Journal of Economic Cooperation and Development, **47**, 1 (2026), 227-260

Digital Economy and Inclusive Green Growth: Evidence from Indonesia with Implications for OIC Development Cooperation

Meita Indah Fadilla[1] and Sri Yani Kusumastuti[2]

ABSTRACT

The digital economy diversifies economies by leveraging tech to impact socio-economics and environmental quality. This study examines the effects of the digital economy which includes media, e-commerce, and digital infrastructure on inclusive green economic growth and its social, economic, and environmental facets. This study analyzes the influence of each dimension in the digital economy on each pillar of inclusive green economic growth. Multiple linear regression with the Ordinary Least Square (OLS) model is the study methodology employed, and the data is cross-sectional in 2022 across 34 Indonesian provinces. The calculation uses a composite index to obtain the data on each dimension/pillar and index. The digital economy boosts inclusive green growth, and e-commerce strengthens the economic pillar. However, digital infrastructure and e-commerce both have a detrimental influence on the environmental pillar, while e-commerce has a negative impact on the social pillar. With a 45.92% impact on the environmental pillar, the digital economy has the largest impact of the three pillars of inclusive green economic growth, underscoring the necessity of cooperation between the public and private sectors. To secure a sustainable socioeconomic future, this collaboration should concentrate on green technology, digital literacy, and renewable energy.

ملخص

يساهم الاقتصاد الرقمي في تنويع الاقتصاد في البلدان من خلال تسخير التكنولوجيا للتأثير على الجوانب الاجتماعية والاقتصادية وجودة البيئة. تبحث هذه الدراسة في آثار الاقتصاد الرقمي، الذي يشمل وسائل الإعلام والتجارة الإلكترونية والبنية التحتية الرقمية، على النمو الاقتصادي الأخضر الشامل ومختلف جوانبه الاجتماعية والاقتصادية والبيئية. تحلل تأثير كل بعد من أبعاد

[1] Development Economics Department, Universitas Trisakti, Indonesia
E-mail: meitaindah20@gmail.com
[2] Development Economics Department, Universitas Trisakti, Indonesia
E-mail: sriyani.k@trisakti.ac.id

الاقتصاد الرقمي على مختلف ركائز النمو الاقتصادي الأخضر الشامل. والمنهجية المعتمدة في هذه الدراسة هي الارتداد الخطي المتعدد مع نموذج المربعات الصغرى العادية (OLS)، والبيانات مصدرها قطاعات متعددة في عام 2022 على مستوى 34 محافظة إندونيسية. ويعتمد الحساب على مؤشر مركب للحصول على البيانات الخاصة بكل بعد/ركيزة ومؤشر. للاقتصاد الرقمي دور كبير في تعزيز النمو الأخضر الشامل، كما أن من شأن التجارة الإلكترونية تقوية الركيزة الاقتصادية. مع هذا، يبقى للبنية التحتية الرقمية والتجارة الإلكترونية معا أثر عكسي على الركيزة البيئية، في حين أن للتجارة الإلكترونية تأثير سلبي على الركيزة الاجتماعية. ويستأثر الاقتصاد الرقمي بأعلى حصة للأثر على الركائز الثلاث للنمو الاقتصادي الأخضر الشامل، وذلك لتأثيره بنسبة 45.92% على الركيزة البيئية، وهذا ما يؤكد ضرورة التعاون بين القطاعين العام والخاص. لضمان مستقبل مستدام على الجانبين الاجتماعي والاقتصادي، ينبغي أن يقوم هذه التعاون على التكنولوجيا الخضراء، وتعزيز الدراية الرقمية، والطاقة المتجددة.

RÉSUMÉ

L'économie numérique contribue à la diversification des économies en tirant parti de la technologie pour influencer les aspects sociaux et économiques et la qualité de l'environnement. Cette étude examine les effets de l'économie numérique, qui comprend les médias, le commerce électronique et les infrastructures numériques, sur la croissance économique verte inclusive et ses aspects sociaux, économiques et environnementaux. Elle analyse l'impact de chaque dimension de l'économie numérique sur chacun des piliers de la croissance économique verte inclusive. La méthodologie utilisée est celle de la régression linéaire multiple avec le modèle des moindres carrés ordinaires (OLS), et les données proviennent de plusieurs secteurs en 2022 dans 34 provinces indonésiennes. Le calcul utilise un indice composite pour obtenir les données spécifiques à chaque dimension/pilier et indice. L'économie numérique stimule la croissance verte inclusive, et le commerce électronique renforce le pilier économique. Cependant, les infrastructures numériques et le commerce électronique ont un impact négatif sur le pilier environnemental, tandis que le commerce électronique a un impact négatif sur le pilier social. Avec un impact de 45,92 % sur le pilier environnemental, l'économie numérique a le plus grand impact sur les trois piliers de la croissance économique verte inclusive, ce qui souligne la nécessité d'une coopération entre les secteurs public et privé. Afin de garantir un avenir socio-économique durable, cette collaboration doit se concentrer sur les technologies vertes, la culture numérique et les énergies renouvelables.

Keywords: Digital Economy, Digital Infrastructure, Digital Media, Electronic Commerce, Inclusive Green Economic Growth

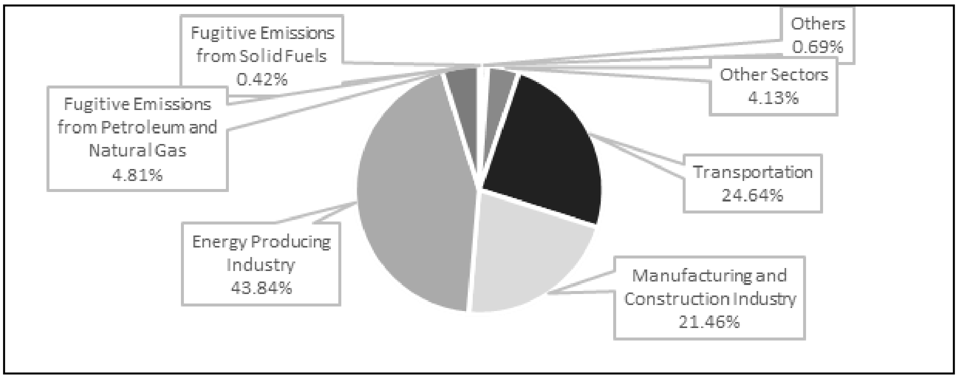
JEL Classification: C12, C31, E20, O13, O39

1. Introduction

Amidst global challenges, Indonesia is leveraging the digital economy for sustainable development, balancing economic growth with social and environmental needs (Tumanggor & Pasaribu, 2019). Key digital economy pillars, as defined by the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce (2018), have significantly enhanced daily life systems.

Technological advancements have reshaped Indonesia's economy, establishing its digital sector as a Southeast Asian frontrunner (Baijal et al., 2021). Based on data from the Ministry of Energy and Mineral Resources (2020), while this digital growth has boosted consumer spending and overall demand, it has also exacerbated environmental challenges, notably rising greenhouse gas emissions.

Figure 1: Contribution of Each Category in GHG Emissions in 2019



Source: ESDM Data and Information Technology Center, 2020

According to data from the Ministry of Energy and Mineral Resources (2020), economic activities, despite their societal benefits, contribute significantly to environmental degradation through increased GHG emissions, impacting social stability. Energy, transportation, and manufacturing are primary emitters, with electricity generation being a major source. Rising fuel consumption directly correlates with increased emissions across these sectors, prompting governmental concern over the environmental impact of digitally driven economic activities.

Based on data from the National Waste Management Information System (SIPSN) of the Ministry of Environment and Forestry (KLHK) (2022), the digital economy's growth has led to increased packaging waste, contributing to Indonesia's rising annual waste, which reached a four-year high of 35.83 million tons in 2022. Notably, e-commerce plastic packaging, like shipping sacks, forms a significant portion.

Prior research indicates that the interplay between the digital economy and inclusive green growth is intricate and multifaceted. Digital innovation, infrastructure, and platforms can enhance ecological efficiency, promote low-carbon development, and facilitate informed consumer behavior that supports green practices (Zhao et al., 2023); (Fan et al., 2022); (Deng & Shao, 2022). The digital economy may worsen environmental degradation, elevate energy consumption, and introduce new social challenges, including inequality, cybercrime, and the marginalization of vulnerable groups (Agung & Marisa, 2019); (Sudiantini et al., 2023); (Heryana & Firmansyah, 2024). E-commerce serves as both a catalyst for sustainability and a contributor to economic growth (Cao et al., 2021); (Wen & Sun, 2023). However, it also presents challenges such as impulsive consumption, cultural changes, and unsustainable resource utilization, especially for SMEs that need to implement sustainability practices to uphold trust and competitiveness (Shari et al., 2024); (Fuqoha & Firmansyah, 2023).

Many prior studies employ the ADB’s composite index approach to measure the Inclusive Green Growth Index (IGGI), characterized by its cross-country and aggregate nature (Jha et al., 2018); (Tumanggor & Pasaribu, 2019); (Aminata et al., 2022). Measurement of digital economy indicators at the subnational level in Indonesia is limited, frequently depending on basic linear regressions that do not thoroughly consider provincial contexts (Nizar & Sholeh, 2021); (Sari & Nasrudin, 2022). Moreover, current research utilizes various methodologies, including qualitative descriptive methods (Sudiantini et al., 2023) and sophisticated quantitative techniques such as quantile regression and PSM-DID (Zhao et al., 2023);(Wen & Sun, 2023). However, there is a lack of integration of these approaches to directly examine the interaction between dimensions of the digital economy and IGGI pillars within a unified empirical framework.

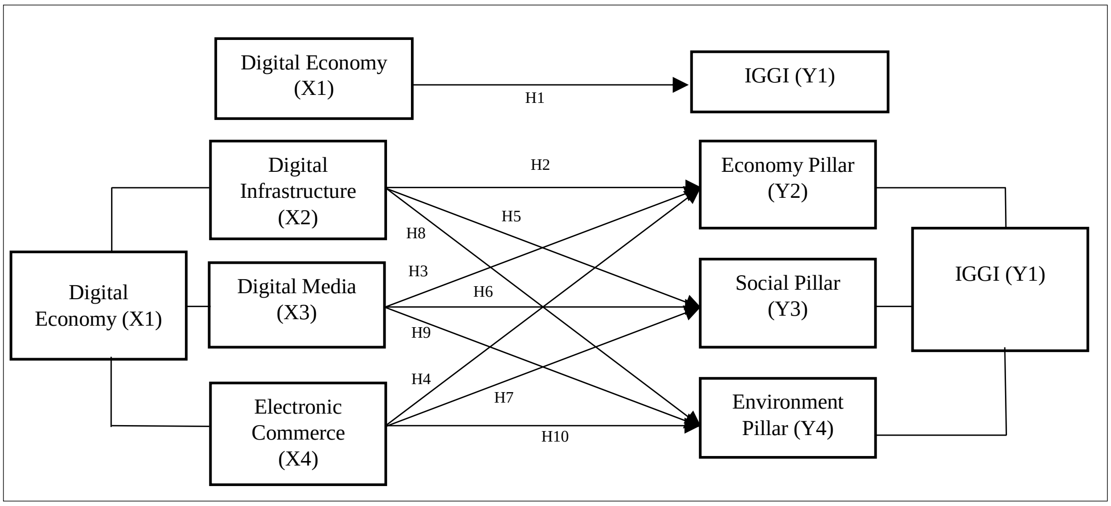
This research addresses this gap by developing an Inclusive Green Growth Index (IGGI) using the latest Indonesian data and combining it with digital economy variables constructed from observable indicators. To measure how these observable variables directly influence one another, a multiple linear regression model is applied to cross-sectional data for 2022. In Indonesia, the rapid growth of the digital economy helps diversify economic activities but also increases environmental pressures through infrastructure, media, and e-commerce. Therefore, this study explores the complex relationship between the digital economy and inclusive green growth, highlighting its strategic importance despite its environmental challenges.

2. Literature Review

The digital economy, as conceptualized by (Tapscott, 1995) and further defined by BEA (2018), encompasses digital infrastructure, e-business, and e-commerce, driven by interconnectedness (Görög, 2018). Achieving inclusive green economic growth (IGGI), as emphasized by (Listyarini & Warlina, 2017) and Indonesian Law No. 32/2009, requires integrated resource management across economic, social, and environmental dimensions. Aligned with Schumpeter's innovation-driven growth theory (Ningsih & Andiny, 2018), the digital economy presents opportunities but also poses challenges, including the "digital divide" (OCDE, 2011); (Limilia & Prihandini, 2018) and the environmental trade-offs depicted by the Environmental Kuznets Curve (Grossman & Krueger, 1991); (Ghifary et al., 2022). In contrast, decoupling theory suggests that technological innovation can reduce environmental and resource pressures while still driving economic growth (Aulia, 2015); (Kasmiati et al., 2016). This necessitates balancing technological advancement with inclusive and sustainable practices.

To guide the analysis, the following theoretical framework has been developed, grounded in the preceding discussion and established theories:

Figure 2: Research Theoretical Framework



Aligning with Schumpeter's theory that innovation fuels growth by introducing novel methods and organizational structures, the digital economy prompts shifts in economic activity, leading to higher income levels. These advancements accelerate the emergence of new industries and improve the efficiency of environmentally conscious production (Jiang & Deng, 2022). Therefore, it's hypothesized that:

Ha1: The Digital Economy has a positive effect on the IGGI

According to BEA (2018), this infrastructure encompasses the essential physical resources and organizational frameworks that enable computer network utilization. Widespread internet connectivity enables digital infrastructure to support electronic economic activities and broaden economic opportunities across regions (Aryani et al., 2021), thereby providing a solid foundation for inclusive and efficient participation in the digital economy (Prasad, 2021). Therefore, the following hypothesis is proposed:

Ha2: The Digital Infrastructure has a positive effect on the Economic Pillar in the IGGI

Digital media includes audiovisual applications and material, such as digital music, digital video, and electronic periodicals, that are directly distributed online (Wibowo et al., 2022). It plays a crucial role in harmonizing digital information dissemination, social media engagement, e-commerce, and electronic payment systems, thereby fostering business revenue growth through information and communication technology (Sholihin et al., 2018). Consequently, the following hypothesis is proposed:

Ha3: The Digital Media has a positive effect on the Economic Pillar of the IGGI

E-commerce, through digital platforms, streamlines trade for both buyers and sellers (Nasution et al., 2020). Echoing Schumpeter's innovation theory, it boosts economic growth by driving entrepreneurship and technological progress (Zhong et al., 2022). Its efficiency and incentives make it a potent tool for economic development (Dianari, 2018). Thus, it's hypothesized:

Ha4: The E-commerce has a positive effect on the Economic Pillar of the IGGI

Effective digital infrastructure lays the groundwork for sustained community benefits, offering enhanced digital access and online skill development opportunities (Miranti et al., 2022). By promoting widespread digital infrastructure development within communities, it mitigates poverty and social inequality, reducing disparities in digital facility utilization and ultimately enhancing overall quality of life (Samoilovych, 2023). Therefore, the following hypothesis is proposed:

Ha5: The Digital Infrastructure has a positive effect on the Social Pillar of the IGGI

Digital media significantly influences the digital economy, creating new avenues for communities to enhance their living standards by facilitating economic activities (Rifai et al., 2022). Furthermore, digital media's growth advances knowledge, simplifies economic transactions, and enables access to better living standards through job opportunities found on social media (Naufal, 2021). Therefore, the following hypothesis is proposed:

Ha_6: The Digital Media has a positive effect on the Social Pillar of the IGGI

E-commerce significantly influences economic growth, directly impacting social well-being by simplifying economic activities and thus improving people's quality of life (Nasution et al., 2020). By digitizing economic processes, e-commerce can alleviate poverty, creating new employment opportunities (Xu et al., 2022); (Hou & Liu, 2024). Therefore, the following hypothesis is proposed:

Ha_7: The E-commerce has a positive effect on the Social Pillar of the IGGI

The construction of digital infrastructure involves substantial natural resource exploitation due to the energy required for material extraction, processing, and transportation, leading to environmental harm (Hatmoko & Indrawati, 2022). Notably, the cellular telecommunications sector significantly contributes to CO_2 emissions, impacting regional economies (Moddilani & Irwandi, 2021). Therefore, the following hypothesis is proposed:

Ha_8: The Digital Infrastructure has a negative effect on the Environmental Pillar of the IGGI

The proliferation of digital media use contributes to environmental degradation through increased energy consumption and significant carbon emissions, driven by the widespread reliance on digital access in daily life (Tomitsch, 2022); (Marks & Przedpełski, 2022). Each online interaction incurs a carbon cost, with data centers and servers, crucial for internet functionality and data processing, being major contributors to greenhouse gas emissions and subsequent climate change (Panchal et al., 2023). Therefore, the following hypothesis is proposed:

Ha_9: The Digital Media has a negative effect on the Environmental Pillar of the IGGI

E-commerce's environmental impact includes pollution from product packaging (Loon & Laaha, 2015). Furthermore, it contributes to increased fuel consumption and carbon emissions through the delivery of goods (Haryanti & Subriadi, 2022). Beyond shipping, e-commerce servers, which rely heavily on information and communication technology, generate greenhouse gases due to their high energy consumption for processing digital transactions (Fichter, 2003). Therefore, the following hypothesis is proposed:

Ha_{10} : The E-commerce has a negative effect on the Environmental Pillar of the IGGI

3. Data and Methodology

This research used a quantitative descriptive methodology, examining cross-sectional statistics data from Indonesia's 34 provinces in 2022 to investigate the connection between inclusive green economy growth and the digital economy with four dependent variables and four independent variables. The calculation of the digital economy is adjusted in the research conducted (Sari & Nasrudin, 2022) dan (Nizar & Sholeh, 2021) based on the availability of data in Indonesia. As for the calculation of inclusive green economic growth in this study, it was obtained from several indicators published by the Asian Development Bank (ADB) in 2018 that has 24 indicators and adjusted to research conducted by (Tumanggor & Pasaribu, 2019) and (Aminata et al., 2022) which aimed to adjust the availability of data in Indonesia.

Table 1: Dimensions and Pillars and Constituent Indicators

Dimensions and Indicators of Digital Economy		
Dimensions	**Indicators**	**Data Source**
Digital Infrastructure	ICT Access and Infrastructure	Statistics Indonesia (BPS)
	Use of ICT	
	ICT Expertise	
Digital Media	Digital Proficiency	Ministry of Communication and Informatics
	Digital Ethics	
	Security Digital	
	Digital Culture	
E-commerce	Number of E-commerce Businesses	BPS
	Proportion of E-commerce Transaction Payments in Cash	
	Proportion of E-commerce Transaction Payments in Transfer Bank	
	Proportion of E-commerce Transaction Payments in Card	
	Proportion of E-commerce Transaction Payments in *E-wallet*	

Pillars and Indicators of Inclusive Green Economic Growth		
Pillars	**Indicators**	**Data Source**
Economy	GRDP per capita	BPS
	GRDP by Business Field based on the 2010 Standardization Area Classification (ADHK)	
Social	Gini Coefficient	BPS
	Household access to electricity use	
	Ratio of working population and working age population	
Environment	Water Quality Index (IKA)	Ministry of Environment and Forestry
	Air Quality Index (IKU)	
	Land Cover Quality Index (IKTL)	
	Seawater Quality Index (IKAL)	

Source: Authors processed, 2025

To quantify the digital economy index and inclusive green economy growth, a composite index measurement approach established by the United Nations Development Programme (UNDP) in 2010 for the revised Human Development Index (HDI) with 0-100 scale was employed. This process involves a series of defined steps.

a) This study uses the Simple Indexing method to normalize data with different units into a common range for analysis. The details of the calculation in the data normalization stage based on UNDP (2010) are as follows:

$$z(Y) = \frac{Y - Min(Y)}{[\max(Y) - \min(Y)]} x\ 100 \qquad (1)$$

Where Z denotes data normalization results; Y is the value of an indicator; Min(Y) is minimum value for an indicator; and Max(Y) is maximum value for an indicator.

b) Calculate each dimension in the digital economy or each pillar in inclusive green economic growth using the arithmetic mean to obtain the average value of each dimension or each pillar. Once the value of the indicator has been obtained, it is calculated according to the direction of influence of each indicator in the formula according to UNDP (2010) as follows:

$$Dimension/Pillar = \frac{z(Y1) + z(Y2) + z(Yn)}{n} \qquad (2)$$

Where z(Yn) denotes the results of data normalization on the indicator; n is the number of indicators used in the dimension/pillar

c) Calculate the digital economy and IGGI by using the same method in calculating each dimension or each pillar using a geometric mean. After the value for the dimension or pillar is obtained, the index is calculated using the formula according to UNDP (2010) as follows:

$$DIG\_ECO = \sqrt[3]{DIGINFR\ x\ DIGMED\ x\ ECOM} \quad (3)$$

$$IGGI = \sqrt[3]{ECON\ x\ SOCL\ x\ ENVR} \quad (4)$$

Where DIG_ECO denotes digital economy index; DIGINFR is digital infrastructure dimension; DIGMED is digital media dimension; ECOM is e-commerce dimension; IGGI is Inclusive Green Growth Index; ECON is economy pillar; SOCL is social pillar; ENVR is environment pillar.

Multiple regression analysis, more especially the Ordinary Least Squares (OLS) approach with multiple linear regression. The study primarily utilizes a log-log linear model. In summary, the study's methodology encompasses:

$$\text{Log(IGGI)i} = \text{C}(1) + \text{C}(2) * \text{Log(DIG\_ECO)i} \quad (5)$$

$$\text{Log(ECON)i} = \text{C}(3) + \text{C}(4) * \text{Log(DIGINFR)i} + \text{C}(5) * \text{Log(DIGMED)i} + \text{C}(6) * \text{Log(ECOM)i} + \text{ei} \quad (6)$$

$$\text{Log}(SOCL)\text{I} = \text{C}(7) + \text{C}(8) * \text{Log(DIGINFR)I} + \text{C}(9) * \text{Log(DIGMED)I} + \text{C}(10) * \text{Log(ECOM)I} + \text{ei} \quad (7)$$

$$\text{Log(ENVR)i} = \text{C}(11) - \text{C}(12) * \text{Log(DIGINFR)i} - \text{C}(13) * \text{Log(DIGMED)i} - \text{C}(14) * \text{Log(ECOM)i} + \text{ei} \quad (8)$$

Where C1,3,7,11 denote constants*;* C2,4,5,6,8,9,10,12,13,14 are coefficients; and e is error terms, respectively.

To validate the research hypotheses, the study employs regression analysis followed by hypothesis testing, including R-squared, F-statistic, and T-tests. Classical assumption tests are also performed to ensure the regression model's reliability (BLUE).

4. Empirical Results

The primary data for this study were calculated using a composite index method with 0-100 scale, with the results presented in Appendix A. Scores near 0 indicate poor performance, while scores near 100 indicate strong performance.

Table 2: Correlation Matrix of Key Variables

	IGGI	ECON	SOCL	ENVR	DIG_ECO	DIGINFR	DIGMED	ECOM
IGGI	1,0000							

ECON	0,9778	1,0000						
	0,0000	-----						
SOCL	-0,0680	-0,2344	1,0000					
	0,7020	0,1819	-----					
ENVR	-0,2899	-0,4374	0,2445	1,0000				
	0,0962	0,0097	0,1634	-----				
DIG_ECO	0,5075	0,6032	-0,3014	-0,6699	1,0000			
	0,0022	0,0002	0,0832	0,0000	-----			
DIGINFR	0,3417	0,3846	0,04139	-0,5425	0,7100	1,0000		
	0,0479	0,0247	0,8162	0,0009	0,0000	-----		
DIGMED	0,1774	0,2335	-0,2303	-0,2736	0,3990	0,0848	1,0000	
	0,3155	0,1837	0,1901	0,1174	0,0194	0,6331	-----	
ECOM	0,4843	0,5849	-0,4083	-0,5837	0,9278	0,4073	0,3774	1,0000
	0,0037	0,0003	0,0165	0,0003	0,0000	0,0168	0,0277	-----

Source: Authors processed, 2025

Independent variables exhibit significant correlations with most dependent variables, while the latter show moderate correlations, as illustrated in Table 2. The digital infrastructure and digital economy exhibit a negative correlation with the environmental pillar, while demonstrating a significant positive correlation with the economic pillar. The hypothesis exhibits a partial deviation, evidenced by negative correlations between e-commerce and the social and environmental pillars, alongside positive correlations with IGGI and the economic pillar.

Table 3: Multiple Linear Regression Results

	Dependent Variables											
	Model 1			**Model 2**			**Model 3**			**Model 4**		
	IGGI			**Economy Pillar**			**Social Pillar**			**Environment Pillar**		
Independent Variables	**Coef.**	**Std. Error**	**Prob.**	**Coef.**	**Std. Error**	**Prob.**	**Coef.**	**Std. Error**	**Prob**	**Coef.**	**Std. Error**	**Prob.**
Constant	-0,3365	1,1869	0,7786	-9,0479	16,1464	0,5794	4,5929	2,4789	0,0738	7,2872	2,0015	0,0010
DIG_ECO	0,9758	0,2928	0,0011									
DIGINFR				0,9071	0,8128	0,1366	0,1716	0,1247	0,0895	-0,2548	0,1007	0,0084*
DIGMED				0,6749	3,6346	0,4269	-0.2217	0,5580	0,3469	-0,2853	0,4505	0,2656
ECOM				1,4231	0,4867	0,0032*	-0,1889	0,0747	0,0084*	-0,1509	0,0603	0,0090*
Goodness Of Fit												
R^2	0,2575			0,3685			0,2225			0,4592		
Adjusted R^2	0,2343			0,3054			0,1447			0,4052		
F-statistic	11,1015			5,8364			2,8621			8,4942		
Prob(F-statistic)	0,0021*			0,0028*			0,0532			0,0003*		
Root Mean Squared Error (RMSE)	0,1790			0,5328			0.0818			0,0660		

Test of Classical Assumptions								
	Result	Decision	Result	Decision	Result	Decision	Result	Decision
Normality (Jarque Bera Test)	0,7696*	Normal	0,7155*	Normal	0,3254*	Normal	0,3153*	Normal
Autocorrelation (LM Test)	0,5972*	No	0,4404*	No	0,8413*	No	0,2052*	No
Heteroscedasticity (White Test)	0,5166*	No	0,1256*	No	0,3452*	No	0,2908*	No
Multicollinearity (VIF)	EKODIG = 1	No	IDIG = 1,2069 MEDIG = 1,1739 ECOM = 1,3973	No	IDIG = 1,2069 MEDIG = 1,1739 ECOM = 1,3973	No	IDIG = 1,2069 MEDIG = 1,1739 ECOM = 1,3973	No
Linearity (RamseyRESET Test)	0,5242*	Linear	0,2542*	Linear	0,0639*	Linear	0,1359*	Linear
Stability (CUSUM & CUSUMQ)	Between in two lines	Stable	Between in two lines	Stable	Between in two lines	Stable	Between in two lines	Stable
Note: significance level of one-sided test probability, *) Alpha 5 %								

Source: Authors processed, 2025

The adjusted R-squared values across four models are generally below 50%, indicating limited explanation of dependent variable variations by the independent variables, suggesting other influential factors. Model 3, focusing on the social pillar, showed the lowest explanatory power (22.25%), while Model 4, examining the environmental pillar, had the highest (45.92%).

4.1. Analysis and Discussion

4.1.1. Results of Multiple Linear Regression

4.1.1.1. The Effect of the Digital Economy on IGGI

Findings indicate that the hypothesis (H1) is supported. The digital economy, encompassing technology-driven human behavior in production, consumption, and distribution, eliminates the need for physical transactions (Permana & Puspitaningsih, 2019). It's an economy where digital innovation is central to driving growth, optimizing industry, and boosting competitiveness (Liu et al., 2022). Thus, the digital economy serves as a form of societal economic diversification, leveraging globalization's impact on social life (Ren et al., 2020).

The digital economy demonstrably fosters inclusive green economic growth through technological optimization of production and promotion of cleaner practices (Jiang & Deng, 2022). It enhances sustainable Green Total Factor Productivity by improving industrial structures and environmental quality (Zhao et al., 2023). Moreover, it drives low-carbon growth and resource allocation efficiency, facilitating industrial agglomerations that boost labor and knowledge absorption (Xiang et al., 2022).

4.1.1.2. The Effect of Digital Infrastructure on the Economic Pillar of IGGI

The study found that H2 was not supported. In Indonesia, limited ICT usage and skills persist, partly due to age-related declines in mental and physical abilities, which impede the effective utilization of ICT (Palupi et al., 2019). Furthermore, ICT access is often underutilized for productive purposes, as it's frequently used for entertainment-focused social media rather than activities that drive productivity (Kumorotomo, 2014).

Unequal access to ICT and a deficiency in digital skills stem from the digital divide, hindering information and communication access due to limitations in hardware, software, and internet connectivity (Rodzi, 2023). This divide is further exacerbated by disparities in communication infrastructure development and regional regulations, resulting in skill gaps, motivational issues, and a lack of digital adaptation (Tyas et al., 2015).

4.1.1.3. The Effect of Digital Media on the Economic Pillar in IGGI

The research revealed that, H3 is rejected. The economic impact of digital media in Indonesia is constrained by low digital literacy, which limits the population's ability to effectively utilize digital platforms for content creation and distribution in alignment with national values (Naufal, 2021). Furthermore, a strong emphasis on nationalism within digital media content has narrowed market reach compared to broader, global trends, thus hindering its economic efficacy (Jadidah et al., 2023).

Growing digital security threats, such as ransomware, pose significant risks to the public through potential fraud and data theft, leading to financial losses and anxiety (Hartono, 2023). Indonesia faces particular challenges due to low digital literacy and awareness, contributing to a rise in digital crimes, including online loan scams stemming from economic hardship and inadequate personal data protection (Syafuddin et al., 2023).

4.1.1.4. The Effect of E-commerce on the Economic Pillar of IGGI

E-commerce significantly impacts economic growth (H4 accepted). Furthermore, MSMEs perceive e-commerce as a key economic driver, enabling income growth, market expansion, cost savings, and streamlined transactions via digital platforms (Putra et al., 2023).

E-commerce boosts GDP by enhancing accessibility, transforming electronic payments, fostering R&D, improving supply chain efficiency, and generating widespread employment, leading to significant societal multiplier effects (Kabir et al., 2020); (Zhong et al., 2022).. Furthermore, electronic payment transactions streamline economic activities, altering consumer behavior towards both local and remote purchases through electronic money, which now serves as a primary or substitute for cash payments (Herawaty & Hasnawati, 2024).

4.1.1.5. The Effect of Digital Infrastructure on the Social Pillar of IGGI

Contrary to the hypothesis (H5), digital infrastructure, encompassing high-speed internet, IoT, and cloud storage (World Bank, 2019), does not directly correlate with the observed outcomes. However, digital infrastructure's role in expanding ICT access demonstrably contributes to economic growth, decreased income inequality, and poverty reduction by empowering communities (Samoilovych, 2023); (Suhrab et al., 2024).

ICT infrastructure development can lead to land acquisition conflicts, displacing communities and hindering their quality of life (Amila & Malihah, 2016). In Indonesia, infrastructure gaps, including "blank spots" (NSS et al., 2015) and urban-rural disparities, persist, contributing to a digital divide that limits access to information, education, and overall well-being (Gryaznova et al., 2019).

4.1.1.6. The Effect of Digital Media on the Social Pillar of IGGI

The findings indicate that H6 was not supported. Digital media’s impact is constrained by unequal access to digital technologies (Saputri, S., & Dewi, 2022). Digital media also contributes to issues like cybercrime and misinformation due to social disparities and weak digital literacy and ethics (Sudiantini et al., 2023), leading to skepticism and reluctance in its social use.

A deficiency in digital ethics and literacy facilitates the spread of misinformation by those seeking notoriety or exploiting situations, leading to irrelevant digital content (Khatimah, 2018). Consequently, individuals prioritize entertainment over educational or socially beneficial content due to inadequate digital literacy (Bujuri et al., 2023).

4.1.1.7. The Effect of E-commerce on the Social Pillar of IGGI

The findings concluded that H7 is rejected. This may be attributed to "information poverty," leading to ethical concerns and confusion regarding online shopping practices (Nurfitria & Laksmi, 2021). Furthermore, uncontrollable online reviews (e-WOM) can negatively affect businesses through harsh language and misinformation (Citra et al., 2023). Lastly, inadequate government oversight in e-commerce security poses a challenge (Mustajibah & Trilaksana, 2021).

Traditional market vendors face increased competition and losses due to price pressures and imported goods, leading to business closures and job losses (Rizkiyani et al., 2024). Furthermore, e-commerce can negatively impact living standards through health issues associated with increased electromagnetic radiation from cell phone usage (Tiwari & Singh, 2011).

Additionally, it can foster excessive consumerism and facilitate fraud, both of which harm communities (Hidayati & Yansi, 2020).

4.1.1.8. The Effect of Digital Infrastructure on the Environmental Pillar of IGGI

The energy demands of ICT, particularly in telecommunications and data centers, lead to substantial CO2 emissions and greenhouse gas effects (Batmunkh, 2022); (Supa, 2023). Unsustainable construction and technology practices can harm ecosystems (Simorangkir, 2022), leading to deforestation, habitat disruption, and water cycle disturbances (Heryana & Firmansyah, 2024). Furthermore, electronic waste (e-waste) from digital devices presents a significant challenge due to hazardous components. Improper e-waste recycling releases toxic chemicals into the environment ignored (Djafar et al., 2023), with heavy metals posing carcinogenic threats (Parahita, 2019).

4.1.1.9. The Effect of Digital Media on the Environmental Pillar of IGGI

The research revealed that H9 was not supported. Digital media often fails to translate information into concrete actions for environmental sustainability due to the lack of effective mechanisms to drive behavioral change (Fadli & Sazali, 2023). Digital media's role in fostering environmental awareness is hindered by unequal digital literacy, limiting effective information use (Arwien et al., 2024). Additionally, its pertinence is called into question when individuals prioritize immediate, practical solutions over engagement with digital campaigns (Chandra, 2020).

Digital media, as a main information source, has transformed community activities, increasing energy use and CO2 emissions that intensify global warming (Panchal et al., 2023). This environmental impact is further compounded by inadequate regulations or incentives that fail to promote environmentally sustainable digital media usage (Saniscara, 2022).

4.1.1.10. The Effect of E-commerce on the Environmental Pillar of IGGI

The study verifies that e-commerce use creates environmental issues (H10 accepted). Economic growth stimulates higher electricity consumption, thereby potentially impacting environmental quality because of carbon emissions (Canbay, 2021). Energy is essential to the production of goods and services that are either exported overseas through international trade or used locally (Opeyemi & Paul-Francois, 2019).

Additionally, packaging waste, including non-biodegradable plastics and other materials, poses a significant pollution problem (Haryanti & Subriadi, 2022). Furthermore, carbon emissions extend beyond device usage to encompass product distribution, with a preference for rapid transport methods exacerbating fuel consumption and environmental pollution (Tiwari & Singh, 2011).

4.1.2. Results of Robustness Test

4.1.2.1. Adding Variables to Model 3 (Social Pillar)

Table 3 indicates that digital infrastructure, digital media, and e-commerce influence the social pillar; however, this model demonstrates the lowest explanatory power among the four models. This limitation may arise from omitted relevant variables and the cross-sectional design, which constrains generalizability across time and regions. To enhance the model’s validity, additional control variables such as poverty (Bila & Biyase, 2023) and investment (Paramastuti & Suliswanto, 2024) indicators should be incorporated, as these factors more comprehensively capture aspects of well-being and economic development.

Table 4: Robustness' Result by Adding Variables

Variables	**Social Pillar**					
	Without adding variables			**With adding variables**		
	Coef.	**Std. Error**	**Prob.**	**Coef.**	**Std. Error**	**Prob.**
Constanta	4,5929	2,4789	0,0738	2,6591	2,0426	0,2040
DIGINFR	0,1716	0,1247	0,0895	-0,0715	0,1414	0,3084
DIGMED	-0.2217	0,5580	0,3469	0,4955	0,4465	0,1384
ECOM	-0,1889	0,0747	0,0084*	-0,2247	0,0708	0,0001*
POVERTY				-0,0366	0,0172	0,0215*
DINV				0,0524	0,0188	0,0049*
FDI				-0,0305	0,0102	0,0031*
Adj. R2	0,1447			0,4894		

Notes: * are the significant at the 5% level.

Source: Authors processed, 2025

The robustness check results indicate that adding domestic investment (DINV), foreign direct investment (FDI), and poverty (POVERTY) improves the explanatory power of the model, as reflected by the increase in the adjusted R^2 from 0,1447 to 0,4894. E-commerce remains negatively significant, confirming its consistent negative association with the social pillar.

4.1.2.2. Comparing Regression Model Assumptions in Model 4 (Environment Pillar)

A robustness test is carried out by comparing the regression outcomes of Model 4 (Environment Pillar) estimated with and without a log-log transformation, in order to examine whether the main results are sensitive to the functional form of the model.

Table 5: Robustness' Result by Comparing Regression Model

Variables	Environment Pillar					
	Log-log Specification			Linear Specification		
	Coef.	Std. Error	Prob.	Coef.	Std. Error	Prob.
Constanta	7,2872	2,0015	0,0010	136,6831	37,5107	0,0005
DIGINFR	-0,2548	0,1007	0,0084*	-0,4034	0,1681	0,0114*
DIGMED	-0,2853	0,4505	0,2656	-0,2051	0,4280	0,3176
ECOM	-0,1509	0,0603	0,0090*	-0,2814	0,1225	0,0144*
Adj. R2	0,4052			0,4071		
Notes: * are the significant at the 5% level.						

Source: Authors processed, 2025

The results indicate that digital infrastructure (DIGINFR) and e-commerce (ECOM) consistently have a significant negative effect on the environmental pillar in both models. This confirms that the main findings are robust to the choice of functional form.

4.1.2.3. Excluding One Province (DKI Jakarta) Identified as an Outlier

The results of estimation [See in Appendix B] present a robustness check show that excluding DKI Jakarta from the sample reduces the impact of the digital economy dimension on IGGI, the Economy Pillar, and the Environment Pillar, while slightly increasing its effect on the Social Pillar. This implies that DKI Jakarta contributes significantly to the influence of the digital economy and IGGI as a whole. Furthermore, the coefficients and significance levels of the key independent variables remain largely consistent whether DKI Jakarta is included or excluded from the analysis. This indicates that the main findings are robust and not overly sensitive to the influence of this outlier province. In addition, the adjusted R^2 values show only slight variations, further supporting the stability of the models.

5. Conclusion

This study shows that digital infrastructure and e-commerce positively influence inclusive green growth, while digital media has no significant effect. Digital infrastructure strengthens the environmental pillar, and e-commerce supports the economic pillar but negatively affects social and environmental aspects. Based on these findings, Indonesia does not align with the decoupling theory, as trade-offs between economic, social, and environmental dimensions remain necessary in the digital economy.

According to these findings, governmental initiatives should concentrate on enhancing digital infrastructure powered by renewable energy, promoting equitable internet access, and fortifying legal frameworks to support sustainable e-commerce. To raise consumer awareness and create a more environmentally friendly digital economy, doable actions like supporting biodegradable packaging, enforcing EPR in waste management, encouraging the use of electric vehicles for deliveries, and working with digital platforms to monitor carbon footprints are advised.

Limitations of the study include its cross-sectional design using data from 2022, the use of a comparatively straightforward index computation method, and the absence of important variables like trade and investment. Future studies should use more thorough models and longer time horizons to properly capture the dynamic relationships between inclusive green growth and the digital economy.

References

Agung, P., & Marisa, F. (2019). Analisis Statistik pada Dampak Negatif dari Sosial Media Terhadap Perilaku Manusia. *JOINTECS (Journal of Information Technology and Computer Science)*, *4*(1), 1. https://doi.org/10.31328/jointecs.v4i1.997

Amila, M., & Malihah, E. (2016). Konflik Pembebasan Lahan Pembangunan Bendungan Jatigede Di Desa Wado. *Sosietas*, *6*(2). https://doi.org/10.17509/sosietas.v6i2.4248

Aminata, J., Nusantara, D. I. K., & Susilowati, I. (2022). The Analysis of Inclusive Green Growth In Indonesia. *Jurnal Ekonomi & Studi Pembangunan*, *23*(1), Layouting. https://doi.org/10.18196/jesp.v23i1.13811

Arwien, R. T., Wirawan, Z., Veryani, A. N., Sahabuddin, E., Muriati, S., & Sari, J. (2024). Pelatihan Literasi Digital dalam Mendukung Sustainable Development Berwawasan Lingkungan Hidup. *Malebbi: Jurnal Pengabdian Kepada Masyarakat*, *2*(1), 1–11. https://ojs.unpatompo.ac.id/index.php/malebbi/article/view/307

Aryani, D. N., Nair, R. K., Hoo, D. X. Y., Hung, D. K. M., Lim, D. H. R., Chandran, D. A. R., Chew, W. P., & Desai, A. (2021). A Study on Consumer Behaviour: Transition from Traditional Shopping to Online Shopping During the COVID-19 Pandemic. *International Journal of Applied Business and International Management*, *6*(2), 81–95. https://doi.org/10.32535/ijabim.v6i2.1170

Aulia, N. F. (2015). Pemanfaatan Spent Resources dalam Mendukung Kegiatan Eco-Economic Decoupling di Provinsi Jawa Tengah. *Jurnal Bina Praja*, *07*(03), 259–267. https://doi.org/10.21787/jbp.07.2015.259-267

Baijal, A., Cannarsi, A., Hoppe, F., Chang, W., Davis, S., & Sipahimalani, R. (2021). e-Conomy SEA 2021. *Google, Temasek, Bain & Company*, 1–128. https://services.google.com/fh/files/misc/e_conomy_sea_2021_report.pdf

Barefoot, K., Curtis, D., Jolliff, W., Nicholson, J. R., & Omohundro, R. (2018). Defining and Measuring the Digital Economy. *US Department of Commerce Bureau of Economic Analysis, Washington, DC*, 1–24. http://www.tandfonline.com/doi/full/10.1081/ERC-200027380

Batmunkh, A. (2022). Carbon Footprint of The Most Popular Social Media Platforms. *Sustainability (Switzerland)*, *14*(4). https://doi.org/10.3390/su14042195

Bila, S., & Biyase, M. (2023). Determinants of Subjective Poverty in Rural and Urban Areas of South Africa. *Journal of Economic Cooperation and Development*, *44*(1), 25–56.

Bujuri, D. A., Sari, M., Handayani, T., & Saputra, A. D. (2023). Penggunaan media sosial dalam pembelajaran: analisis dampak penggunaan media Tiktok terhadap motivasi belajar siswa di Sekolah Dasar. *Jurnal Ilmiah Pendidikan Dasar*, *10*(2), 112. https://doi.org/10.30659/pendas.10.2.112-127

Canbay, Ş. (2021). Electricity consumption and economic growth in d8 countries: Bootstrap panel causality. *Journal of Economic Cooperation and Development*, *42*(2), 37–68.

Cao, X., Deng, M., & Li, H. (2021). How does e-commerce city pilot improve green total factor productivity?Evidence from 230 cities in China. *Journal of Environmental Management*, *289*, 112520. https://doi.org/10.1016/j.jenvman.2021.112520

Chandra, F. (2020). Peran Masyarakat Hukum Adat Dalam Mewujudkan Pelestarian Lingkungan Hidup. *Jurnal Ekopendia: Jurnal Ekonomi Dan Pendidikan*, *5*(1), 103–110. https://d1wqtxts1xzle7.cloudfront.net/117667208/322_Article_Text_955_1_10_20201026_4_-libre.pdf?1724477709=&response-content-disposition=inline%3B+filename%3DPeran_Masyarakat_Hukum_Adat_Dalam_Mewuju.pdf&Expires=1735743565&Signature=BUnqBdWK6DlE6De6rnlMe4l

Citra, M. E. A., Sutrisni, N. K., & Dewantara, C. D. (2023). Perlindungan Hukum Terhadap Pelaku Usaha Dalam Transaksi Elektronik (E-Commerce) Atas Penilaian Buruk Konsumen Yang Ditimbulkan Dari Kesalahan Konsumen Sendiri. *Jurnal Hukum Saraswati (JHS)*, *5*(1), 381–392. https://doi.org/https://doi.org/10.36733/jhshs.v2i2

Deng, W., & Shao, J. (2022). Empowering Green Development: How Social Media Interaction Influences Environmental Information Disclosure of High-Polluting Firms. *International Journal of Environmental Research and Public Health*, *19*(16). https://doi.org/10.3390/ijerph191610315

Dianari, R. G. F. (2018). The Impact of E-Commerce on Indonesia Economic Growth. *Bina Ekonomi*, *22*(1), 43. https://doi.org/https://doi.org/10.26593/be.v22i1.3619.45-64

Djafar, A. Y., Puluhulawa, F., Puluhulawa, J., & Harun, A. A. (2023). Dampak Dari Pencemaran Lingkungan Akibat Sampah Elektronik Dalam Prespektif Hukum Lingkungan. *Journal of Comprehensive Science (JCS)*, *2*(6), 1637–1646. https://doi.org/10.59188/jcs.v2i6.388

Fadli, A., & Sazali, H. (2023). Peran Media Sosial Instagram @Greenpeaceid Sebagai Media Kampanye Dalam Menjaga Lingkungan. *Jurnal Ilmu Komunikasi UHO : Jurnal Penelitian Kajian Ilmu Komunikasi Dan Informasi*, *8*(2), 209–222. https://doi.org/10.52423/jikuho.v8i2.32

Fan, L., Zhang, Y., Jin, M., Ma, Q., & Zhao, J. (2022). Does New Digital Infrastructure Promote the Transformation of the Energy Structure? The Perspective of China's Energy Industry Chain. *Energies*, *15*(23). https://doi.org/10.3390/en15238784

Fichter, K. (2003). E-Commerce: Sorting Out the Environmental Consequences. *Journal of Industrial Ecology*, *6*(2). http://mitpress.mit.edu/jie

Fuqoha, M. S., & Firmansyah, A. (2023). Sustainability E-Commerce Di Indonesia: Kebijakan Dan Strategi Untuk Mengurangi Dampak Lingkungan. *Jurnalku*, *3*(3), 352–364. https://doi.org/10.54957/jurnalku.v3i3.548

Ghifary, H., Duta Pramudyawardani, F., Rania Annisa, S., & Ery Setiyawari, M. (2022). Studi Literatur Keterkaitan Pembangunan Ekonomi dengan Kualitas Lingkungan Hidup di Indonesia. *Jurnal Pendidikan Dan Konseling*, *4*, 4409–4414. https://doi.org/https://doi.org/10.31004/jpdk.v4i6.8962

Görög, G. (2018). The Definitions of Sharing Economy: A Systematic Literature Review. *Management*, *13*(2), 175–189. https://doi.org/10.26493/1854-4231.13.175-189

Grossman, G. M., & Krueger, A. B. (1991). Environmental impacts of a North American free trade agreement. *National Bureau of Economic Research*, *3914*. https://doi.org/10.3386/w3914

Gryaznova, A., Antonyuk, V., & Kornienko, E. (2019). Regional problems in managing communications infrastructure in the digital economy. *Upravlenets*, *10*(4), 38–50. https://doi.org/10.29141/2218-5003-2019-10-4-4

Hartono, B. (2023). Ransomware: Memahami Ancaman Keamanan Digital. *Bincang Sains Dan Teknologi*, *2*(02), 55–62. https://doi.org/10.56741/bst.v2i02.353

Haryanti, T., & Subriadi, A. . (2022). E-commerce Acceptance in the Dimension of Sustainability. *Journal of Modelling in Management*, *17*(2), 715–745. https://doi.org/https://doi.org/10.1108/JM2-05-2020-0141

Hatmoko, W., & Indrawati, D. (2022). *Pengelolaan Sumber Daya Air* (H. Noviar (ed.); Pertama). Syiah Kuala University Press. uskpress.usk.ac.id

Herawaty, R. Y., & Hasnawati. (2024). Perceived usefulness, perceived ease of use, social influence, facilitating conditions, perceived trust. *Jurnal Ilmiah Indonesia*, *9*(11). https://doi.org/http://dx.doi.org/10.36418/syntax-literate.v9i11

Heryana, D., & Firmansyah, A. (2024). Green Infrastructure Framework: Sebuah Strategi Pembangunan Infrastruktur Hijau Nasional. *Journal of Law, Administration, and Social Science*, *4*(2), 172–185. https://doi.org/10.54957/jolas.v4i2.742

Hidayati, A., & Yansi, M. (2020). ROLE OF SOCIAL MEDIA IN MARKETING OF MICRO, SMALL, AND MEDIUM ENTERPRISES (MSMEs) PRODUCT DURING COVID 19 PANDEMIC. *Jurnal Ilmiah Teunuleh: The International Journal of Social Sciences*, *1*(2), 239–249. https://doi.org/10.51612/teunuleh.v1i2.39

Hou, J., & Liu, Y. (2024). Assessing the impact of rural E-commerce on regional poverty alleviation: A spatial spillover analysis. *International Review of Economics and Finance*, *94*(July), 103399. https://doi.org/10.1016/j.iref.2024.103399

Jadidah, I. T., Rahayu, A., Bella, H. S., Julinda, J., & Anggraini, T. W. (2023). Pengaruh Media Digital Terhadap Sosial Budaya Pada Anak Usia Sekolah. *Jurnal Multidisipliner Kapalamada*, *2*(04), 253–268. https://doi.org/10.62668/kapalamada.v2i04.830

Jha, S., Sandhu, S. C., & Wachirapunyanont, R. (2018). Inclusive Green Growth Index: A New Benchmark for Quality of Growth. In *Asian Development Bank* (Issue October). https://www.adb.org/publications/inclusive-green-growth-index

Jiang, Y., & Deng, F. (2022). Multi-Dimensional Threshold Effects of the Digital Economy on Green Economic Growth?—New Evidence from China. *Sustainability (Switzerland)*, *14*(19). https://doi.org/10.3390/su141912888

Kabir, A. I., JAKOWAN, M., BOSU, J., MOHSIN, S., & HAMIM, R. (2020). The Emergence of E-Commerce Sites and Its Contribution towards the Economic Growth of Bangladesh: A Quantitative Study. *Informatica Economica*, *24*(3/2020), 40–53. https://doi.org/10.24818/issn14531305/24.3.2020.04

Kasmiati, Dharmawan, A. H., & Bratakusumah, D. S. (2016). Ekowisata, Sistem Nafkah, Dan Decoupling Sustainability Di Wakatobi, Sulawesi Tenggara. *Sodality: Jurnal Sosiologi Pedesaan*, *4*(2), 158–164. http://journal.ipb.ac.id/index.php/sodality/article/view/13391

Khatimah, H. (2018). Posisi Dan Peran Media Dalam Kehidupan Masyarakat. *Tasamuh*, *16*(1), 119–138. https://doi.org/10.20414/tasamuh.v16i1.548

Kumorotomo, W. (2014). Kegagalan Penerapan E-Government dan Kegiatan tidak Produktif. *Universitas Gadjah Mada*, *December*. https://www.researchgate.net/publication/251485069

Limilia, P., & Prihandini, P. (2018). Perbedaan Motif Penggunaan Internet Antar Gender Sebagai Bentuk Baru Kesenjangan Digital. *Medium*, *6*(2), 1–14. https://doi.org/10.25299/medium.2018.vol6(2).2003

Listyarini, S., & Warlina, L. (2017). Konsep Kebijakan Lingkungan. *Tinjauan Mata Kuliah*, 1–42. http://www.pustaka.ut.ac.id/lib/wp-content/uploads/pdfmk/PWKL4305-M1.pdf

Liu, C., Xin, L., Li, J., & Sun, H. (2022). The Impact of Renewable Energy Technology Innovation on Industrial Green Transformation and Upgrading: Beggar Thy Neighbor or Benefiting Thy Neighbor. *Sustainability (Switzerland)*, *14*(18). https://doi.org/10.3390/su141811198

Loon, A. F. Van, & Laaha, G. (2015). Hydrological drought severity explained by climate and catchment characteristics. *Journal of Hydrology*, *526*, 3–14. https://doi.org/10.1016/j.jhydrol.2014.10.059

Marks, L. U., & Przedpełski, R. (2022). The Carbon Footprint of Streaming Media: Problems, Calculations, Solutions. In *Palgrave Studies in Media and Environmental Communication*. Springer International Publishing. https://doi.org/10.1007/978-3-030-98120-4_10

Miranti, R., Sulistyaningrum, E., & Mulyaningsih, T. (2022). Women's Roles in the Indonesian Economy during the COVID-19 Pandemic: Understanding the Challenges and Opportunities. *Bulletin of Indonesian Economic Studies*, *58*(2), 109–139. https://doi.org/10.1080/00074918.2022.2105681

Moddilani, G., & Irwandi, I. (2021). Perkembangan Teknologi Informasi, TFP, dan Emisi Gas CO2 di Indonesia. *Jurnal Ekonomi Dan Pembangunan Indonesia*, *21*(1), 31–40. https://doi.org/10.21002/jepi.2021.03

Mustajibah, T., & Trilaksana, A. (2021). Dinamika E-Commerce Di Indonesia Tahun 1999-2015. *E-Journal Pendidikan Sejarah*, *10*(3), 3–11. https://ejournal.unesa.ac.id/index.php/avatara/article/view/40965

Nasution, E. Y., Hariani, P., Hasibuan, L. S., & Pradita, W. (2020). Perkembangan Transaksi Bisnis E-Commerce terhadap Pertumbuhan Ekonomi di Indonesia. *Jesya: Jurnal Ekonomi & Ekonomi Syariah*, *3*(2), 506–519. https://doi.org/10.36778/jesya.v3i2.227

Naufal, H. A. (2021). Literasi Digital. *Perspektif*, *1*(2), 195–202. https://doi.org/10.53947/perspekt.v1i2.32

Ningsih, D., & Andiny, P. (2018). Analisis Pengaruh Inflasi dan Pertumbuhan Ekonomi Terhadap Kemiskinan di Indonesia. *JURNAL SAMUDRA EKONOMIKA*, *2*(1), 53–61. https://core.ac.uk/download/pdf/327251948.pdf

Nizar, N. I., & Sholeh, A. N. (2021). Peran Ekonomi Digital Terhadap Ketahanan dan Pertumbuhan Ekonomi Selama Pandemi COVID-19. *Jurnal Madani: Ilmu Pengetahuan, Teknologi, Dan Humaniora*, *4*(1), 87–99. https://doi.org/10.33753/madani.v4i1.163

NSS, R. L. P., Suryawardana, E., & Triyani, D. (2015). Analisis Dampak Pembangunan Infrastruktur Jalan Terhadap Pertumbuhan Usaha Ekonomi Rakyat Di Kota Semarang. *Jurnal Dinamika Sosial Budaya*, *17(1)*, 82–103. https://doi.org/http://dx.doi.org/10.26623/jdsb.v17i1.505

Nurfitria, A., & Laksmi. (2021). Dampak Kemiskinan Informasi Masyarakat Dalam Transaksi Berbelanja Online. *AL Maktabah*, *6*(2), 141. https://doi.org/10.29300/mkt.v6i2.5714

OCDE. (2011). *2012 NEA Annual Report*. https://doi.org/9789264991798

Opeyemi, A. Y., & Paul-Francois, M. (2019). Electricity consumption, trade openness and economic growth in South Africa: An ARDL approach. *Journal of Economic Cooperation and Development*, *40*(1), 135–156.

Palupi, N. K., Holillulloh, & Yanzi, H. (2019). The Influence of Factors Age of Interest and the Capability of Civics Education Teachers In the Use of Ict. *Journal of Chemical Information and Modeling*, *53*(9), 3. https://media.neliti.com/media/publications/247871-pengaruh-faktor-usia-terhadap-minat-dan-98eaeace.pdf

Panchal, B. Y., Patel, J., Vachhrajani, K. V, Gantara, A., Chhaya, A., & Thakkar, V. (2023). Survey on Carbon Dioxide Emissions Through Email Conversion. *SAMRIDDHI : A Journal of Physical Sciences, Engineering and Technology*, *15*(01), 122–127. https://doi.org/10.18090/samriddhi.v15i01.16

Parahita, I. P. (2019). *DAMPAK LIMBAH ELEKTRONIK (Electronic Waste) TERHADAP LINGKUNGAN HIDUP DAN KESEHATAN MANUSIA SERTA HUBUNGANNYA DENGAN PERILAKU MASYARAKAT*. *June*. https://www.researchgate.net/publication/333748954%0ADAMPAK

Paramastuti, K. D., & Suliswanto, M. S. W. (2024). Determinants of Household Consumption Expenditure in the Middle East. *Journal of Economic Cooperation and Development*, *45*(3), 145–168.

Permana, T., & Puspitaningsih, A. (2019). Fenomena uang digital. *Jurnal Ekonomi Pembangunan*, *9*(2), 363–373. https://ojs.uho.ac.id/index.php/JEP/article/view/12177

Prasad, E. (2021). New Financial Technologies, Sustainable Development, and the International Monetary System. *Asian Development Bank Institute*, *1277*, 318–345. https://hdl.handle.net/10419/249456

Putra, S. Z., Harianto, S. T., & Matondang, Y. C. (2023). Analisis Pengaruh E-Commerce: Studi Literatur Terhadap Pertumbuhan Ekonomi UMKM. *Jurnal Ilmiah Sistem Informasi Dan Ilmu Komputer*, *3*(2), 119–131. https://doi.org/10.55606/juisik.v3i2.494

Ren, X., Shao, Q., & Zhong, R. (2020). Nexus between green finance, non-fossil energy use, and carbon intensity: Empirical evidence from China based on a vector error correction model. *Journal of Cleaner Production*, *277*, 122844. https://doi.org/10.1016/j.jclepro.2020.122844

Rifai, D., Fitri, S., Ramadhan, I. N., & Ramadan, R. (2022). Perkembangan Ekonomi Digital Mengenai Perilaku Pengguna Media Sosial Dalam Melakukan Transaksi. *ADI Bisnis Digital Interdisiplin Jurnal*, *3*(1), 49–52. https://doi.org/10.34306/abdi.v3i1.752

Rizkiyani, M., Kinasih, C. P., & Fahmi, L. N. (2024). PENGARUH E-COMMERCE TERHADAP KEBERLANGSUNGAN PERDAGANGAN UMKM INDONESIA (Studi Kasus Platform Shopee dan Pasar Tanah Abang). *Management Sriwijaya : Proceedings of Economic Innovation*, 1–11. https://proceeding.unikal.ac.id/index.php/managementsriwijaya/article/view/2332

Rodzi, M. F. (2023). Pembangunan Infrastruktur Dan Pemerataan Ekonomi Di Indonesia. *Jurnal Masyarakat Dan Desa*, *3*(2), 151–163. https://doi.org/10.47431/jmd.v3i2.353

Samoilovych, A. (2023). Scientific approaches to the research of the impact of digitalization on ensuring the sustainable of the country and its regions. *Economic Synergy*, *2*(2), 131–147. https://ideas.repec.org/a/bja/23es02/y2023i2p131-147.html

Saniscara, P. (2022). Media Luar Ruang Serta Dampaknya Terhadap Kualitas Dan Lingkungan Hidup Masyarakat. *Jurnal Dimensi DKV Seni Rupa Dan Desain*, *7*(2), 163–174. https://doi.org/10.25105/jdd.v7i2.15168

Saputri, S., & Dewi, D. A. (2022). Tantangan Nilai-Nilai Pancasila pada Generasi Milenium di Era Digital. *Jurnal Pendidikan Tambusai*, *6*(2), 9909–9913.

Sari, D. R., & Nasrudin. (2022). The Nonlinear Impact of Payment System Innovation on Financial System Stability in the ASEAN-4 Countries. *Economics and Finance in Indonesia*, *69*(1), 114–131. https://doi.org/10.47291/efi.2022.05

Shari, W., Hassan, M. H. A., Subri, M. S. B. M., & Wahab, N. M. A. (2024). Determinants of Environmental, Social, and Governance (ESG) Practices Among Malaysian Small and Medium Enterprises (SMEs). *Journal of Economic Cooperation and Development*, *45*(4), 55–86.

Sholihin, M. R., Arianto, W., & Khasanah, D. F. (2018). Keunggulan Sosial Media Dalam Perkembangan Ekonomi Kreatif Era Digital Di Indonesia. *Prosiding 4th Seminar Nasional Dan Call for Papers Fakultas Ekonomi Universitas Muhammadiyah Jember*, 149–160.

Simorangkir, W. (2022). Analisa dan evaluasi perkembangan pembangunan infrastruktur serta pertumbuhan ekonomi. *JURNAL PRICE : Ekonomi Dan Akuntasi*, *01*(01), 2985–3559. https://ejournal.seaninstitute.or.id/index.php/jecoa/article/view/3595

Sudiantini, D., Ayu, M. P., Aswan, M. C. A. S., Prastuti, M. A., & Apriliya Melani. (2023). Transformasi Digital : Dampak, Tantangan, Dan Peluang Untuk Pertumbuhan Ekonomi Digital. *Trending: Jurnal Ekonomi, Akuntansi Dan Manajemen*, *1*(3), 21–30. https://doi.org/https://doi.org/10.30640/trending.v1i3.1115

Suhrab, M., Chen, P., & Ullah, A. (2024). Digital financial inclusion and income inequality nexus: Can technology innovation and infrastructure development help in achieving sustainable development goals? *Technology in Society*, *76*. https://doi.org/10.1016/j.techsoc.2023.102411

Supa, F. B. (2023). Infrastruktur Digital Indonesia: Meningkatkan Pertumbuhan Ekonomi Dan Kesejahteraan Masyarakat. *Research Gate*, *June*, 1–6. https://www.researchgate.net/publication/371562945%0AINFRASTRUKTUR

Syafuddin, K., Jamalullail, & Rafi'i. (2023). Peningkatan Literasi Keamanan Digital Dan Perlindungan Data Pribadi Bagi Siswa Di Smpn 154 Jakarta. *Eastasouth Journal of Impactive Community Services*, *1*(03), 122–133. https://doi.org/10.58812/ejimcs.v1i03.119

Tapscott, D. (1995). The Digital Economy: Promise and Peril in the Age of Networked Intelligence. In *The Digital Economy*. McGraw-Hill. https://dontapscott.com/books/the-digital-economy/

Tiwari, S., & Singh, P. (2011). E-Commerce: Prospect or Threat for Environment. *International Journal of Environmental Science and Development*, *2*(3), 211–217. https://doi.org/10.7763/ijesd.2011.v2.126

Tomitsch, M. (2022). *Why we need a planetary health star rating for apps | World Economic Forum*. World Economic Forum. World Economic Forum. https://www.weforum.org/stories/2021/11/why-we-need-a-planetary-health-star-rating-for-apps/

Tumanggor, D. M. L., & Pasaribu, E. (2019). PEMBENTUKAN BIGGI DALAM MENGUKUR PERTUMBUHAN INKLUSIF HIJAU Studi Kasus: Indonesia Tahun 2017 (Forming BIGGI in Measuring Inclusive Green Growth Case Study: Indonesia 2017). *Seminar Nasional Official Statistics 2019*, *1*(Seminar Nasional Official Statistics), 266–274. https://doi.org/https://doi.org/10.34123/semnasoffstat.v2019i1.84

Tyas, D. L., Budiyanto, A. D., & Santoso, A. J. (2015). Pengaruh Kekuatan Media Sosial dalam Pengembangan Kesenjangan Digital. *Scientific Journal of Informatics*, *2*(2), 147. https://doi.org/10.15294/sji.v2i2.5083

Wen, L., & Sun, S. (2023). The Impact of Urban E-Commerce Transformation on Carbon Emissions in Chinese Cities: An Empirical Analysis Based on the PSM-DID Method. *Sustainability (Switzerland)*, *15*(7). https://doi.org/10.3390/su15075659

Wibowo, A., Wahyudi, W., & Utari, D. R. (2022). Media Sosial Sebagai Solusi Pemasaran Umkm Yang Adaptif Di Masa Pandemi Covid-19. *Jurnal PKM Pengabdian Kepada Masyarakat*, *4*(6), 558. https://doi.org/10.30998/jurnalpkm.v4i6.8148

World Bank, W. B. (2019). *The Chaning Nature of Work*. https://thedocs.worldbank.org/en/doc/808261547222082195-0050022019/original/WDR19EnglishPresentation.pdf

Xiang, X., Yang, G., & Sun, H. (2022). The Impact of the Digital Economy on Low-Carbon, Inclusive Growth: Promoting or Restraining. *Sustainability (Switzerland)*, *14*(12), 1–27. https://doi.org/10.3390/su14127187

Xu, G., Zhao, T., & Wang, R. (2022). Research on the Efficiency Measurement and Spatial Spillover Effect of China's Regional E-Commerce Poverty Alleviation from the Perspective of Sustainable Development. *Sustainability (Switzerland)*, *14*(14), 8456. https://doi.org/10.3390/su14148456

Zhao, P., Guo, J., & Wang, Y. (2023). How does the digital economy affect green innovation efficiency: evidence from China. *Journal of Environmental Planning and Management*, *15*(15), 11596. https://doi.org/10.1080/09640568.2023.2289103

Zhong, M., Wang, Z., & Ge, X. (2022). Does Cross-Border E-Commerce Promote Economic Growth? Empirical Research on China's Pilot Zones. *Sustainability (Switzerland)*, *14*(17). https://doi.org/10.3390/su141711032

Appendix A: Results of Calculation of the Digital Economy and IGGI in 2022

No	Provinces	DIG_ECO	DIGINFR	DIGMED	ECOM	IGGI	ECON	SOCL	ENVR
1	Nangroe Aceh Darussalam	55,66	56,00	88,25	34,90	33,85	10,71	39,37	92,01
2	North Sumatera	55,60	59,00	86,50	33,67	43,54	24,97	39,30	84,11
3	West Sumatera	59,85	60,10	88,25	40,42	36,57	13,43	41,68	87,34
4	Riau	52,92	60,20	83,25	29,57	47,53	35,55	36,97	81,70
5	Jambi	54,52	58,00	88,50	31,58	36,58	16,26	37,90	79,43
6	South Sumatera	53,49	57,60	86,50	30,73	39,56	19,61	38,94	81,06
7	Bengkulu	54,51	59,50	88,75	30,67	29,45	7,88	40,26	80,51
8	Lampung	55,27	56,30	87,25	34,38	35,69	14,21	40,57	78,85
9	Bangka Belitung Islands	51,45	58,20	88,00	26,59	34,81	12,03	43,66	80,32
10	Riau Islands	61,29	66,90	89,75	38,35	45,93	29,28	39,21	84,38
11	DKI Jakarta	77,97	76,40	89,75	69,14	58,28	100	30,43	65,05
12	West Java	70,48	61,60	90,00	63,14	48,32	49,48	31,77	71,78
13	Central Java	64,94	58,30	90,25	52,04	45,76	34,58	37,12	74,66
14	DI Yogyakarta	68,12	72,50	91,00	47,91	29,38	11,17	31,12	72,99
15	East Java	64,75	59,10	89,50	51,32	55,68	56,60	37,36	81,62
16	Banten	62,78	62,90	87,00	45,22	38,99	23,23	33,64	75,84
17	Bali	68,66	66,40	86,25	56,53	34,93	13,25	40	80,41
18	West Nusa Tenggara	57,13	55,90	86,00	38,79	28,49	7,69	36,57	82,20
19	East Nusa Tenggara	55,84	51,30	84,75	40,04	26,22	5,47	39,19	84,08
20	West Kalimantan	54,45	55,80	91,00	31,79	32,62	11,08	39,33	79,70
21	Central Kalimantan	55,87	57,80	90,00	33,53	36,27	13,65	39,32	88,92
22	South Kalimantan	58,59	58,80	87,00	39,32	34,83	12,94	39,77	82,13
23	East Kalimantan	62,72	66,00	90,50	41,30	54,62	48,70	37,99	88,08
24	North Kalimantan	57,49	64,10	80,25	36,94	47,44	26,86	42,49	93,53
25	North Sulawesi	55,21	58,70	85,00	33,73	32,72	12,38	34,21	82,67
26	Central Sulawesi	51,84	56,00	86,00	28,93	42,12	19,83	40,81	92,33
27	South Sulawesi	56,49	59,20	87,50	34,81	38,99	19,85	35,08	85,10
28	Southeast Sulawesi	57,04	57,80	89,25	35,97	34,71	12,96	36,16	89,17
29	Gorontalo	50,07	56,20	83,75	26,67	28,23	7,66	31,88	92,17
30	West Sulawesi	50,84	54,90	83,00	28,84	28,82	7,14	37,46	89,45
31	Maluku	53,79	57,70	88,50	30,48	27,11	5,68	37,97	92,37
32	North Maluku	50,41	52,70	87,25	27,86	32,01	9,34	37,79	92,84
33	West Papua	59,07	55,40	90,50	41,11	37,77	16,17	33,34	99,95
34	Papua	46,59	32,20	88,75	35,39	35,76	15,08	31,45	96,47

Source: Authors Processed, 2025

Appendix B: Robustness' Result (by excluding DKI Jakarta considered to be an outlier from the analysis) (Alpha 5%)

Excluding *DKI Jakarta considered to be an outlier*												
	Dependent Variables											
	IGGI			**Economy Pillar**			**Social Pillar**			**Environment Pillar**		
Independent Variables	**Coef.**	**Std. Error**	**Prob.**	**Coef.**	**Std. Error**	**Prob.**	**Coef.**	**Std. Error**	**Prob.**	**Coef.**	**Std. Error**	**Prob**
Constant	-0,4540	1,4255	0,7523	-7,5007	15,9560	0,6418	0,8588	2,1860	0,6973	7,0874	1,9724	0,0012
DIG_ECO	1,0074	0,3525	0,0038									
DIGINFR				0,6732	0,8192	0,2089	0,2590	0,1122	0,0141*	-0,2245	0,1012	0,0173*
DIGMED				0,7314	3,5830	0,4198	0,5965	0,4908	0,1170	-0,2926	0,4429	0,2570
ECOM				1,1811	0,5113	0,0141*	-0,2659	0,0700	0,0003*	-0,1196	0,0632	0,0341*
Adjusted R^2	0,1829			0,1625			0,2875			0,2640		

Including *DKI Jakarta considered to be an outlier*												
	Dependent Variables											
	IGGI			**Economy Pillar**			**Social Pillar**			**Environment Pillar**		
Independent Variables	**Coef.**	**Std. Error**	**Prob.**	**Coef.**	**Std. Error**	**Prob.**	**Coef.**	**Std. Error**	**Prob.**	**Coef.**	**Std. Error**	**Prob.**
Constant	-0,3365	1,1869	0,7786	-9,0479	16,1464	0,5794	4,5929	2,4789	0,0738	7,2872	2,0015	0,0010
DIG_ECO	0,9758	0,2928	0,0011									
DIGINFR				0,9071	0,8128	0,1366	0,1716	0,1247	0,0895	-0,2548	0,1007	0,0084*
DIGMED				0,6749	3,6346	0,4269	-0.2217	0,5580	0,3469	-0,2853	0,4505	0,2656
ECOM				1,4231	0,4867	0,0032*	-0,1889	0,0747	0,0084*	-0,1509	0,0603	0,0090*
Adjusted R^2	0,2343			0,3054			0,1447			0,4052		

Source: Authors Processed, 2025