). Optimal Size of the General Government Sector from the Point of View of its Impact on the EU Economies. *South East European Journal of Economics and Business*, *14*(2), 95–105. https://doi.org/10.2478/jeb-2019-0016.

Mutascu, M., Horky, F., & Strango, C. (2023). Good or Bad? Digitalisation and Green Preferences. *Energy Economics*, *121*, 106640. https://doi.org/10.1016/j.eneco.2023.106640.

Oikonomou, M., Pierri, N., & Timmer, Y. (2023). IT Shields: Technology Adoption and Economic Resilience During the COVID-19 Pandemic. *Labour Economics*, *81*, 102330. https://doi.org/10.1016/j.labeco.2023.102330.

Palei, T. (2015). Assessing the Impact of Infrastructure on Economic Growth and Global Competitiveness. *Procedia Economics and Finance*, *23*, 168–175. https://doi.org/10.1016/s2212-5671(15)00322-6.

Park, H. J., & Choi, S. O. (2019). Digital Innovation Adoption and Its Economic Impact Focused on Path Analysis at National Level. *Journal of Open Innovation: Technology, Market, and Complexity*, *5*(3), 56. https://doi.org/10.3390/joitmc5030056.

Peng, Y., & Tao, C. (2022). Can Digital Transformation Promote Enterprise Performance? —From the Perspective of Public Policy and Innovation. *Journal of Innovation and Knowledge*, *7*(3), 100198. https://doi.org/10.1016/j.jik.2022.100198.

Qureshi, F., Qureshi, S., Vinh Vo, X., & Junejo, I. (2021). Revisiting the Nexus Among Foreign Direct Investment, Corruption and Growth in Developing and Developed Markets. *Borsa Istanbul Review*, *21*(1), 80–91. https://doi.org/10.1016/j.bir.2020.08.001.

Santos, A. M., Barbero, J., Salotti, S., & Conte, A. (2023). Job Creation and Destruction in The Digital Age: Assessing Heterogeneous Effects Across European Union Countries. *Economic Modelling*, *126*, 106405. https://doi.org/10.1016/j.econmod.2023.106405.

Sevinc, D., Sevil, G., & Oz-Yalaman, G. (2019). The Impact of Government Size on Output Volatility: Evidence from World Economies. *Business and Economics Research Journal*, *10*(4), 761–776. https://doi.org/10.20409/berj.2019.199.

Srisathan, W. A., & Naruetharadhol, P. (2022). A COVID-19 Disruption: The Great Acceleration of Digitally Planned and Transformed Behaviors in Thailand. *Technology in Society*, *68*, 101912. https://doi.org/10.1016/j.techsoc.2022.101912.

Xie, X., & Wang, S. (2023). Digital Transformation of Commercial Banks in China: Measurement, Progress and Impact. *China Economic Quarterly International*, *3*(1), 35–45. https://doi.org/10.1016/j.ceqi.2023.03.002.

Zhang, K., Cao, B., Guo, Z., Li, R., & Li, L. (2024). Research on the Impact of Government Attention on The Digital Economy of Chinese Provinces. *Innovation and Green Development*, *3*(2), 100118. https://doi.org/10.1016/j.igd.2023.100118.

Zhang, W., Zhao, S., Wan, X., & Yao, Y. (2021). Study on The Effect of Digital Economy on High-Quality Economic Development in China. *PLoS ONE*, *16*. https://doi.org/10.1371/journal.pone.0257365.

Zhao, N., Hong, J., & Lau, K. H. (2023). Impact of Supply Chain Digitalization on Supply Chain Resilience and Performance: A Multi-Mediation Model. *International Journal of Production Economics*, *259*, 108817. https://doi.org/10.1016/j.ijpe.2023.108817.

Zhao, Y., Song, Z., Chen, J., & Dai, W. (2023). The Mediating Effect of Urbanisation on Digital Technology Policy and Economic Development: Evidence from China. *Journal of Innovation and Knowledge*, *8*(1), 100318. https://doi.org/10.1016/j.jik.2023.100318.

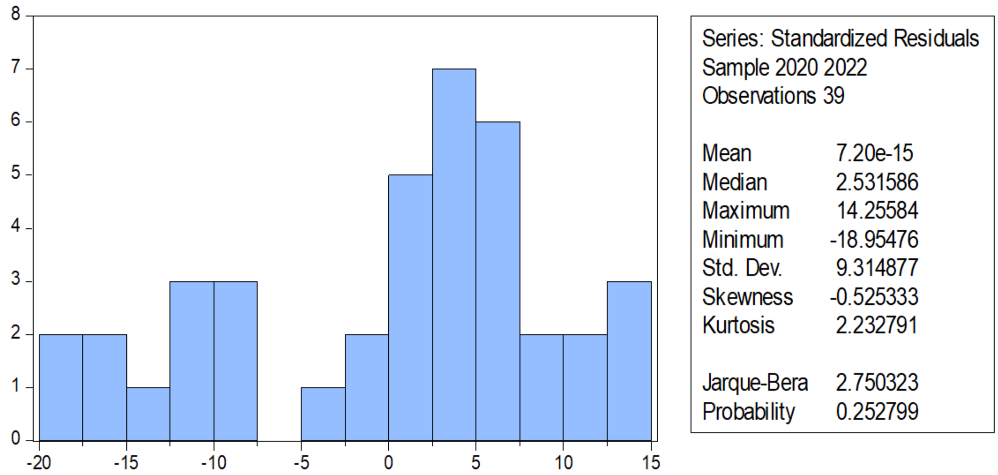
Appendix 1. Correlation Between Research Variables

	X_1	X_2	X_3	X_4	Y
X_1	1.000	0.898	0.932	0.664	0.649
X_2	0.898	1.000	0.890	0.805	0.648
X_3	0.932	0.890	1.000	0.654	0.577
X_4	0.664	0.805	0.654	1.000	0.542
Y	0.649	0.648	0.577	0.542	1.000

Appendix 2. Correlation Between Research Variables with changes in variables X_2 and X_3

	X_1	$D(X_2)$	$D(X_3)$	X_4	Y
X_1	1.000	0.125	0.126	0.658	0.690
$D(X_2)$	0.125	1.000	0.747	-0.084	-0.235
$D(X_3)$	0.126	0.747	1.000	-0.045	-0.159
X_4	0.658	-0.084	-0.045	1.000	0.591
Y	0.690	-0.235	-0.159	0.591	1.000

Appendix 3. Normality Test



Appendix 4. Research Data

Country	Year	Knowledge	Digital Policy	IT Integration	Economic Performance	Government Efficiency
Indonesia	2019	48.40	56.26	48.17	64.42	67.26
	2020	41.26	46.77	46.70	64.32	60.52
	2021	36.58	45.29	41.67	60.55	64.26
	2022	42.20	55.33	50.31	51.52	52.11
Thailand	2019	58.44	72.79	52.86	76.65	69.84
	2020	54.19	73.17	49.94	69.63	69.95
	2021	48.19	68.42	45.97	67.78	70.21
	2022	55.52	74.97	51.70	55.05	56.26
Malaysia	2019	77.61	76.84	71.51	74.21	67.81
	2020	73.64	74.77	64.05	72.20	61.60
	2021	66.46	66.01	60.50	71.38	61.13
	2022	70.08	71.45	65.33	62.34	50.46

Country	Year	Knowledge	Digital Policy	IT Integration	Economic Performance	Government Efficiency
Korea Rep.	2019	83.36	79.66	89.66	63.43	62.07
	2020	82.50	82.63	96.12	64.13	63.03
	2021	75.49	77.96	88.82	69.41	59.40
	2022	80.44	84.66	98.12	59.15	51.75
Japan	2019	74.69	75.08	77.35	68.43	56.40
	2020	70.09	71.77	67.93	71.16	52.21
	2021	64.76	63.18	64.20	72.67	52.39
	2022	68.83	71.35	67.95	60.31	47.30
India	2019	63.72	54.98	54.95	64.86	52.54
	2020	56.23	49.98	42.80	58.62	44.47
	2021	50.06	46.91	41.51	60.06	47.27
	2022	53.95	60.25	55.20	56.33	43.55
Kazakhstan	2019	68.97	64.09	63.60	57.50	68.94
	2020	62.94	57.29	63.84	53.17	61.81
	2021	55.31	53.78	62.21	54.54	69.85
	2022	67.64	61.56	67.51	39.12	59.05
China	2019	78.07	72.86	80.74	91.71	57.83
	2020	85.11	71.71	80.00	76.47	54.60
	2021	82.50	69.23	74.66	80.16	63.46
	2022	79.27	76.69	80.93	71.91	56.95
Taiwan	2019	78.89	84.93	85.56	68.64	79.97
	2020	76.34	88.68	91.81	68.31	84.82
	2021	73.91	88.71	87.20	76.32	86.60
	2022	79.23	90.70	89.99	62.79	81.65
Philippines	2019	53.54	51.47	52.09	60.14	55.71
	2020	42.56	47.25	44.79	56.45	50.39
	2021	35.16	41.74	37.69	42.79	48.36
	2022	40.51	51.58	43.95	44.74	40.49
Singapore	2019	90.50	100.00	86.41	83.07	93.84
	2020	92.03	99.50	87.12	83.42	92.33
	2021	84.13	88.14	86.23	83.35	89.16
	2022	91.44	96.43	88.19	81.09	87.63
Hongkong SAR	2019	85.82	89.80	84.23	75.11	97.39
	2020	85.38	94.60	87.87	63.99	100.00
	2021	83.84	92.66	86.33	63.15	97.14
	2022	86.53	96.19	77.97	61.91	92.32
Mongolia	2019	43.67	41.72	42.94	69.65	39.60
	2020	44.13	34.40	37.02	40.50	42.19
	2021	36.92	26.89	31.37	41.49	40.23
	2022	40.73	37.50	35.15	30.05	28.73

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