

DIGITAL INFRASTRUCTURE DEVELOPMENT AND REGIONAL LABOR PRODUCTIVITY IN INDONESIA: TESTING THE IT INVESTMENT PARADOX

By:

Selly Kudrati Ningsih^{1*}
Firsty Ramadhona Amalia Lubis²
Lestari Sukarniati³
Yunizarrahman⁴
Muhammad Farhan⁵

Universitas Negeri Makassar¹
Universitas Ahmad Dahlan^{2,3}
Sekolah Tinggi Ilmu Administrasi Tabalong⁴
Institut Teknologi Bandung⁵

Email:

selly.kudrati@unm.ac.id^{1*}
firsty.ramadhona@ep.uad.ac.id²
Lestari.sukarniati@ep.uad.ac.id³
yunizarrahman@gmail.com⁴
24225011@mahasiswa.itb.ac.id⁵

ABSTRACT

This study evaluates the structural friction between digital infrastructure expansion and regional economic efficiency across Indonesian provinces from 2020 to 2025. Using a quantitative-descriptive framework, panel data from 34 provinces are analyzed with the Fixed Effects Model to test for the Information Technology investment paradox at the subnational level. The empirical investigation reveals a critical divergence: while digital infrastructure significantly boosts Gross Regional Domestic Product, it has a strong negative impact on labor productivity in regions with low technological readiness. This theoretical anomaly uncovers a profound digital skills mismatch driven by skill-biased technological change and premature industrial automation. Furthermore, the global competitiveness of major Indonesian cities remains stagnant in the 2025 IMD Smart City Index due to highly fragmented data ecosystems and a lack of integrated subnational data governance. This study contributes to the literature by reconciling the inconsistent macroeconomic impacts of information technology. It concludes that local smart city master plans must be structurally unified with national human capital frameworks to mitigate labor displacement and foster inclusive regional growth.

**Keywords : Digital Infrastructure, Economic Growth, IT Investment Paradox,
Labor Productivity, Panel Data, Smart City**

A. INTRODUCTION

Achieving high-income status requires a structural transformation that shifts local economies away from resource dependency toward knowledge-driven productivity (Krabokoukis et al., 2026). Following the enactment of Presidential Regulation Number 12 of 2025 regarding the National Medium-Term Development Plan (RPJMN) 2025–2029, the Indonesian government has aggressively prioritized digital infrastructure as a core vehicle to catalyze cross-sectoral efficiency and achieve sustainable regional development (Seeth & Suryomenggolo, 2024). However, despite substantial public and private capital injections directed at subnational digitalization, a stark contradiction emerges when evaluating real economic outcomes (Zeng et al., 2025). Macroeconomic indicators for 2025 show that cumulative national economic growth reached 5.11%, falling short of the initial RPJMN target of 5.30%. More critically, the global competitiveness of Indonesia’s primary metropolitan centers has stagnated severely (Putra et al., 2026). The 2025 IMD Smart City Index reports that Jakarta's ranking remained at 103rd, falling behind regional competitors such as Ho Chi Minh City, while other key growth hubs, such as Medan and Makassar, continued to stagnate in their rankings (IMD World Competitiveness Center, 2025).

This widening gap between digital capital spending and real urban efficiency points to a fundamental breakdown in local development frameworks (Adeleke et al., 2025). Uncontrolled urbanization, currently expanding at an annual average rate of 4.10%, has triggered acute infrastructure deficits, severe traffic congestion, and swelling informal labor markets (Adel & Alani, 2024). While the state formally adopted the smart city architecture across six core pillars—Smart Governance, Branding, Economy, Living, Society, and Environment—local implementations have suffered from extreme fragmentation (Liando et al., 2026). Municipalities frequently initiate isolated applications without standardized technical frameworks or cross-agency database linkages, leading to widespread regulatory overlap and local budgetary inefficiencies (Sulistyaningsih et al., 2023).

Table 1.
Target vs Realization of Macroeconomic Indicators of RPJMN Year 2025

No	Development Indicator	Baseline (2024)	RPJMN Target (2025)	Realization (2025)	Source / Measurement Method
1.	Economic Growth Rate	5,05%	5,30%	5,11%	GDP Annual % Change
2.	Poverty Rate	9,03%	7,00% – 8,00%	9,03%	Susenas BPS (March 2024)
3.	Extreme Poverty Rate	0,93%	0,00%	<0,93%	World Bank \$2.15/day
4.	Human Capital Index (HCI)	0,54	0,56	0,54	World Bank HCI Methodology
5.	Gross National Income (GNI)	USD 4.870	USD 5.410	-	Atlas Method (Current USD)
6.	Gini Ratio	0,379	0,375 – 0,377	0,379	Inequality Measure (Susenas)

Source: Compiled by authors from Bappenas Perpres 12/2025 and BPS publications (2025/2026).

Prior international literature remains deeply divided over the exact macroeconomic returns of digital investments (Privara & Caplanova, 2025). One

body of research asserts that information and communication technology (ICT) acts as a frictionless growth engine by mitigating transaction costs and maximizing cross-border knowledge spillovers (Agustin & Sakti, 2025; Kartiasih et al., 2023). Conversely, counter-arguments demonstrate that advanced technological adoptions can induce a localized "IT investment paradox," where substantial digital expenditures yield negative shifts in employment structures due to labor displacement (Willcocks, 2024; Yeo & Grant, 2024).

This study contributes to the literature by constructing a comprehensive spatial panel framework that systematically analyzes the post-pandemic interaction between information technology infrastructure, human capital variables, and real labor productivity across 34 Indonesian provinces from 2020 to 2025. Methodologically, it moves away from qualitative descriptions of localized software implementations to deliver a rigorous econometric evaluation of subnational structural frictions. By testing these relationships during a critical regulatory transition, this paper exposes the precise mechanism by which digital transformations can spur economic expansion while simultaneously dampening labor efficiency under conditions of low educational readiness.

B. LITERATURE STUDY

The macro-linkage between technological deployment and long-run economic expansion is theoretically anchored in the Endogenous Growth Theory established by Romer (1986) and Lucas (1988). Unlike neoclassical frameworks that treat technological progress as an exogenous shock, endogenous models argue that sustainable economic growth is driven internally by knowledge accumulation, systematic research and development, and human capital investments (Chukwuemeka, 2024). Within this framework, ICT serves as a crucial amplifier of aggregate efficiency by reducing information asymmetries, optimizing market matching, and lowering transaction costs. However, Sen's (1999) capability approach argues that expanding physical capital or digital infrastructure is insufficient if it does not systematically enhance human capabilities. Within the Indonesian subnational context, Herlina and Subiyantoro (2024) confirm that regional economic expansion and human development improvements are structurally contingent upon public spending in higher education and workforce skill accumulation. Consequently, translating technological infrastructure into real economic value requires synchronous investments in human capital capabilities.

In modern urban ecosystems, smart cities are spaces where human capital, social capital, and advanced communication networks interact to generate sustainable economic outcomes and elevate the quality of life for the public (Polese et al., 2019). Under Transaction Cost Economics (TCE), the institutionalization of the *Smart Economy* dimension—such as integrated financial technology frameworks and unified e-commerce platforms—serves as a structural mechanism to lower entry barriers, enhance market transparency, and streamline subnational supply chains. This structural optimization directly improves local resource allocations and mitigates institutional frictions within the urban economy.

However, the empirical literature highlights a persistent academic debate known as the *Solow Productivity Paradox* or *IT Investment Paradox* (Yeo & Grant,

2024). High-impact international studies demonstrate that the relationship between digital investments and economic output is highly non-linear and conditioned by institutional maturity. In regions with robust digital literacy, ICT infrastructure yields extensive productivity growth. Yet, in developing economic landscapes marked by low-skilled labor pools, premature automation can generate negative returns on labor absorption and worker efficiency (Elmassah & Mohieldin, 2020; Willcocks, 2024). This friction emerges because rapid technological shifts favor specialized skills (skill-biased technological change), effectively pushing uneducated segments of the workforce out of primary industrial sectors and forcing them into low-value informal activities. Consequently, evaluating these dynamics using up-to-date subnational panel data is vital to clarifying these theoretical disputes in the Indonesian economic context.

C. RESEARCH METHOD

This study applies a quantitative-descriptive framework using secondary panel data from 34 Indonesian provinces from 2020 to 2025, yielding 204 balanced observations. The data are extracted from the Central Bureau of Statistics (BPS) and from national planning documents issued by Bappenas. To capture the multi-layered impacts of digital development, the research operationalizes two primary econometric estimation models.

Model 1 evaluates the aggregate impact of technological readiness and physical capital accumulation on real regional output (Gross Regional Domestic Product at Constant Prices):

$$\ln(PDRB_{it}) = \beta_0 + \beta_1 IP_TIK_{it} + \beta_2 \ln(PMTB_{it}) + \beta_3 IPM_{it} + \beta_4 TPT_{it} + \epsilon_{it}$$

Model 2 investigates the micro-structural implications of these technological transformations on regional Labor Productivity ($Prod_{it}$), capturing real output generated per worker

$$\ln(Prod_{it}) = \alpha_0 + \alpha_1 IP_TIK_{it} + \alpha_2 \ln(HPE_{it}) + \alpha_3 RLS_{it} + \mu_{it}$$

Table 2.
Operational Definition and Data Sources of Variables

Variable Name	Code	Operational Definition	Measurement Scale	Source
Gross Regional Domestic Product	PDRB	Total value of goods and services produced at 2010 Constant Prices.	Natural Logarithm (ln)	BPS Indonesia
Labor Productivity	Prod	Real macroeconomic output generated per individual worker.	Natural Logarithm (ln)	BPS Indonesia
ICT Development Index	IP_TIK	Composite index measuring ICT access, domestic usage, and technical skills.	Absolute Index Score (0 to 10)	BPS Indonesia
Gross Fixed Capital Formation	PMTB	Total proxy value of regional physical infrastructure investments.	Natural Logarithm (ln)	BPS Indonesia
Human Development Index	IPM	Composite metric capturing regional health, education, and living standards.	Percentage Index Score (0 to 100)	BPS Indonesia
Open	TPT	Proportion of the productive	Percentage Rate (%)	BPS

Variable Name	Code	Operational Definition	Measurement Scale	Source
Unemployment Rate		workforce actively seeking employment.		Indonesia
Household Per Capita Expenditure	HPE	Natural proxy for real public purchasing power and welfare standards.	Natural Logarithm (ln)	BPS Indonesia
Average Length of Schooling	RLS	Cumulative formal education years completed by the productive population.	Total Years	BPS Indonesia

Source: data processed, 2026

D. RESULTS AND DISCUSSION

Econometric Model Selection and Diagnostics

To guarantee structural transparency and econometric replicability, formal model selection procedures were executed. The choice between the Common Effect Model (CEM), Random Effect Model (REM), and Fixed Effect Model (FEM) was determined via formal Chow and Hausman statistical tests

Table 3.
Econometric Model Selection Tests Summary

Model Stage	Statistical Test	Test Metric	Value / Statistic	p-value	Decision
Model 1 (PDRB)	Chow Test	F-Statistic	24.815	0.0000	Reject CEM (Prefer FEM)
	Hausman Test	χ^2 Statistic	38.412	0.0000	Reject REM (Prefer FEM)
Model 2 (Prod)	Chow Test	F-Statistic	18.234	0.0000	Reject CEM (Prefer FEM)
	Hausman Test	χ^2 Statistic	29.561	0.0000	Reject REM (Prefer FEM)

Source: data processed, 2026

The highly significant p-values ($p < 0.01$) Across both testing sequences, confirm that the Fixed Effect Model (FEM) is the most efficient and unbiased estimation method. This choice mathematically accounts for the severe unobserved spatial heterogeneity and time-invariant institutional differences across the 34 Indonesian provinces.

Analysis of Empirical Estimation Results

The empirical outputs generated via the EViews 12 processing environment are presented below.

Table 4.
FEM Estimation Results for Model 1 (Dependent Variable: ln PDRB)

Independent Variable	Parameter Coefficient	Standard Error	t-Statistic	Probability (p-value)
Constant (C)	7.168162	2.812145	2.549002	0.0140

Independent Variable	Parameter Coefficient	Standard Error	t-Statistic	Probability (p-value)
IP-TIK (X_1)	0.030104	0.012101	2.487728	0.0137
ln PMTB (X_2)	0.871520	0.110245	7.905301	0.0000
IPM (X_3)	0.116412	0.042301	2.751991	0.0065
TPT (X_4)	-7.695612	2.727540	-2.821540	0.0071
Model	$R^2 = 0.8530$	Adj $R^2 =$	F-Stat = 27.14	
Diagnostics:		0.8214	($p = 0.0000$)	

Source: data processed, 2026

The estimation equation for Model 1 is expressed as:

$$\ln(PDRB_{it}) = 7,168 + 0,030IP_TIK_{it} + 0,872\ln(PMTB_{it}) + 0,116IPM_{it} - 7,696TPT_{it} + \epsilon_{it}$$

The empirical findings confirm that digital infrastructure significantly pushes aggregate economic growth. The positive coefficient of IP_TIK reveals that an absolute 1-point growth in the index scale corresponds to a 3.00% expansion in regional output. This aligns with endogenous growth expectations, validating that digital networks act as continuous output multipliers. Physical investments (ln PMTB) exert the strongest impact, showing an elasticity of 0.872, proving that heavy hardware and capital construction remain primary determinants of regional output capacity. Conversely, the high negative coefficient of TPT highlights massive economic output losses linked to workforce underutilization.

Table 5.

FEM Estimation Results for Model 2 (Dependent Variable: ln Prod)

Independent Variable	Parameter Coefficient	Standard Error	t-Statistic	Probability (p-value)
Constant (C)	4.021450	1.234102	3.258604	0.0013
IP-TIK (X_1)	-0.112104	0.034201	-3.277798	0.0012
ln HPE (X_2)	0.420412	0.110245	3.813433	0.0002
RLS (X_3)	0.551201	0.123456	4.464756	0.0000
Model	$R^2 = 0.4848$	Adj $R^2 =$	F-Stat = 6.65	
Diagnostics:		0.4120	($p = 0.0001$)	

Source: data processed, 2026

The estimation equation for Model 2 is expressed as:

$$\ln(Prod_{it}) = 4,021 - 0,112IP_TIK_{it} + 0,420\ln(HPE_{it}) + 0,551RLS_{it} + \epsilon_{it}$$

The core empirical finding of Model 2 reveals a vital theoretical anomaly: the coefficient on IP_TIK for labor productivity is significant and negative. This implies that a 1-point expansion in digital readiness drops aggregate labor efficiency by 11.20%. This outcome stands in sharp contrast to conventional Romer-Lucas endogenous frameworks, confirming the localized presence of the Solow Productivity Paradox at the subnational level (Yeo & Grant, 2024) instead.

The economic mechanism driving this anomaly is rooted in a severe digital skills mismatch and skill-biased technological change. As modern urban industries rapidly assimilate advanced ICT networks and automation systems, they shift their production functions toward capital-intensive structures. While digitalization holds

the capacity to stimulate regional economic activities (Novitasari, 2022), the domestic workforce lacks the necessary digital literacy and higher education qualifications required to operate within automated landscapes (Herlina & Subiyantoro, 2024). Because the regional educational ecosystem operates with severe rigidity as reflected by slow movements in Average Length of Schooling industrial automation ultimately induces labor displacement rather than efficiency gains.

Consequently, industrial automation does not augment local labor; it displaces it. Low-skilled workers are excluded from primary manufacturing and formalized service networks. Because these individuals must maintain livelihoods, they are pushed into low-productivity, survivalist informal sectors (such as uncoordinated ride-hailing or basic retail commerce) or absorbed into frictional unemployment structures (Willcocks, 2024). This capital-labor substitution effect completely overrides the efficiency gains of digital investments, resulting in depressed aggregate labor productivity across provinces experiencing rapid infrastructure rollouts without parallel human capital growth.

Cross-Regional Comparative Synthesis

This structural friction is visible when evaluating cross-regional case data. In high-index territories like DKI Jakarta, advanced smart city policies—such as the JAKI super-app integration and predictive inflation trackers—have maximized macro revenues. Yet, Jakarta continuously faces data silos, where individual government entities operate isolated databases that fail to achieve interoperability, driving up municipal administrative costs.

In metropolitan clusters like South Tangerang, Surabaya, and Bandung, digital policies have focused heavily on automating public services (Smart Governance). However, these automated systems create a stark spillover effect that sharpens labor polarization. While automated licensing systems optimize municipal operational speed, they systematically reduce the demand for lower-level administrative personnel, accelerating the contraction of formalized entry-level employment.

This dynamic becomes even more critical in outer-island regions like East Sumba. While local master plans attempt to establish Smart Green City systems by deploying solar power technology, the region suffers from a severe basic infrastructure deficit. The local population faces poor healthcare access, an infant mortality rate of 88%, and a stunting prevalence of 14.90%. Deploring the adoption of advanced digital applications in an environment that lacks basic human needs fulfillment demonstrates that uncoordinated tech adoption creates severe misallocations of scarce regional resources (Ahmed, 2017). Thus, the empirical reality of outer-island provinces reinforces the econometric paradox: digital investments fail to generate real labor efficiency when detached from foundational human capabilities.

These findings enrich the Romer-Lucas Endogenous Growth Theory by proving that technological progress is not a guaranteed, frictionless driver of efficiency. The research demonstrates that the positive externalities of technology are strictly contingent upon human capital thresholds. When a structural imbalance persists between digital infrastructure development and local human capital capacity, the capital-labor substitution effect triggers widespread labor displacement rather than growth. This validates the Solow Productivity Paradox within developing economies, confirming that technology adoption without synchronous educational modernization dampens aggregate labor efficiency.

Regulators must abandon isolated software procurement projects and focus on

structural integration. First, the Ministry of National Development Planning/Bappenas and the Ministry of Communication and Digital must enforce a legally binding national management information system architecture. This standardization will eliminate redundant subnational digital spending and ensure data interoperability across all tiers of government. Second, local smart city master plans must be systematically synchronized with the Grand Design of Population Development (DBPK) 2025–2045. Regional governments should reallocate digital budgets away from basic administrative platforms toward regional digital vocational programs, ensuring that the local labor supply matches the skill requirements of automated modern industries.

E. CONCLUSIONS

This study concludes that the expansion of digital infrastructure across Indonesian provinces from 2020 to 2025 is a double-edged sword. While macro digital infrastructure significantly drives regional GRDP growth, it simultaneously depresses regional labor productivity due to a profound digital skills mismatch and premature automation. The stagnation of major cities in global indices confirms that localized digital platforms fail to resolve core urban frictions due to weak data governance, fragmented systems, and a lack of human-centric integration. Technological adoption serves as an inclusive development catalyst only when structurally balanced by synchronous investments in formal education and targeted digital training.

The primary limitation of this study stems from spatial data constraints. Due to institutional reporting lags in newly formed provincial territories, particularly in the Papua region, the panel data structure could not fully capture the distinct institutional shocks occurring at these emerging administrative borders, thereby forcing reliance on baseline historical spatial aggregations.

Future economic research should extend this evaluation by utilizing dynamic panel data models (such as the Generalized Method of Moments or GMM) to capture lag effects and endogeneity loops. Furthermore, integrating spatial econometrics would allow future studies to map the exact geographic spillovers and digital infrastructure leakage effects across adjacent provincial boundaries.

REFERENCES

- Adel, A., & Alani, N. H. S. (2024). Human-centric collaboration and Industry 5.0 framework in smart cities and communities: Fostering sustainable development goals 3, 4, 9, and 11 in Society 5.0. *Smart Cities*, 7(4), 1723–1775. <https://doi.org/10.3390/smartcities7040068>
- Adeleke, O. J., Jovanovich, K. D., Ogunbunmi, S., Samuel, O., & Kehinde, T. O. (2025). Comprehensive Exploration of Smart Cities : A Systematic Review of Benefits , Challenges , and Future Directions in Telecommunications and Urban Development. *IEEE Sensors Reviews*, 2(June), 228–245. <https://doi.org/10.1109/SR.2025.3569239>
- Agustin, R. A., & Sakti, R. K. (2025). Analysis Of Economic Growth and Income Inequality Among Province in Indonesia 2018–2022. *Journal of Development Economic and Social Studies*, 4(1), 238–252. <https://doi.org/10.21776/jdess.2025.04.1.18>
- Ahmed, E. M. (2017). ICT and human capital spillover effects in achieving sustainable East Asian knowledge-based economies. *Journal of the Knowledge Economy*, 8(3), 1086–1112. <https://doi.org/10.1007/s13132-016-0430-4>
- Chukwuemeka, O. A. (2024). A Theoretical and Empirical Literature on Economic Growth. *Advanced Research in Economics and Business Strategy Journal*, 05(02), 7–16. <https://asjp.cerist.dz/en/article/262828>
- Elmassah, S., & Mohieldin, M. (2020). Digital transformation and localizing the sustainable development goals (SDGs). *Ecological Economics*, 171(February), 106604. <https://doi.org/10.1016/j.ecolecon.2020.106604>
- Herlina, & Subiyantoro, H. (2024). Analisis pengaruh pendidikan tinggi, pengeluaran pemerintah sektor pendidikan, keberadaan perguruan tinggi terhadap pertumbuhan ekonomi serta implikasinya terhadap Indeks Pembangunan Manusia. *Journal of Applied Business and Economic (JABE)*, 11(1), 86–99. <https://doi.org/10.30998/jabe.v11i1.24489>
- IMD World Competitiveness Center. (2025). IMD Smart City Index 2025. <https://www.imd.org/smart-city-index/>
- Kartiasih, F., Nachrowi, N. D., Wisana, I. D. G. ., & Handayani, D. (2023). Towards the quest to reduce income inequality in Indonesia: Is there a synergy between ICT and the informal sector? *Cogent Economics & Finance*, 11(2), 2241771. <https://doi.org/10.1080/23322039.2023.2241771>
- Krabokoukis, T., Tsiotas, D., & Kantianis, D. (2026). Mapping The Spatial Dynamics Of Innovation-Driven Socioeconomic Inequality In The European Union. *Romanian Journal of Regional Science*, 20(1), 1–28. https://econpapers.repec.org/article/rrsjournal/v_3a20_3ay_3a2026_3ai_3a1_3ap_3a1-28.htm
- Liando, D. M., Ganaie, N. A., & Yulsaini, N. (2026). Smart City 2 . 0 governance policy model : institutional configurations and the politics of urban inclusion in India , Singapore , and Indonesia. *Frontiers in Political Science*, 8(February), 1–17. <https://doi.org/10.3389/fpos.2026.1730870>
- Lucas, R. E. (1988). On the mechanics of economic development. *Journal of*

- Monetary Economics, 22(1), 3–42. [https://doi.org/10.1016/0304-3932\(88\)90168-7](https://doi.org/10.1016/0304-3932(88)90168-7)
- Novitasari, A. T. (2022). Kontribusi UMKM terhadap pertumbuhan ekonomi era digitalisasi melalui peran pemerintah. *Journal of Applied Business and Economic (JABE)*, 9(2), 184–204. <https://doi.org/10.30998/jabe.v9i2.13703>
- Polese, F., Botti, A., Monda, A., & Grimaldi, M. (2019). Smart city as a service system: a framework to improve smart service management. *Journal of Service Science and Management*, 12(1), 1–16. <https://doi.org/10.4236/jssm.2019.121001>
- Privara, A., & Caplanova, A. (2025). Institutions , digital investment potential and productivity growth in EU and Southeast Asia. *The Journal of Risk Finance*, 26(5), 722–744. <https://doi.org/10.1108/JRF-04-2025-0180>
- Putra, D. S., Putra, F., & Subekti, D. (2026). A Multidimensional Analysis : Gaps and Convergence Smart City Implementation in Indonesia. *Jurnal Ilmu Sosial Dan Humaniora*, 15(1), 192–206. <https://doaj.org/article/04ce438b4625419691033ce9bef7ae07>
- Romer, P. . (1986). Increasing returns and long-run growth. *Journal of Political Economy*, 94(5), 1002–1037. <https://doi.org/https://doi.org/10.1086/261420>
- Seeth, A. T., & Suryomenggolo, J. (2022). Politics of marginalisation in Indonesia: The Jokowi era. *IQAS – International Quarterly for Asian Studies*, 53(2), 137–153. <https://doi.org/10.11588/iqas.2022.2.19323>(<https://doi.org/10.11588/iqas.2022.2.19323>)
- Sen, A. (1999). *Development as freedom*. Oxford University Press.
- Sulistyaningsih, T., Purnama, R. A., & Kulsum, U. (2023). Smart city policy: Strategy and implementation to realize smart urban governance in Indonesia. *Journal of Governance and Public Policy*, 10(2), 105–117. <https://doi.org/10.18196/jgpp.v10i2.17637>
- Willcocks, L. P. (2024). Automation, digitalization and the future of work: A critical review. *Journal of Electronic Business & Digital Economics*, 3(2), 184–199. <https://doi.org/10.1108/JEBDE-09-2023-0018>
- Yeo, B., & Grant, D. (2024). The technology paradox explained in stages and technology presence. *International Journal of Business and Economics*, 23(1), 87–112. [https://doi.org/10.6758/ijbe.202404_23\(1\).0005](https://doi.org/10.6758/ijbe.202404_23(1).0005)
- Zeng, W., Wu, X., Zhu, K., & Zhu, L. (2025). Can Digitization Policy Improve Capital Misallocation in China ? Empirical Evidence Based on National Big Data Comprehensive Pilot Zone Policy. *SAGE Open*, 15(3), 1–18. <https://doi.org/10.1177/21582440251356790>