Drivers of Green Sustainable Development in Emerging Economies: A Sur-Based Income Inequality

Rusiadi, Abdiyanto, Elfitra Desy Surya, Anggi Pratiwi Sitorus

Abstract
This study investigates the key financial drivers influencing green sustainable development (GSDev) and income distribution equality across selected emerging and advanced economies namely the U.S., Brazil, Indonesia, France, and the U.K. Using the Seemingly Unrelated Regression (SUR) model, the research explores the impact of financial inclusion, digital financial services, bank credit risk, and net investment in non-financial assets on GSDev and inequality outcomes. The findings reveal that enhanced financial inclusion and digital financial transactions significantly support green development, while higher income inequality hinders sustainability progress. Conversely, green development itself is found to exert a negative influence on equitable income distribution. However, this adverse effect can be offset by greater public investment in non-financial sectors and improved credit risk management. These interlinkages highlight the complex yet critical role of financial ecosystems particularly access, risk, and digitalization in fostering sustainable and inclusive economic growth. The study offers strategic insights for policymakers and financial authorities, emphasizing the importance of integrated, stability-oriented financial policies to support long-term green transformation in emerging markets.

Keywords: Green Sustainable Development, Income Inequality

[1]Rusiadi
[1]Master of Economics, Universitas Pembangunan Panca Budi, Medan, Indonesia
rusiadi@dosen.pancabudi.ac.id[1]

Abdiyanto, Elfitra Desy Surya, Anggi Pratiwi Sitorus
[2]Master of Urban and Regional Planning, Universitas Pembangunan Panca Budi, Indonesia
[3]Master of Management, Universitas Pembangunan Panca Budi, Indonesia
[4]Faculty of Economics, Universitas Negeri Medan, Indonesia
e-mail: Abdiyanto@dosen.pancabudi.ac.id[2], elfitradesysurya@dosen.pancabudi.ac.id[3], anggisitorus@unimed.ac.id[4]
2nd International Cofference on the Epicentrum of Economic Global Framework (ICEEGLOF)
Theme: Navigating The Future: Business and Social Paradigms in a Transformative Era.
https://proceeding.pancabudi.ac.id/index.php/ICEEGLOF/issue/view/9

Introduction

The intricate relationship between the financial sector, economic growth, and overall development has been thoroughly examined by economists for centuries (Hua et al., 2024), (Dar & Nain, 2024). However, because digitalization and the financial sector's changing position have an impact on financial frictions in the global economy, they still present difficulties. (Z. Zhang et al., 2025) (Correa et al., 2022). Technology-driven financial innovation is exemplified by the paradigm shift that is the digital transformation of finance. (Z. Han & Wang, 2025), (Abbas et al., 2024), (Sara Ravan Ramzani Peter Konhaeusner Oluwasegun Akinola Olaniregun Ahmad Abu-Alkheil Nizar Alsharari, 2024). The role of digital financial transmission and financial inclusion is crucial in fostering technological innovation (Suhrab et al., 2024). Digital transformation enhances risk detection, improves financial accessibility, and fosters financial inclusion (Vargas-Hernández et al., 2022), (Abdulquadri et al., 2021). Financial inclusion serves as a foundation for digital transformation, enabling financial institutions to expand customer bases, analyze financial profiles more effectively, and mitigate default risks (F. Yang & Masron, 2024). However, financial inclusion can also drive dynamic shifts in credit risk, potentially hindering economic growth and sustainable development transformation (Xie & Wang, 2023), (L. Han et al., 2023), (Wu & Strezov, 2023), (Huang et al., 2023), (Song et al., 2024).

The digital financial transformation and financial inclusion transmission provide substantial benefits to financial service users, digital financial service providers, governments, and the overall economy (Jarvis & Han, 2021). Since 2010, the G20 and the World Bank have spearheaded financial inclusion initiatives in developing economies to alleviate poverty (P.K. (P. K. Ozili, 2018), (P. Ozili, 2022) The proliferation of digital technology has expanded financial service accessibility, including online banking, mobile banking, e-wallets, and credit/debit cards Despite the convenience and accessibility of digital financial services, challenges persist, such as cybersecurity threats, high transaction costs, inadequate network coverage, and merchant reluctance to adopt cashless payment systems (Jarvis & Han, 2021). Although cashless transactions are widely accepted, consumer concerns regarding security, financial literacy, and digital payment infrastructure gaps remain prevalent (Xu et al., 2024).

Digital Financial Inclusion in Emerging Economies, among emerging economies, Brazil had the lowest digital financial penetration in 2021, with 47.72 million (25%) of its population registering for digital banking services. In contrast, Brazil ranked first (32.08%), followed by the United Kingdom (17th, 14.09%), France (22nd, 13.16%), and the United States (30th, 6%) in digital financial adoption. In Indonesia, digital financial users are projected to reach 39% (74.79 million) by 2026 (Rangkuty & Efendi, 2022). Financial inclusion enhances financial accessibility and usage, benefiting both households and businesses. It empowers low-income families, stimulates economic mobilitys, and supports sustainable development (Tan et al., 2022).

The Problem of Sustainable Development and Income DistributionSustainable development has had difficulty in recent decades in promoting fair income distribution among all socioeconomic groups. Inequalities in economic position, income levels, and wealth distribution have been made worse by the disregard for income distribution and redistribution laws in many countries (Min & Rao, 2023a), (Omar & Inaba, 2020). Economic crises have further hindered green economic growth and sustainable development (Mihai et al., 2021), (Y. Wang, 2023).The SDGs, which prioritize health, education, environmental sustainability, and green business efforts, have not succeeded in reducing global wealth disparity since their establishment in 2015. (Chand et al., 2021), (Hari Kristianto, 2020)(Hari Kristianto, 2020)(Hari Kristianto, 2020)(Hari Kristianto, 2020)(Hari Kristianto, 2020)(Hari Kristianto, 2020)(Hari Kristianto, 2020)(Hari Kristianto, 2020) (Paransa & Sadewo, 2019) (Nasution et al., 2022), (Chand et al., 2021; Gade & Selman, 2023), (McCowan, 2023) and (Lyulyov et al., 2024).

The lack of focus on the financial sector, specifically financial inclusion, digital finance, banking credit risk, and net investment in non-financial assets, is the reason why the SDGs have failed to promote green economic growth and income equality. (Vergara & Agudo, 2021), (Kanga et al., 2022) bank credit risk and low Net Investment in Nonfinancial Assets on economic growth (Liao et al., 2024), (Hua et al., 2024), (F. Yang & Masron, 2024).). To address these challenges, it is imperative to develop an integrated framework that facilitates digital financial transmission, financial inclusion, and net investment in non-financial assets (Ye et al., 2022) (Sarma, 2012)(Sarma, 2012)(Sarma, 2012)(Sarma, 2012)(Sarma, 2012)(Sarma, 2012)(Sarma, 2012)(Sarma, 2012) transmission of financial inclusion,(Mkansi & Mugurusi, 2022), credit risk (Mesjasz-Lech & Włodarczyk, 2022), (Nurpeisova et al., 2022), (Suhrab et al., 2024), (Guo et al., 2024). Supply chain financing has become an important complement to access to financing, and business innovation is essential for business development (Bai et al., 2024), (Lou et al., 2024) However, despite its crucial role in guaranteeing the efficiency of the financial supply chain, little is known about how digital supply chain finance affects income distribution inequality (DII) and GSDev.

Given the concerns expressed, the following questions are intended to be addressed by this study: (1) How should digital financial transmission, financial inclusion, and net investment in non-financial assets be organized for short-, medium-, and long-term integration? (2) What are the short-, medium-, and long-term dynamics of income distribution inequality and GSDev? (3) How may GSDev be enhanced and DII decreased in emerging economies through the use of Digital Financial Transmission, Financial Inclusion, and Net Investment in Non-Financial Assets? This study makes three important contributions: (1) Conceptual Framework Novelty: This study examines the relationship between GSDev and income distribution disparity in developing countries by integrating digital financial transmission, financial inclusion, and net investment in non-financial assets. (2) Model of Interdependence: developing a comprehensive analytical model that examines the long-term relationships between GSDev and income inequality. (3) Implications for Policy: Making recommendations for policies that highlight the significance of digital finance, financial inclusion, and investment in achieving sustainable growth.

Literature Review

2.1 Grand Theory, Middle Theory and Applied Theory

Grand theories provide a broad conceptual foundation and function as the primary theoretical framework for this study: Endogenous Growth Theory by Romer, 1986. According to this theory, financial infrastructure, digital financial inclusion, and investment in non-financial assets are intrinsic components that promote economic growth and sustainability. Digital finance and financial inclusion drive increased investment and economic efficiency, which ultimately accelerates sustainable growth. Income distribution theory (Stamatiou, 2023).

By serving as a bridge between large theories and real-world occurrences, middle theories provide a focused framework for understanding financial dynamics: the theory of financial inclusion (Senyo & Osabutey, 2020). Financial inclusion fosters long-term growth and reduces economic inequality by expanding public access to financial services. This study examines how financial inclusion and digital finance can reduce income disparities and enhance access to financial services for low-income groups. Bank credit risk theory (Suhrab et al., 2024). Credit risk has a significant impact on financial stability and banking institutions' ability to lend money to support economic expansion and green investment. As digital finance develops, big data analytics and AI-powered credit scoring systems can enhance risk assessment and lower default risks. Sustainable development theory (Ruggerio, 2021). This concept highlights how important it is to account for social and environmental impacts when promoting economic progress. By examining green sustainable development as an extension of this concept, this

study investigates how investment, financial inclusion, and digital finance promote a green economy in developing countries.

2.2 Digital Finance and Financial Inclusion

Financial inclusion is a wide notion that varies depending on a country's socioeconomic progress (Ansar et al., 2025). Some academics define financial exclusion as the inability to use formal financial systems, which is commonly linked to social and economic marginalization. Financial exclusion is the process through which individuals from low-income origins are excluded from official financial systems. (Dong et al., 2025a) emphasized systemic barriers to financial inclusion, defining financial exclusion as a circumstance in which certain social groups lack access to financial services (Y. Z. Wang & Zhang, 2025).

2.3 Digital Technology's Contribution to Financial Inclusion

Technology is one of the primary instruments for enhancing institutional effectiveness and financial accessibility(Dong et al., 2025b). Digital technology adoption, social reconfiguration, and continuous financial access are all very beneficial to economically disadvantaged populations (Wei et al., 2025). In light of digitalization, banks need to reconsider and reorganize their financial systems to better serve their economically disadvantaged clients (Ayadi et al., 2025). Some financial platforms will quickly gain market dominance, according to the financial(Li et al., 2025) perspective, even if this approach usually disregards innovation and customer interaction (Li et al., 2025).

Methods

3.1 Data Types and Sources

This study makes use of panel data, which blends time-series data (covering the period from January 2021 to December 2023) with cross-sectional data from emerging economies (Brazil, the United Kingdom, Indonesia, France, and the United States). To ensure high-quality empirical insights into the ways that credit risk, non-financial investment, and digital financial inclusion impact sustainable development and income inequality in emerging countries, the study uses reliable international data sources.

Equation 1:

LogGSDev = C(10)+C(11)*log(TFI)+C(12)*log(DF)+C(13)*log(DII)

Where:

Y1 = Y1=GSDev (Green Sustainable Development)
X1 = TFI (Transmission Financial Inclusion)
X2 = DF (Digital Finance)
Y2 = DII (Distribution Income Inequality)
a = Constant

Equation 2:

LogDII = C(20)+C(21)*log(BCR)+C(22)*log(NINA)+C(23)*log(GSDev)

Where:

Y2 =DII (Distribution Income Inequality)
X3 = BCR (Bank Credit Risk)
X4 = NINA (Net Investment in Non-Financial Assets)
Y1 = GSDev (Green Sustainable Development)
a = Constant

Result and Discussion

In the framework of emerging economies, this SUR model ensures reliable and effective regression findings by allowing the simultaneous assessment of the interrelationships between GSWDev and DII.

Tabel 1. GSWDev and DII

Equation: ESD=C(10)+C(11)*(TFI)+C(12)*(DF)+C(13)*(DII)			
Observations: 180			
R-squared	0.770135	Mean dependent var	7.210067
Adjusted R-squared	0.766217	S.D. dependent var	3.055579
S.E. of regression	1.477407	Sum squared resid	384.1605
Durbin-Watson stat	0.116073		
Equation:DII=C(20)+C(21)*(BCR)+C(22)*(NINA)+C(23)*(GSD)			
Observations: 180			
R-squared	0.814974	Mean dependent var	38.82000
Adjusted R-squared	0.811821	S.D. dependent var	7.681417
S.E. of regression	3.332171	Sum squared resid	1954.193
Durbin-Watson stat	0.075425		

GSDev has a significant and positive impact on Distribution Income Inequality (DII). The positively signed GSDev coefficient of 0.719947 indicates that in emerging economies, a 1% rise in GSDev results in a 0.71% increase in DII. This finding highlights the dual nature of sustainable development, which may raise wealth disparities while simultaneously promoting economic growth if equitable policies are not put in place. Sustainable development's contribution to equitable income distribution is consistent with (Omar & Inaba, 2020), (Mihai et al., 2021), (Y. Wang, 2023), (X. Yang et al., 2023).

Tabel 2. Desain SUR di Emerging Economies

Desain Model GSDev - DII		Code	Result	R-squared
***GSDev* _Brazil**	*Transmission Financial Inclusion*	-	significant	100%
	Digital Finance	-	significant	
	Distribution Income Inequality	+	significant	
GSDev_Indonesia	*Transmission Financial Inclusion*	+	significant	100%
	Digital Finance	+	significant	
	Distribution Income Inequality	-	significant	
GSDev_Inggris	*Transmission Financial Inclusion*	-	significant	100%
	Digital Finance	+	significant	
	Distribution Income Inequality	+	significant	
GSDev_Prancis	*Transmission Financial Inclusion*	+	significant	100%
	Digital Finance	-	significant	
	Distribution Income Inequality	+	significant	
GSDev_Amerika Serikat	*Transmission Financial Inclusion*	-	significant	100%
	Digital Finance	-	significant	
	Distribution Income Inequality	+	significant	
DII_Brazil	*Bank Credit Risk*	-	significant	98.2%
	Net Investment in Nonfinancial Assets	-	significant	
	GSDev	-	Signifikan	
DII_Indonesia	*Bank Credit Risk*	-	not significant	51.14%
	Net Investment in Nonfinancial Assets	+	not significant	
	GSDev	-	significant	
DII_Inggris	*Bank Credit Risk*	+	significant	77.16%
	Net Investment in Nonfinancial Assets	+	significant	
	GSDev	+	significant	
DII_Prancis	*Bank Credit Risk*	+	significant	99.08%
	Net Investment in Nonfinancial Assets	-	significant	
	GSDev	+	significant	
DII_Amerika Serikat	*Bank Credit Risk*	+	significant	85.11%
	Net Investment in Nonfinancial Assets	+	significant	
	GSDev	-	significant	

According to the study framework, practically every factor affects how financial inclusion and digital supply chain transmission affect distribution income inequality and green sustainable development over the long run. However, the results indicate that Indonesia is an exception, as the variables Bank Credit Risk and Net Investment in Non-Financial Assets have no discernible effects on GSDev and DII in Indonesia. This suggests that: The strategies for the sustainability and income distribution of the Indonesian banking sector may not yet fully incorporate credit risk management and non-financial investments. Other challenges related to digital finance and financial inclusion may have a greater impact on Indonesia's income distribution dynamics and economic sustainability.

Tabel 3. Result and Research-gap

	Brazil	Hasil	Research-gap
GSDev	*Transmission Financial Inclusion*	-Signifikan	(Suhrab et al., 2024), (P. Ozili, 2022), (X. Zhang et al., 2023a)
	Digital Finance	-Signifikan	(X. Zhang et al., 2023b), (Hao et al., 2023), (Abbas et al., 2024)
	Distribution Income Inequality	+Signifikan	(Azad & Chakraborty, 2020) (Papadopoulos, 2019), (Amponsah et al., 2023)
	Bank Credit Risk	-Signifikan	(Correa et al., 2022), (F. Yang & Masron, 2024), (An et al., 2023), (Civelek, 2021)
DII	*Net Investment in Nonfinancial Assets*	-Signifikan	(Mesjasz-Lech & Włodarczyk, 2022), (Nurpeisova et al., 2022)
	GSDev	-Signifikan	(Min & Rao, 2023a)(Min & Rao, 2023a)(Min & Rao, 2023a)(Min & Rao, 2023a)(Min & Rao, 2023a)(Min & Rao, 2023a)(Min & Rao, 2023a)(Giannetti et al., 2023), (Houssam et al., 2023)
	Indonesia	Result	Research-gap
GSDev	*Transmission Financial Inclusion*	+Signifikan	(Suhrab et al., 2024)
	Digital Finance	+Signifikan	(X. Zhang et al., 2023b)
	Distribution Income Inequality	-Signifikan	(Suhrab et al., 2024) (Y. Zhang & Qu, 2024)(Suhrab et al., 2024)(Suhrab et al., 2024)(Suhrab et al., 2024)(Suhrab et al., 2024)(Suhrab et al., 2024)(Suhrab et al., 2024)(Suhrab et al., 2024)(Suhrab et al., 2024)
	Bank Credit Risk	-no Signifikan	(Correa et al., 2022), (F. Yang & Masron, 2024), (An et al., 2023), (Civelek, 2021)
DII	*Net Investment in Nonfinancial Assets*	+ Tidak Signifikan	(Mesjasz-Lech & Włodarczyk, 2022), (Nurpeisova et al., 2022)
	GSDev	-Signifikan	(Giannetti et al., 2023), (Houssam et al., 2023)
	Inggris	Result	Research-gap
GSDev	*Transmission Financial Inclusion*	-Signifikan	(Suhrab et al., 2024)
	Digital Finance	+Signifikan	(X. Zhang et al., 2023b)
	Distribution Income Inequality	+Signifikan	(Azad & Chakraborty, 2020), (Papadopoulos, 2019), (Amponsah et al., 2023)
	Bank Credit Risk	+Signifikan	(Correa et al., 2022), (F. Yang & Masron, 2024), (An et al., 2023), (Civelek, 2021)
DII	*Net Investment in Nonfinancial Assets*	+Signifikan	(Mesjasz-Lech & Włodarczyk, 2022), (Nurpeisova et al., 2022)
	GSDev	+Signifikan	(Giannetti et al., 2023), (Houssam et al., 2023)
	Prancis	Result	Research-gap
GSDev	*Transmission Financial Inclusion*	+Signifikan	(Suhrab et al., 2024)
	Digital Finance	-Signifikan	(X. Zhang et al., 2023b)
	Distribution Income Inequality	+Signifikan	(Azad & Chakraborty, 2020), (Suhrab et al., 2024), (Amponsah et al., 2023)
	Bank Credit Risk	+Signifikan	(Correa et al., 2022), (F. Yang & Masron, 2024), (An et al., 2023), (Civelek, 2021)
DII	*Net Investment in Nonfinancial Assets*	-Signifikan	(Mesjasz-Lech & Włodarczyk, 2022), (Nurpeisova et al., 2022)
	GSDev	+Signifikan	(Giannetti et al., 2023), (Houssam et al., 2023)
	Amerika Serikat	Result	Research-gap

	Brazil	Hasil	Research-gap
	Transmission Financial Inclusion	-Signifikan	(Suhrab et al., 2024)
GSDev	*Digital Finance*	-Signifikan	(X. Zhang et al., 2023b)
	Distribution Income Inequality	+Signifikan	(Azad & Chakraborty, 2020), (Amponsah et al., 2023) (Min & Rao, 2023b)(Min & Rao, 2023b)(Min & Rao, 2023b)(Min & Rao, 2023b)(Min & Rao, 2023b)(Min & Rao, 2023b)(Min & Rao, 2023b)(de Haan & Sturm, 2017)
	Bank Credit Risk	+Signifikan	(Correa et al., 2022), (F. Yang & Masron, 2024), (An et al., 2023), (Civelek, 2021)
DII	*Net Investment in Nonfinancial Assets*	+Signifikan	(Mesjasz-Lech & Włodarczyk, 2022), (Nurpeisova et al., 2022)
	GSDev	-Signifikan	(Min & Rao, 2023a)(Min & Rao, 2023a)(Min & Rao, 2023a)(Min & Rao, 2023a)(Min & Rao, 2023a)(Min & Rao, 2023a)(Min & Rao, 2023a)(Giannetti et al., 2023), (Houssam et al., 2023)

Source : output model SUR, 2025

Results of the GSDev and DII Model Design by Country. The SUR model's results confirm that the key factors significantly affect GSDev in each of the emerging economies that were studied, including the US, Brazil, Indonesia, the UK, and France. These include Transmission Financial Inclusion, Digital Finance, and Distribution Income Inequality. This study validates the significance of Digital Supply Chain Financial Inclusion in advancing Green Sustainable Development and improving income distribution. In order to achieve sustainable development and lessen income disparities, it is crucial to integrate TFI, DF, Bank Credit Risk, and Net Investment in Non-Financial Assets (Nasution et al., 2022). (Nasution et al., 2022) (Min & Rao, 2023a), (Omar & Inaba, 2020), (Y. Wang, 2023), (X. Yang et al., 2023), (McCowan, 2023), (Zhao et al., 2021), (Yin et al., 2023) and (Lyulyov et al., 2024) (Rusiadi; Fatia Ulfa; Bakhtiar Efendi; Dewi Mahrani Rangkuty, 2024). Findings on DII Model Design by Country. The analysis also shows that in all countries studied, the SCDFI variables significantly contribute to DII, specifically: Bank Credit Risk (BCR), Net Investment in Non-Financial Assets (NINA), Green Sustainable Development (GSDev).

However, Indonesia stands as an exception, as BCR and NINA do not significantly impact DII. This suggests that: Bank Credit Risk does not significantly support economic development in Indonesia (Syamlan & Jannah, 2019), (Gurendrawati et al., 2021), (Surjaningsih et al., 2018) (Rangkuty & Efendi, 2022). Net Investment in Non-Financial Assets has limited effectiveness in supporting Indonesia's development (Setiawan, 2018), (Raharjo et al., 2022), (Susantono et al., 2018).

The Strategic Role of Digital Transmission Financial Inclusion in Sustainable Development. The integration of Digital Transmission Financial Inclusion and Net Investment in Non-Financial Assets is necessary for a comprehensive analytical framework for sustainable economic development. Promoting inclusive financial transformation also requires reducing bank credit risk and increasing net investment in non-financial assets. It is anticipated that the digital design of Transmission Financial Inclusion will be able to establish a green economy and equitable income distribution. (Vergara & Agudo, 2021), (Kanga et al., 2022) through reducing bank credit risk, Net Investment in Nonfinancial Assets (Liao et al., 2024), (Hua et al., 2024), (F. Yang & Masron, 2024) (Suhendi et al., 2020) (Sari, 2022). Therefore, strong attention needs to be paid to the formation of transmission in digital financial services (Ye et al., 2022), (Sarma, 2012), (Neaime & Gaysset, 2018), (X. Zhang et al., 2023a), (Mkansi & Mugurusi, 2022), (Mesjasz-Lech & Włodarczyk, 2022), (Nurpeisova et al., 2022), (Suhrab et al., 2024)(Suhrab et al., 2024)(Suhrab et al., 2024)(Suhrab et al., 2024)(Suhrab et al., 2024)(Suhrab et al., 2024)(Suhrab et al., 2024)(Bai et al., 2024), (Lou et al., 2024), (Liao et al., 2024) (Wei et al., 2025), (Shreya Pal, Shravni Vankila Fernandes, 2025).

Conclusion

The impact of digital finance, digital transmission financial inclusion, bank credit risk, and net investment in non-financial assets on distribution income inequality and green sustainable development in emerging nations is empirically demonstrated in this paper. Digital finance and transmission financial inclusion have a significant influence on GSDev in each of the countries that are being studied. Distribution Income Inequality is another significant component of GSDev, suggesting the need for inclusive management of economic growth. Bank Credit Risk (BCR) and Net Investment in Non-Financial Assets have a significant influence on DII in most emerging economies. As an exception, Indonesia faces significant financial challenges, as seen by the minimal impact of BCR and NINA on DII. Our findings demonstrate that Digital Transmission Financial Inclusion is crucial for promoting sustainable development and lowering economic inequality, even though its effectiveness varies by country. This study offers a comprehensive framework for investigating the connections between credit risk, digital finance, financial inclusion, and sustainable development in emerging nations. A strategic policy tool for fostering fair and sustainable economic growth is the proposed Net Investment in Non-Financial Assets and Digital Transmission Financial Inclusion approach. By controlling financial risks, enhancing investment strategies, and expanding digital financial services, emerging economies can achieve green economic development and reduce income inequality..

This study improves theories of financial development by integrating investment strategies, digital finance, and financial inclusion into a framework for sustainable development. proves that economic sustainability is driven by internal financial factors, thereby bolstering the Endogenous Growth Theory. supports the Kuznets Curve Theory by demonstrating how financial participation helps to reduce income inequality over the long run. proves the validity of the Financial Development Theory by showing how investment and financial stability drive sustainable development. Implications for the Practice. Strengthening laws pertaining to digital finance and financial inclusion might hasten sustainable economic growth. Reducing bank credit risk is necessary to ensure equitable income distribution. When non-financial asset investments are optimized, economic growth benefits all aspects of society. Since emerging economies have varying levels of policy effectiveness, country-specific financing techniques are needed.

Presenting Digital Transmission Financial Inclusion and Net Investment in Non-Financial Assets, two crucial elements of sustainable development. Unlike other studies, this one integrates digital financial inclusion with sustainable economic policies. employing the SUR technique to examine the combined effects of risk management, investment, digital finance, and financial inclusion. The SUR approach ensures objective evaluation by considering the interdependencies between financial and economic variables. filling a gap in the literature by examining supply chain financing and digital supply chain financing in relation to GSDev and DII. Prior studies have not looked at how supply chain financial inclusion supports income distribution and sustainable development.

Enhancing financial inclusion and digital finance. Governments and financial organizations should expand access to digital financial services, particularly in rural and disadvantaged areas. Policies should promote financial literacy in order to ensure that low-income groups gain from digital financial inclusion. managing the bank credit risk. To reduce credit risks and improve financial stability, regulatory frameworks should strengthen risk assessment practices. By using AI-driven credit scoring algorithms, banks may increase the precision of their risk assessments. Nationally Specific Financial Strategies. Indonesia should focus on financial risk management and investment efficiency since BCR and NINA do not yet make a substantial contribution to the nation's economic growth. To guarantee that digital

financial services promote inclusive growth, other emerging economies should improve their financial regulation regimes.

References

[1] Abbas, J., Balsalobre-Lorente, D., Amjid, M. A., Al-Sulaiti, K., Al-Sulaiti, I., & Aldereai, O. (2024). Financial innovation and digitalization promote business growth: The interplay of green technology innovation, product market competition and firm performance. *Innovation and Green Development*, *3*(1), 1–28. https://doi.org/10.1016/j.igd.2023.100111

[2] Abdulquadri, A., Mogaji, E., Kieu, T. A., & Nguyen, N. P. (2021). Digital transformation in financial services provision: a Nigerian perspective to the adoption of chatbot. *Journal of Enterprising Communities*, *15*(2), 258–281. https://doi.org/10.1108/JEC-06-2020-0126

[3] Amponsah, M., Agbola, F. W., & Mahmood, A. (2023). The relationship between poverty, income inequality and inclusive growth in Sub-Saharan Africa. *Economic Modelling*, *126*(September). https://doi.org/10.1016/j.econmod.2023.106415

[4] An, X., Ding, Y., & Wang, Y. (2023). *Green credit and bank risk : Does corporate social responsibility matter ? 58*(December), 1–5.

[5] Ansar, S., Klapper, L., & Singer, D. (2025). *Publication Financial Inclusion and Economic Development A Review of the Data and Evidence.pdf* (p. 432). https://openknowledge.worldbank.org/entities/publication/37271e00-4b20-4b90-b81f-5f5cd4280f4e

[6] Ayadi, R., Chiaramonte, L., Cucinelli, D., & Migliavacca, M. (2025). Digitalization and banks' efficiency: Evidence from a European analysis. In *International Review of Financial Analysis* (Vol. 97). https://doi.org/10.1016/j.irfa.2024.103837

[7] Azad, R., & Chakraborty, S. (2020). Green Growth and the Right to Energy in India. *Energy Policy*, *141*(March), 111456. https://doi.org/10.1016/j.enpol.2020.111456

[8] Bai, H., Huang, L., & Wang, Z. (2024). Supply chain financing, digital financial inclusion and enterprise innovation: Evidence from China. *International Review of Financial Analysis*, *91*(January), 1–5. https://doi.org/10.1016/j.irfa.2023.103044

[9] Chand, A. A., Lal, P. P., Prasad, K. A., & Mamun, K. A. (2021). Practice, benefits, and impact of personal protective equipment (PPE) during COVID-19 pandemic: Envisioning the UN sustainable development goals (SDGs) through the lens of clean water sanitation, life below water, and life on land in Fiji. *Annals of Medicine and Surgery*, *70*(August), 102763. https://doi.org/10.1016/j.amsu.2021.102763

[10] Civelek, M. (2021). The Mediating Role of SMEs' Performance in the Relationship between Entrepreneurial Orientation and Access to Finance. *BAR - Brazilian Administration Review*, *18*(4), 1–25. https://doi.org/10.1590/1807-7692BAR2021210045

[11] Correa, R., Paligorova, T., Sapriza, H., & Zlate, A. (2022). Cross-Border Bank Flows and Monetary Policy. *Review of Financial Studies*, *35*(1), 438–481. https://doi.org/10.1093/rfs/hhab019

[12] Dar, M. H., & Nain, M. Z. (2024). An analysis of economic stability and financial development in India using asymmetric cointegration and simulative causality tests. *Journal of Economic Asymmetries*, *30*(November), 1–9. https://doi.org/10.1016/j.jeca.2024.e00383

[13] de Haan, J., & Sturm, J. E. (2017). Finance and income inequality: A review and new evidence. *European Journal of Political Economy*, *50*, 171–195. https://doi.org/10.1016/j.ejpoleco.2017.04.007

[14] Dong, Q., Balsalobre-Lorente, D., & Syed, Q. R. (2025a). The critical role of financial

inclusion in green growth: Evidence from BRICS countries. In *Research in International Business and Finance* (Vol. 76). https://doi.org/10.1016/j.ribaf.2025.102847

[15] Dong, Q., Balsalobre-Lorente, D., & Syed, Q. R. (2025b). The critical role of financial inclusion in green growth: Evidence from BRICS countries. In *Research in International Business and Finance* (Vol. 76). https://doi.org/10.1016/j.ribaf.2025.102847

[16] Gade, A. N., & Selman, A. D. (2023). Early implementation of the sustainable development goals in construction projects: A Danish case study. *Journal of Building Engineering*, *79*(November), 1–7. https://doi.org/10.1016/j.jobe.2023.107815

[17] Giannetti, B. F., Langa, E. S., Almeida, C. M. V. B., Agostinho, F., de Oliveira Neto, G. C., & Lombardi, G. V. (2023). Overcoming poverty traps in Mozambique: Quantifying inequalities among economic, social and environmental capitals. *Journal of Cleaner Production*, *383*(January), 1–7. https://doi.org/10.1016/j.jclepro.2022.135266

[18] Guo, B., Hu, P., & Lin, J. (2024). *The effect of digital infrastructure development on enterprise green transformation*. *92*(March), 1–7. https://www.sciencedirect.com/science/article/abs/pii/S1057521924000176

[19] Gurendrawati, E., Khairunnisa, H., Ulupui, I. G. K. A., Suryarini, T., & Zakaria, A. (2021). Bank Risk Profile and Credit Growth in Indonesia. *Jurnal Ilmiah Akuntansi Dan Bisnis*, *16*(1), 84. https://doi.org/10.24843/jiab.2021.v16.i01.p06

[20] Han, L., Zhang, D., & Hua, X. (2023). Assessing the coordinative and coupling development of China's green economic growth: role of sports economics. *Economic Research-Ekonomska Istrazivanja*, *36*(3), 1–29. https://doi.org/10.1080/1331677X.2022.2164037

[21] Han, Z., & Wang, Z. (2025). Digitalization and supply chain finance risk: Evidence from listed firms in the construction industry. In *Finance Research Letters* (Vol. 74). https://doi.org/10.1016/j.frl.2024.106726

[22] Hao, X., Li, Y., Ren, S., Wu, H., & Hao, Y. (2023). The role of digitalization on green economic growth: Does industrial structure optimization and green innovation matter? *Journal of Environmental Management*, *325*(January), 1–6. https://doi.org/10.1016/j.jenvman.2022.116504

[23] Hari Kristianto, A. (2020). SUSTAINABLE DEVELOPMENT GOALS (SDGs) DALAM KONSEP GREEN ECONOMY UNTUK PERTUMBUHAN EKONOMI BERKUALITAS BERBASIS EKOLOGI. *Business, Economics and Entrepreneurship*, *2*(1), 27–38. https://doi.org/10.46229/b.e.e..v2i1.134

[24] Houssam, N., Ibrahiem, D. M., Sucharita, S., El-Aasar, K. M., Esily, R. R., & Sethi, N. (2023). Assessing the role of green economy on sustainable development in developing countries. *Heliyon*, *9*(6), 1–32. https://doi.org/10.1016/j.heliyon.2023.e17306

[25] Hua, M., Li, Z., Zhang, Y., & Wei, X. (2024). Does green finance promote green transformation of the real economy? *Research in International Business and Finance*, *67*(January), 1–4. https://doi.org/10.1016/j.ribaf.2023.102090

[26] Huang, L., Zhang, H., Si, H., & Wang, H. (2023). Can the digital economy promote urban green economic efficiency? Evidence from 273 cities in China. *Ecological Indicators*, *155*(November), 1–30. https://doi.org/10.1016/j.ecolind.2023.110977

[27] Jarvis, R., & Han, H. (2021). Fintech Innovation: Review and Future Research Directions. *International Journal Bank Fin Ins Tech*, *1*(1), 79–102. https://researchlakejournals.com/index.php/IJBFIT/article/view/126

[28] Kanga, D., Oughton, C., Harris, L., & Murinde, V. (2022). The diffusion of fintech, financial inclusion and income per capita. *European Journal of Finance*, *28*(1), 108–136. https://doi.org/10.1080/1351847X.2021.1945646

[29] Li, Y., Deng, M., Cui, Y., & Pan, J. (2025). Does monetary policy impact bank risk-taking? An empirical study based on the data of 119 commercial banks in China. *Finance*

Research Letters, *81*(July), 1–6. https://doi.org/10.1016/j.frl.2025.107547
[30] Liao, F., Hu, Y., Chen, M., & Xu, S. (2024). Digital transformation and corporate green supply chain efficiency: Evidence from China. *Economic Analysis and Policy*, *81*(March), 195–207. https://doi.org/10.1016/j.eap.2023.11.033
[31] Lou, Z., Xie, Q., Shen, J. H., & Lee, C. C. (2024). Does Supply Chain Finance (SCF) alleviate funding constraints of SMEs? Evidence from China. *Research in International Business and Finance*, *67*(January), 1–7. https://doi.org/10.1016/j.ribaf.2023.102157
[32] Lyulyov, O., Pimonenko, T., Saura, J. R., & Barbosa, B. (2024). How do e-governance and e-business drive sustainable development goals? *Technological Forecasting and Social Change*, *199*(February), 123082. https://doi.org/10.1016/j.techfore.2023.123082
[33] McCowan, T. (2023). The crosscutting impact of higher education on the Sustainable Development Goals. *International Journal of Educational Development*, *103*(November), 1–9. https://doi.org/10.1016/j.ijedudev.2023.102945
[34] Mesjasz-Lech, A., & Włodarczyk, A. (2022). The role of logistics infrastructure in development of sustainable road transport in Poland. *Research in Transportation Business and Management*, *44*(September), 1–4. https://doi.org/10.1016/j.rtbm.2022.100841
[35] Mihai, F., Aleca, O. E., Gogu, E., Dobrin, C., & Gheorghe, M. (2021). The challenges of the green economy in romania. Scientific literature review. *Sustainability (Switzerland)*, *13*(23). https://doi.org/10.3390/su132313113
[36] Min, J., & Rao, N. D. (2023a). Growth and inequality trade-offs to eradicate absolute poverty. *Heliyon*, *9*(11), 1–20. https://doi.org/10.1016/j.heliyon.2023.e21441
[37] Min, J., & Rao, N. D. (2023b). Growth and inequality trade-offs to eradicate absolute poverty. *Heliyon*, *9*(11), 1–18. https://doi.org/10.1016/j.heliyon.2023.e21441
[38] Mkansi, M., & Mugurusi, G. (2022). E-grocery supply chain innovation and financial inclusion: A framework. *Procedia Computer Science*, *217*, 979–987. https://doi.org/10.1016/j.procs.2022.12.296
[39] Nasution, L. N., Suhendi, S., Rusiadi, R., Rangkuty, D. M., & Abdiyanto, A. (2022). Covid-19 Pandemic: Impact on Economic Stability In 8-Em Muslim Countries. *Atestasi : Jurnal Ilmiah Akuntansi*, *5*(1), 336–352. https://doi.org/10.57178/atestasi.v5i1.626
[40] Neaime, S., & Gaysset, I. (2018). Financial inclusion and stability in MENA: Evidence from poverty and inequality. *Finance Research Letters*, *24*(March), 199–220. https://doi.org/10.1016/j.frl.2017.09.007
[41] Nurpeisova, A., Blokhina, T., Zueva, A., Kievskaya, S., & Varzin, V. (2022). Infrastructure, technology and financial engineering in the transport services market. *Transportation Research Procedia*, *63*, 1396–1403. https://doi.org/10.1016/j.trpro.2022.06.150
[42] Omar, M. A., & Inaba, K. (2020). Does financial inclusion reduce poverty and income inequality in developing countries? A panel data analysis. *Journal of Economic Structures*, *9*(1). https://doi.org/10.1186/s40008-020-00214-4
[43] Ozili, P. (2022). Digital finance research and developments around the World: a literature review. *International Journal of Business Forecasting and Marketing Intelligence*, *1*(1), 1. https://doi.org/10.1504/ijbfmi.2022.10049390
[44] Ozili, P. K. (2018). Impact of digital finance on financial inclusion and stability. *Borsa Istanbul Review*, *18*(4), 329–340. https://doi.org/10.1016/j.bir.2017.12.003
[45] Papadopoulos, G. (2019). Income inequality, consumption, credit and credit risk in a data-driven agent-based model. *Journal of Economic Dynamics and Control*, *104*(July), 39–73. https://doi.org/10.1016/j.jedc.2019.05.002
[46] Paransa, S., & Sadewo, Y. D. (2019). Sustainable Development Goals (SDGs) in Concept of Green Economy. *Journal Business Economics and Entrepreneurship*, *1*(2), 1–8.

http://jurnal.shantibhuana.ac.id/jurnal/index.php/bee

[47] Raharjo, E. P., Candrarahayu, A. M., & Adidana, I. K. S. P. (2022). Analysis of the Impact of Transportation Infrastructure Development on Traffic Performance in NTB Province. *Jurnal Teknologi Transportasi Dan Logistik*, *3*(2), 173–182. https://doi.org/10.52920/jttl.v3i2.89

[48] Rangkuty, D. M., & Efendi, B. (2022). *TEORI EKSPOR (Studi Kasus: Ekspor Indonesia ke Negara ASEAN)* (Vol. 19, Issue January).

[49] Ruggerio, C. A. (2021). Sustainability and sustainable development: A review of principles and definitions. *Science of the Total Environment*, *786*(September), 1–6. https://doi.org/10.1016/j.scitotenv.2021.147481

[50] Rusiadi; Fatia Ulfa; Bakhtiar Efendi; Dewi Mahrani Rangkuty. (2024). *THE ROLE OF ENERGY CONSUMPTION IN GREEN BUSINESS AND GREEN ECONOMIES IN 5GO-GREEN COUNTRIES*. *02*(01), 370–378. https://www.ejournal.unuja.ac.id/index.php/icesh/article/viewFile/7825/2807

[51] Sara Ravan Ramzani Peter Konhaeusner Oluwasegun Akinola Olaniregun Ahmad Abu-Alkheil Nizar Alsharari. (2024). *Integrating AI-Driven Green Finance Strategies for Sustainable Development: A Comparative Analysis of Renewable Energy Investments in Germany and Denmark* (p. 24). https://www.ejbmr.org/index.php/ejbmr/article/view/2277

[52] Sari, W. I. (2022). Analysis Of Digital Economic Transformation In Improving The Economy Of Home Industries In Kota Pari Village. *The 1st Proceeding of The International Conference on Economics and Business*, *2*(1). https://doi.org/DOI: https://doi.org/10.55606/iceb.v2i1.258

[53] Sarma, M. (2012). Fintech, financial inclusion and income inequality: a quantile regression approach. *Berlin Working Papers on Money, Finance, Trade and Development*, *28*(1), 86–107. https://doi.org/10.1080/1351847X.2020.1772335

[54] Senyo, P. K., & Osabutey, E. L. C. (2020). Unearthing antecedents to financial inclusion through FinTech innovations. *Technovation*, *98*(June 2019), 102155. https://doi.org/10.1016/j.technovation.2020.102155

[55] Setiawan, S. (2018). Indonesian Logistics Infrastructure: The Performance and Fiscal Support. *International Journal of Finance & Banking Studies (2147-4486)*, *7*(2), 9–18. https://doi.org/10.20525/ijfbs.v7i2.896

[56] Shreya Pal, Shravni Vankila Fernandes, M. N. (2025). *Interplay of Financial Inclusion and Economic Growth in Emerging Economies.pdf* (p. 213). https://www.sciencedirect.com/science/article/pii/S2772655X25000011

[57] Song, Y., Gong, Y., & Song, Y. (2024). The impact of digital financial development on the green economy: An analysis based on a volatility perspective. *Journal of Cleaner Production*, *434*(January), 1–33. https://doi.org/10.1016/j.jclepro.2023.140051

[58] Stamatiou, P. (2023). Modeling Environmental Degradation: The Effects of Electricity Consumption, Economic Growth and Globalization. *International Journal of Energy Economics and Policy*, *13*(5), 62–72. https://doi.org/10.32479/ijeep.14626

[59] Suhendi, ., Zulhelmy, ., Ferine, K. F., & Alamsyah, B. (2020). *Islamic Accounting Information based on Statement of Financial Accounting Standards (SFAS) 109 in BAZNAS Riau Province*. *Unicees 2018*, 1367–1370. https://doi.org/10.5220/0009506513671370

[60] 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*(March), 1–5. https://doi.org/10.1016/j.techsoc.2023.102411

[61] Surjaningsih, N., Kurniati, I. N., & Indriani, R. (2018). Credit Risk Models for Five

Major Sectors in Indonesia. *Buletin Ekonomi Moneter Dan Perbankan*, *20*(4), 409–428. https://doi.org/10.21098/bemp.v20i4.900

[62] Susantono, B., Berawi, M. A., Miraj, P., & Petroceany, J. S. (2018). Improving Logistics Distribution Through Transportation Infrastructure Development in Greater Jakarta. *CSID Journal of Infrastructure Development*, *1*(1), 101. https://doi.org/10.32783/csid-jid.v1i1.13

[63] Syamlan, Y. T., & Jannah, W. (2019). the Determinant of Credit Risk in Indonesian Islamic Commercial Banks. *Share: Jurnal Ekonomi Dan Keuangan Islam*, *8*(2), 11–13. https://doi.org/10.22373/share.v8i2.5051

[64] Tan, X., Xiao, Z., Liu, Y., Taghizadeh-Hesary, F., Wang, B., & Dong, H. (2022). The effect of green credit policy on energy efficiency: Evidence from China. *Technological Forecasting and Social Change*, *183*(October), 1–7. https://doi.org/10.1016/j.techfore.2022.121924

[65] Vargas-Hernández, J. G., Rakowska, J., & Vargas-González, O. C. (2022). Green Economic Development as the Framework for Green Finance and Green Investment. *Economic and Regional Studies / Studia Ekonomiczne i Regionalne*, *15*(3), 304–322. https://doi.org/10.2478/ers-2022-0021

[66] Vergara, C. C., & Agudo, L. F. (2021). Fintech and sustainability: Do they affect each other? *Sustainability (Switzerland)*, *13*(13). https://doi.org/10.3390/su13137012

[67] Wang, Y. (2023). Exploring resource endowment and human capital impact on regional energy efficiency in China in the context of COP26. *Resources Policy*, *81*(January), 1–6. https://doi.org/10.1016/j.resourpol.2023.103422

[68] Wang, Y. Z., & Zhang, Z. T. (2025). Digital development and rural financial inclusion: Evidence from China. In *Research in International Business and Finance* (Vol. 73). https://doi.org/10.1016/j.ribaf.2024.102637

[69] Wei, F., Xie, B., & Chen, M. (2025). Digital financial inclusion, e-commerce development and entrepreneurial activity. In *International Review of Financial Analysis* (Vol. 97). https://doi.org/10.1016/j.irfa.2024.103806

[70] Wu, J., & Strezov, V. (2023). Green technologies and sustainability: A new trend. *Green Technologies and Sustainability*, *1*(1), 100008. https://doi.org/10.1016/j.grets.2023.100008

[71] Xie, X., & Wang, S. (2023). Digital transformation of commercial banks in China: Measurement, progress and impact. *China Economic Quarterly International*, *3*(1), 35–45. https://doi.org/10.1016/j.ceqi.2023.03.002

[72] Xu, D., Guo, D., Yue, P., & Li, M. (2024). Household green consumption: Does digital inclusion matter? *International Review of Financial Analysis*, *91*(January), 1–6. https://doi.org/10.1016/j.irfa.2023.102977

[73] Yang, F., & Masron, T. A. (2024). Role of financial inclusion and digital transformation on bank credit risk. *Journal of International Financial Markets, Institutions and Money*, *91*(March), 1–5. https://doi.org/10.1016/j.intfin.2023.101934

[74] Yang, X., Liu, X., Ran, Q., & Razzaq, A. (2023). How does natural resource dependence influence industrial green transformation in China? Appraising underlying mechanisms for sustainable development at regional level. In *Resources Policy* (Vol. 86). https://doi.org/10.1016/j.resourpol.2023.104191

[75] Ye, Y., Chen, S., & Li, C. (2022). Financial technology as a driver of poverty alleviation in China: Evidence from an innovative regression approach. *Journal of Innovation and Knowledge*, *7*(1), 100164. https://doi.org/10.1016/j.jik.2022.100164

[76] Yin, C., Zhao, W., Fu, B., Meadows, M. E., & Pereira, P. (2023). Key axes of global progress towards the Sustainable Development Goals. *Journal of Cleaner Production*, *385*(January), 1–6. https://doi.org/10.1016/j.jclepro.2022.135767

[77] Zhang, X., Li, J., Xiang, D., & Worthington, A. C. (2023a). Digitalization, financial inclusion, and small and medium-sized enterprise financing: Evidence from China. *Economic Modelling*, *126*(September), 1–6. https://doi.org/10.1016/j.econmod.2023.106410

[78] Zhang, X., Li, J., Xiang, D., & Worthington, A. C. (2023b). Digitalization, financial inclusion, and small and medium-sized enterprise financing: Evidence from China. *Economic Modelling*, *126*(September), 1–5. https://doi.org/10.1016/j.econmod.2023.106410

[79] Zhang, Y., & Qu, Y. (2024). Has the digital economy improved the consumption of poor and subsistence households? *China Economic Review*, *83*(February), 1–5. https://doi.org/10.1016/j.chieco.2023.102083

[80] Zhang, Z., Meng, Q., Wang, J., & Wu, Y. (2025). *Digital economy , customer stability , and organizational resilience*. *72*(February), 1–6. https://www.sciencedirect.com/science/article/abs/pii/S154461232401609X

[81] Zhao, Z., Cai, M., Wang, F., Winkler, J. A., Connor, T., Chung, M. G., Zhang, J., Yang, H., Xu, Z., Tang, Y., Ouyang, Z., Zhang, H., & Liu, J. (2021). Synergies and tradeoffs among Sustainable Development Goals across boundaries in a metacoupled world. *Science of the Total Environment*, *751*, 141749. https://doi.org/10.1016/j.scitotenv.2020.141749