



INDONESIAN TREASURY REVIEW

JURNAL PERBENDAHARAAN, KEUANGAN NEGARA DAN KEBIJAKAN PUBLIK

THE ROLE OF FINANCIAL DEVELOPMENT IN ACHIEVING SUSTAINABLE DEVELOPMENT

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ABSTRACT

Research Originality — This study provides a novel contribution by examining how financial institutions and financial markets influence sustainable development, using environmental, social, and governance (ESG) performance as an overall indicator. The research is comprehensive and not overly explored in existing literature because it employs a dynamic panel methodology and incorporates trade and investment variables to provide a broader perspective.

Research Objectives — The proposed study will examine whether financial development can go beyond just increasing access to financial services to also fostering sustainable economic growth free from negative social or environmental effects.

Research Methods — This paper uses panel data on 56 countries from 2016 to 2023. In a dynamic relationship, the system generalised method of moments (SYS-GMM) is used to apply a dynamic panel data method to overcome endogeneity and dynamic relationships.

Empirical Result — The results indicate that ESG performance can support sustainable development in the short term, while its long-term success depends on stronger policies and regulatory frameworks. Traditional approaches to financial development can hinder the achievement of ESG goals, but proper regulation can steer financial systems towards sustainability objectives. Economic growth, measured by GDP, often conflicts with ESG performance, although international trade can contribute positively to a sustainable economy when backed by green trade policies. Additionally, foreign direct investment has minimal impact unless there is a focus on sustainable sectors.

Implications — The study emphasizes the need for policy and regulatory reforms to better align financial development and economic growth with sustainability goals. It also highlights the importance of green trade policies and targeted investment strategies in promoting sustainable development outcomes.

Keywords: ESG; Dynamic Panel Data; Financial Development; Green Finance; Sustainability

ARTICLE INFO

Article History

Received : March 5, 2025

Revised : February 3, 2026

Accepted : February 28, 2026

Published : March 31, 2026

JEL Classification: C33; F21; G20; O16; Q56

How to Cite: Brily, R. M., Suharto, S. D., Mulatsih, S., & Purnamadewi, Y. L. (2026). The role of financial development in achieving sustainable development. *Indonesian Treasury Review (ITRev): Jurnal Perbendaharaan, Keuangan Negara, dan Kebijakan Publik*, 11(1), 84-98. <https://doi.org/10.33105/itrev.v11i1.1379>

INTRODUCTION

Most traditional development models focus more on economic growth, but such growth doesn't always benefit all parts of society equally. Income inequality remains a concern, as the economic gains tend to go to the wealthier sections of the population (Intyas et al., 2022; Rahayu, 2020). In addition, the development of the economy is commonly linked to the annihilation of the environment and pollution (Kartiasih & Setiawan, 2020). These dynamics highlight the disadvantages of traditional growth paradigms and the need to be more integrative about development to achieve a better balance between economic, social and environmental agendas to attain the Sustainable Development Goals (SDGs).

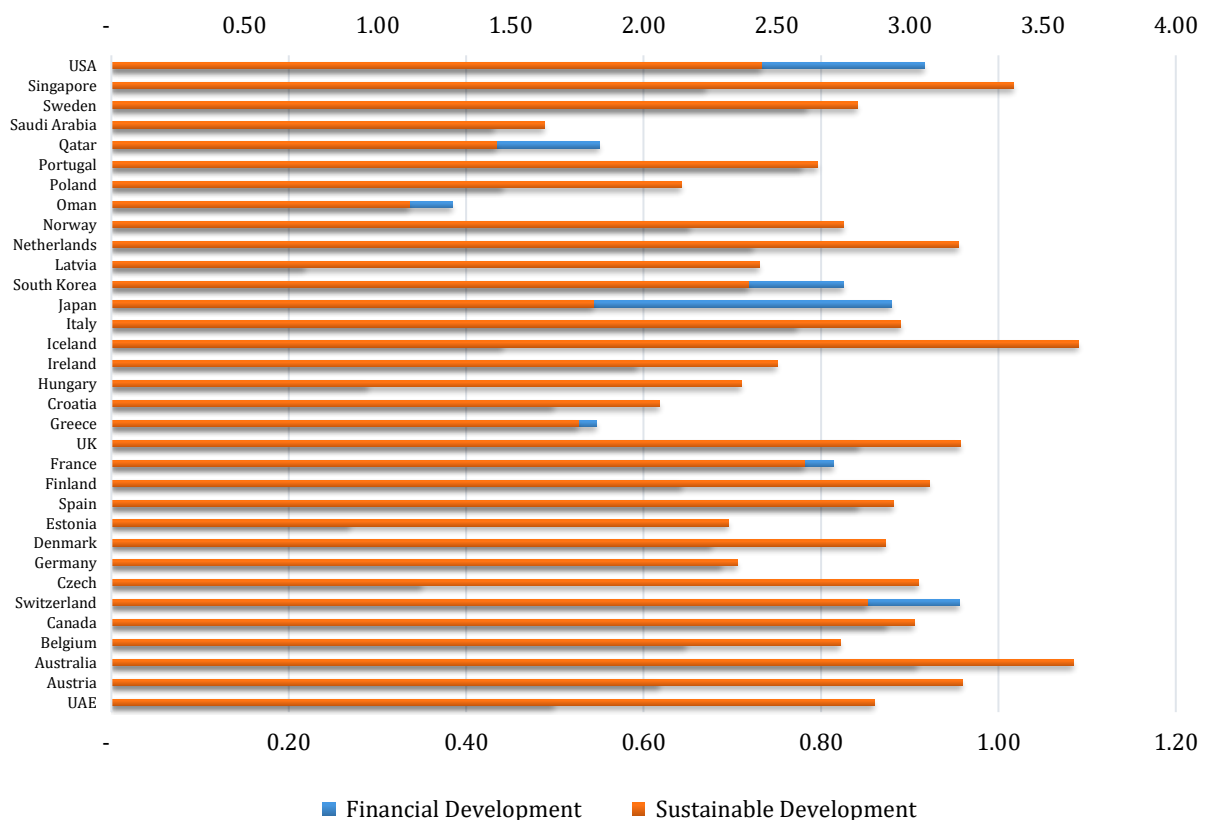
Sustainability, broadly defined as the ability to meet the needs of the current generation without compromising the ability of future generations to meet theirs, can be simplified into three pillars: economic viability, social equity, and environmental integrity. When evaluating the success of these objectives, this research paper employs the environmental, social, and governance (ESG) model, which is a widely recognised set of indicators for the responsible stewardship of the environment, social performance, and institutional governance (Berg et al., 2022). In parallel, financial development refers to the expansion and efficiency of financial institutions and markets in mobilizing resources and managing risks, which are fundamental to driving inclusive and long-term growth (Botev et al., 2019).

A sustainability-focused approach requires not only resource efficiency and innovation but also stronger financial regulations and alignment within institutions. Financial systems are crucial in fostering inclusive growth and long-term resilience by directing capital to environmentally responsible projects and managing social and ecological risks (Iskandar, 2020). Sustainability-focused institutions and technologies, such as digital finance, can enhance access, encourage green investment, and integrate sustainability into development strategies (Raharjo, 2021).

APPLICATIONS FOR PRACTICE

- Governments should strengthen their ESG policies, offer incentives, engage in sustainable finance using tools like green bonds and environmental risk assessments in the lending process, and align economic development with green industries through tax breaks and carbon trading schemes.
- Additionally, international trade and FDI systems ought to incorporate ESG standards.
- This can be effectively achieved through cross-sectoral cooperation, robust monitoring mechanisms, and adherence to international guidelines.

Figure 1 Comparison of Financial Development and Sustainable Development in Several Developed Countries in 2023



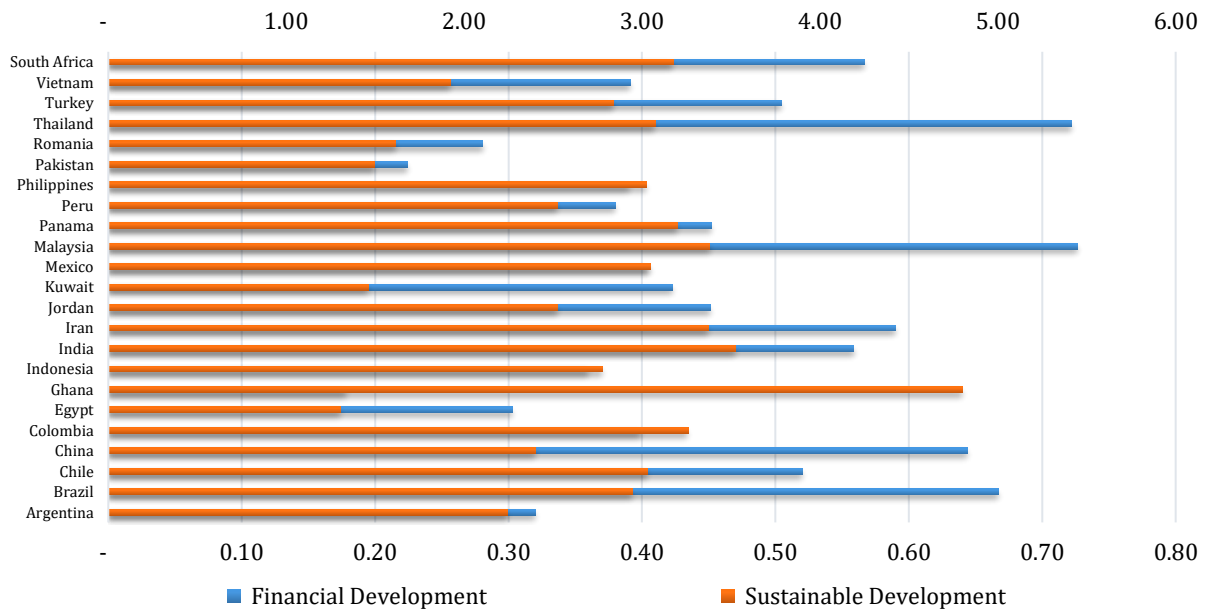
Source: Bloomberg (2023), International Monetary Fund (2023)

As previously discussed, financial development improves access to capital and supports a fairer distribution of resources, thereby aiding in reaching sustainable development goals by lowering carbon emissions. As shown in Figure 1, most developed countries seem to follow this theoretical model; however, some notable exceptions exist. Countries such as the United States, Qatar, and Japan show high levels of financial development but do not have equivalent levels of sustainable development.

Conversely, Figure 2 highlights the diverse conditions among developing countries. While many display both high financial development and strong sustainable development performance, discrepancies remain. For

example, Ghana has high sustainable development, even though its financial development is relatively lower than Portugal's, which has advanced financial development and low sustainability effects. Such discrepancies require further research to identify the root causes and contextual factors that underlie them.

Figure 2 Comparison of Financial Development and Sustainable Development in Several Developing Countries in 2023



Source: Bloomberg (2023), International Monetary Fund (2023)

These research gaps are taken into consideration in this study as they are found in the recent literature. To begin with, despite the growing popularity of recent researches assessing the connection between financial development and sustainability through ESG indicators, environmental performance, or green finance metrics (Ng et al., 2020; Omri et al., 2019), not much emphasis has been placed on the direct and indirect impact of financial development on sustainable business conduct in both developed and emerging economies. Second, although it is generally accepted that financial development is one of the key contributors to economic growth and financial resiliency (Wesiah & Onyekwere, 2021), little is known regarding how it fosters inclusive economic growth as a subset of sustainable development. This study will fill these gaps and thereby enhance our knowledge about the benefits of geographic and structural contexts between the effectiveness of financial development strategies and the realization of sustainability goals.

The differences in ESG management practices used by different countries provide a conceptual framework through which the role of the financial sector in achieving sustainability objectives can be understood. The study aims to explore the impact of financial development practices on the sustainable development performance of a broad sample of 56 countries, including both developed and developing economies, focusing on how financial systems contribute to meeting sustainability goals. The paper aims to demonstrate that financial development can do more than just increase access to financial services; it can also promote sustainable development without causing undesirable social or environmental impacts.

LITERATURE REVIEW

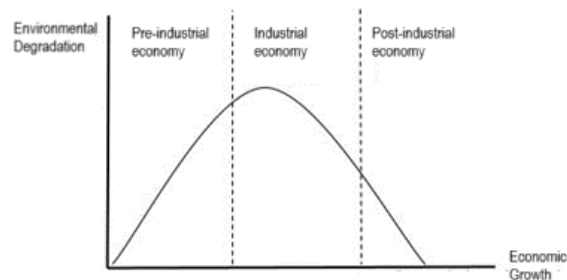
The association between social welfare and economic development has persistently been credited to robust economic growth. Empirical research indicates that growth can serve as a reduction in poverty and redistribution of income (Kang & Li, 2024). Furthermore, Rubio & León (2025) have pointed out that labor markets can be affected by financial development, and hence inequality and poverty rates. In classical theory of growth, the key elements to long-term growth are found in capital accumulation, advancement in technology, and higher production (Ferrara, 2025). In this light, there is a need to have a higher rate of savings, which is a driving force of investment and capital formation, which contributes to productivity.

The Solow growth model provides a framework to understand cross-country convergence based on the production function $Y(t) = f(K(t), L(t))$, where output results from capital and labor inputs. However, the classical model often overlooks environmental constraints and social inclusion. While financial systems are generally seen as effective at allocating capital, incorporating technological innovation into financial development can improve accessibility and reduce carbon emissions, for example, through branchless banking or paperless transactions. This developmental trend supports the idea that financial development, aligned with technological and social goals, can contribute to sustainable development. These processes suggest that

financial systems are not only drivers of growth but can also facilitate sustainable development, offering a conceptual link to the environmental Kuznets curve model.

The connection between the environment and development is explained by means of an economic theory called environmental Kuznets curve (EKC). According to Ulhaq et al. (2023) the EKC hypothesis implies that development, in terms of economic growth, has initially a positive impact on carbon emissions at some point. Nevertheless, economic growth may cause environmental improvements in the long run, which is mainly a result of technological improvements. The hypothesis will be that at the initial phase of economic growth, the rate at which the environment is deteriorating will be high as countries focus on increasing production at minimal consideration to environmental implications. The constant industrial processes cause pollution of soil, water, and air. At some point of maturity, however, there is the onset of societies realizing the significance of the quality of the environment. This turning point, where further economic growth results in reduced environmental degradation, is the central concept of the EKC (Ulhaq et al., 2023).

Figure 3 Kuznets environmental curve



Source: Processed by the Authors

As illustrated in Figure 3, the EKC framework describes a three-stage process in the relationship between environmental quality and economic growth. The first stage reflects economic growth transitioning from an agriculture-based to an industrial and eventually post-industrial (service-based) economy. Environmental degradation tends to rise due to structural changes from rural to urban economies and from agriculture to mass industrial production and consumption growth. However, it begins to decline as the economic structure shifts from energy-intensive heavy industries to technology-based industries and services (Madsen & Strulik, 2025). In the early stages of industrialization, pollution increases rapidly as income becomes a higher priority than clean air and water, and societies are too impoverished to finance pollution control or enforce environmental regulations (Madsen & Strulik, 2025). At low-income levels, countries shift from agriculture to industry, which leads to increased pollution due to higher resource usage for expanding output. In contrast, in the high-income economies, the industry is being influenced more by the service sector, as the environment takes more importance, sustainability investments rise, technologies are more efficient, and the demand on environmentally friendly products grows (Madsen & Strulik, 2025). The curve at this point is an indication of the shift towards more sustainable industries with more efficient regulatory frameworks.

Although the EKC framework brings out the growth environment nexus, it lacks an explicit description of the institutional mechanisms that enable the transition. Financial systems in this aspect have a central role to play through mobilizing capital to cleaner technologies and sustainable investments. This observation links the EKC hypothesis with the financial intermediation theory that explains the potential of the financial development to impact economic and environmental results.

According to the financial intermediation theory, financial institutions play a significant role in transferring money saved or borrowed by savers to investors so that they can invest and allow the economy to operate smoothly (Gbadebo, 2024). An efficient financial system will lower transaction costs, information, and asymmetry that will increase capital allocation and result in growth. In addition, efficiency and access to financial services may be able to determine investment behavior, influence the creation of employment and the economic welfare in general.

Simultaneously, financial development is not neutral with regard to environmental effects. Increase in incomes and production can put a burden on the natural resources unless financial systems are in place to cater to environmentally responsible investment. As an example, green credit, ESG relevant lending or sustainability linked monetary products can direct the capital flows to cleaner technologies. There is also recent literature on how instruments of sustainable finance, e.g., green bonds or ESG screening, are increasingly becoming institutionalized in institutional investment policy, as a signal of a sustainability shift in financial intermediation (Khan & Vismara, 2025; Loiola et al., 2025).

Although the literature on the role of finance in either economic growth or environmental outcomes has been extensive, few studies examine the combined influence of financial development and sustainability within a dynamic empirical framework. The proposed study addresses this gap by analysing how financial institutions and markets affect sustainable development outcomes, measured through ESG performance, while controlling

trade and investment processes. Dynamic panel techniques offer deeper insights into the effects of time and causality, contributing to a more comprehensive understanding of sustainable finance. This approach provides both policy implications and theoretical contributions at the intersection of finance and sustainability.

METHODS

The dynamic panel data analysis that is applied in this research becomes the use of dynamic adjustment method, which is suitable in models that include time-dependent relationship. The use of lagged dependent variable among the predictors implies to the dynamic relationship. The baseline formulation for dynamic panel analysis is given by the following model:

$$y_{it} = \delta y_{i,t-1} + X'_{it}\beta + \mu_{it}; i=1, \dots, N; t=1, \dots, T$$

Here, δ represents a scalar, X'_{it} is a $1 \times K$ matrix of explanatory variables, and β is a $K \times 1$ coefficient vector. The error term μ_{it} is assumed to follow a one-way error component structure:

$$u_{it} = \mu_i + v_{it}$$

where $\mu_i \sim iid(0, \sigma_\mu^2)$ captures the individual-specific effects, and $v_i \sim iid(0, \sigma_v^2)$ denotes idiosyncratic disturbances, which are uncorrelated across time, a condition also referred to as a transient error component.

In static panel data models, estimators such as fixed effects (FEM) and random effects (REM) can provide consistent and efficient results depending on the treatment of μ_i . However, in dynamic models, the situation is fundamentally different. Because y_{it} is a function of μ_i , so is $y_{i,t-1}$. Since μ_i is also part of the error term μ_{it} , the regressor $y_{i,t-1}$ becomes correlated with the composite error term, causing standard estimators like least squares to be biased and inconsistent.

Assuming an autoregressive process of order one, AR(1), with unobserved individual-specific effects, and $|\alpha| < 1$, the standard error component structure is defined such that $E(\eta_i) = 0, E(\varepsilon_{it}) = 0, ,$ and no autocorrelation exists across time in the idiosyncratic component, i.e., $E(\varepsilon_{it}\varepsilon_{is}) = 0$ for $t \neq s$. The initial condition is assumed to be predetermined, implying $E(y_{i1}\varepsilon_{it}) = 0$ for $t \geq 2$. These assumptions yield approximately $m=0.5(T-1)(T-2)$ moment conditions.

$$E(y_{i,t-s} \cdot \varepsilon_{it}) = 0 \text{ for } t = 3, \dots, T \text{ and } s \geq 2$$

This can be expressed in matrix form as:

$$Z_i = \begin{bmatrix} y_{i1} & 0 & \dots & 0 \\ 0 & y_{i1} & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & y_{i,t-2} \end{bmatrix} \text{ and } \Delta y_{i1} = (y_{i3} - y_{i2}, \dots, y_{iT} - y_{i,T-1})'$$

This forms the basis for the generalized method of moments (GMM) framework using lagged values of the dependent variable as instruments, commonly referred to as first-differenced GMM (FD-GMM). This estimator is consistent when the cross-sectional dimension (N) exceeds the time dimension (T) substantially.

Nevertheless, FD-GMM has limitations, particularly when the lagged differences are weak instruments due to the high correlation between first-differenced lagged values. This issue, as noted by Blundell & Bond, can lead to downward-biased estimates that sometimes more severe than those from fixed effects models when T is small. To address this, the use of both levels and lagged differences of regressors as instruments, as implemented in the system GMM (SYS-GMM) estimator, can substantially improve the estimator's performance.

In practice, these limitations can be diagnosed by contrasting the lagged dependent variable coefficients across pooled OLS, fixed effects, and FD-GMM estimates. For a dynamic panel with AR(1) structure, the coefficient from pooled OLS tends to be upward biased, while the fixed effects estimator tends to be downward biased. A consistent estimate is typically found between these two.

The quantitative approach taken in this research is the dynamic panel data estimation with SYS-GMM. The quantitative results and how they are relevant to the economic policy are also interpreted through the use of complementary qualitative descriptive analysis. The Arellano-Bond approach that is furthered to SYS-GMM is most appropriated when the panel has a low number of time periods and high number of cross-sectional units, which is the situation in this research, as it covers several years and a great number of nations. This study adopts the approach proposed by Ng et al. (2020), wherein there is a linear relationship between financial development and sustainable development based on a fixed panel model, as shown below:

$$ESG_{it} = \alpha_0 + \alpha_1 FIND_{it} + \alpha_2 \ln GDP_{it} + \alpha_3 Trade_{it} + \alpha_4 FDI_{it} + \mu_{it} \dots (1)$$

The analysis begins with ordinary least squares (OLS) and fixed effects models as the baseline. In addition, a two-stage least squares (2SLS) framework is employed to address potential endogeneity and simultaneity

issues. If not properly accounted for, these issues may lead to biased and inconsistent statistical estimates. This study adopts the SYS-GMM framework of Blundell & Bond and applies a natural logarithmic transformation as per Juanda (2009). Sustainable development is modelled using the following dynamic panel specification:

$$ESG_{it} = \beta_0 + \beta_1 ESG_{it-1} + \beta_2 FIND_{it} + \beta_3 \ln GDP_{it} + \beta_4 Trade_{it} + \beta_5 FDI_{it} + \mu_{it} \quad \dots (2)$$

$$ESG_{it} = \gamma_0 + \gamma_1 ESG_{it-1} + \gamma_2 FINI_{it} + \gamma_3 \ln GDP_{it} + \gamma_4 Trade_{it} + \gamma_5 FDI_{it} + \mu_{it} \quad \dots (3)$$

$$ESG_{it} = \theta_0 + \theta_1 ESG_{it-1} + \theta_2 FINM_{it} + \theta_3 \ln GDP_{it} + \theta_4 Trade_{it} + \theta_5 FDI_{it} + \mu_{it} \quad \dots (4)$$

The model specification is defined as follow: \ln denotes the natural logarithm, μ_{it} represents the error term, where i refers to the 56 countries in the sample and t denotes the time period spanning from 2016 to 2023. The notation $it - 1$ indicates the first-order lag of the variable. The parameter $\alpha_0, \beta_0, \gamma_0, \theta_0$ represent the intercept, while $\alpha_n, \beta_n, \gamma_n, \theta_n$ are the regression coefficients associated with the explanatory variables, namely sustainable development, financial development, financial institution development, financial market development, economic development, trade openness, and foreign capital formation.

The study of Acheampong (2018), Cao et al. (2023), Qurat-ul-Ain & Maqsood (2024) show that dynamic panel models have been widely used to address endogeneity and omitted variable bias. As time series models gained popularity, dynamic specifications incorporating lagged dependent variables were introduced into panel models. However, estimating such models using traditional fixed or random effects methods leads to biased and inconsistent estimates (Barros et al., 2020). To address this issue, several researches use the GMM approach, which is particularly advantageous as it accommodates serial correlation and heteroskedasticity, thus enhancing efficiency (Alatawi et al., 2025).

The interactions with the sustainable development index and using the panel data techniques assist in defining the relationship between financial and sustainable development that is determined in this paper. Given that sustainable development is dynamic and there might be a two-way effect between financial development and the sustainability outcome, SYS-GMM estimator can be used in order to address the potential area of endogeneity as caused by the reverse causality and omitted variables of all the explanatory variables. Compared to the conventional panel estimators (fixed effects or random effects models), SYS-GMM manages to take advantage of unobserved heterogeneity, in addition to using internal instruments to produce consistent estimations in the presence of endogenous regressors (Alatawi et al., 2025). Moreover, the dynamic specification and appropriate lag structures are utilized in order to decrease the autocorrelation and heteroskedasticity and the usual diagnostic tests in order to test the instrument validity and serial correlation. This approach is more liberated in addition to minimizing the risks of overlooked variable bias (Alatawi et al., 2025), which justifies the influence of country-specific effects that are not controlled and improves the effectiveness of the estimates of the coefficients.

This paper uses secondary dynamic panel data (2016-23) with reliable annual information at the global level. The sample includes 56 countries, comprising both developed and developing economies, chosen to ensure enough diversity in financial development and sustainability characteristics while also providing sufficient data on key variables. Countries were selected if they had comprehensive reports on financial development variables and sustainability indicators at the time of the study, thereby reducing the risk of bias due to significant data gaps. The data was sourced from reputable agencies such as the World Bank, the International Monetary Fund (IMF), and Bloomberg Terminal.

The descriptive practices are mixed as the qualitative and quantitative methods are used in analysis. The quantitative analysis will be performed using the secondary data that will be collected within the said institutions and the qualitative analysis will be performed using supporting literature in terms of context and comparison that will be condensed to textbooks, academic publication, previous studies, and other sources. Table 1 presents the information about variables and sources of the variables.

Table 1 Summary of Variables and Data Sources

Variable	Symbol	Indicator	Unit	Source
Sustainable Development	ESG	Sustainability Index	Index (Scale 1–10)	Bloomberg
Financial Development	FIND	Financial Development Index	Index (Scale 0–1)	IMF
Financial Institution Development	FINI	Financial Institution Index	Index (Scale 0–1)	IMF
Financial Market Development	FINM	Financial Market Index	Index (Scale 0–1)	IMF
Economic Development	GDP	Gross Domestic Product (GDP)	USD per Capita (constant 2015)	WDI
Trade Openness	Trade	Trade-to-GDP Ratio	Percent	WDI
Foreign Capital Formation	FDI	Net Inflows of Foreign Direct Investment (FDI)	Percent	WDI

Source: Processed by the authors

RESULT AND DISCUSSION

The data used in this study first needs to be analysed descriptively before further analysis is done. Descriptive analysis gives general statistics of the data in terms of mean, minimum, maximum, and standard deviation. Table 2 shows the statistical characteristics of each variable that will be used in this study.

Table 2 Statistical Description

Variable	Mean	SD	Minimum	Maximum
ESG	2.66	0.69	1.12	4.80
FIND	0.56	0.20	0.18	0.96
FINI	0.59	0.19	0.24	0.96
FINM	0.52	0.24	0.04	0.91
GDP	28164	24.08	1678	104492
TRADE	93.90	56.01	24.49	338.74
FDI	2.96	7.67	-14.52	41.72

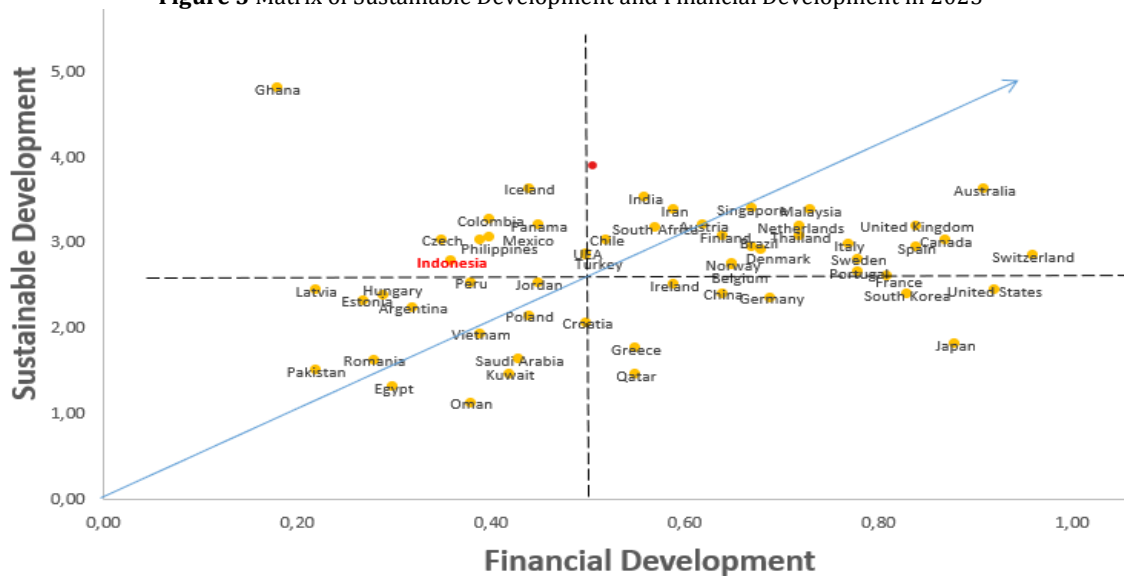
Source: Processed by the authors

The statistical details of each variable are shown in Table 2. The ESG score has an average of 2.55, with a range from 1.12 to 4.80, indicating a moderate level of sustainable development performance across the countries. The indicators of financial development include the financial development index (FIND), which has an average of 0.56, suggesting a fairly developed financial system in most countries, although some lag significantly. The similar mean values of its two components, financial institutions (FINI) and financial markets (FINM), at 0.59 and 0.52 respectively, alongside notable variation, reflect diverse institutional capacities and market structures.

The samples vary significantly in GDP per capita, from USD 1,678 to USD 104,492, with an average income of USD 28,164, highlighting substantial income inequality across the countries. The average trade openness is 93.90 percent of GDP, suggesting most countries are embedded in the global economy, though with notable differences. FDI inflows show the greatest variability, averaging 2.96 percent with a range from -14.52 to 41.72, reflecting diverse experiences with foreign investment dynamics.

These statistics reveal the economic and financial diversity among the sampled countries, highlighting the need for panel methods to account for structural and institutional differences in analysis. Figure 3 presents a scatter plot of ESG scores versus financial development (FIND), illustrating cross-country variation across 56 nations. The data display four main patterns: countries like Australia, Canada, and the United Kingdom excel in both financial development and ESG performance, whereas others such as Pakistan and Egypt are behind in both aspects. Interestingly, countries like Ghana attain high ESG scores despite having weak financial systems, while nations like Japan and South Korea show strong financial development but lower sustainability scores. This scatter suggests that financial growth alone may not always lead to better environments and social outcomes, and that appropriate institutional and policy contexts are vital.

Figure 3 Matrix of Sustainable Development and Financial Development in 2023



Source: Processed by the authors

Also, Figure 3 shows a linear trend line indicating that, in general, there is a positive relationship between financial development and sustainable development, but the picture does not illustrate this relationship in most countries, and a sharp deviation is observed in several nations. Although high financial development countries tend to have high ESG performance, there are a few outliers, such as countries with high ESG but low

financial development like Indonesia and Ghana, and countries with good financial development but low ESG performance like Japan and Qatar. This suggests that financial progress alone cannot guarantee the achievement of sustainability outcomes. These observations highlight the importance of policy-making, the quality of institutions, and non-financial drivers in shaping a country's sustainability pathway, which cannot be determined solely through financial indicators.

Correlation analysis is conducted to examine the linear relationship among the variables used in this study. Table 3 below provides a summary of the results.

Table 3 The Correlation Analysis Results

	ESG	FIND	GDP	TRADE	FDI
ESG	1.00				
FIND	0.19	1.00			
GDP	0.04	0.64***	1.00		
TRADE	0.05	0.02	0.34**	1.00	
FDI	0.12	-0.05	-0.03	0.28**	1.00

*, **, *** indicate significance at the 10%, 5%, 1% respectively.

Source: Processed by the authors

The correlation coefficients between ESG scores and financial development index (FIND) and Financial Institutions Index (FINI) are 0.19 and 0.19 respectively that are satisfactorily low and positive respectively. This implies that the better the financial development and financial institutions in a country, the more developed the ESG governance in the country is, but the relationship is not strong. Previous research by Giese et al. (2019) and Zhang et al. (2020) suggests that though the ESG governance can have no significant effect on financial institutions or the financial sector, there is a positive correlation that assists in the creation of more transparent, efficient, and inclusive financial systems.

Moreover, there is a substantial variance of ESG scores with financial market development (FINM), GDP per capita (GDP), trade openness (TRADE) and foreign direct investment inflows (FDI), at 0.13, 0.04, 0.05, and 0.11, respectively. These findings explain that there are no or few direct correlations between ESG scores and these variables. This is in line with other researchers like Faruq et al. (2025), who observed that the correlation of ESG with macroeconomic variables like FDI and GDP per capita is usually low. The same findings were made by Angelidis et al. (2024) who concluded that though stable firms have a strong governance, the impact of ESG on the macroeconomic factors such as GDP per capita or trade openness is not that significant. Angelidis et al. (2024) emphasized also that the relationship between ESG and such economic factors is usually in the direct direction and weak.

There is a robust positive correlation (0.92) between FINI and the overall financial development index (FIND), indicating that improvements in one component are closely accompanied by advancements in the other. Similarly, the correlation between FIND and FINM is also high, at 0.93, suggesting that the development of financial institutions and markets often progress concurrently in most countries. Additionally, FINI and FINM share a correlation of 0.74, indicating that countries with more developed financial institutions also tend to have more advanced financial markets, though this relationship is slightly weaker than their individual correlations with FIND. Overall, these findings are consistent with the work of Azmeh & Al-Raei (2025) and Struthmann (2025), who concluded that financial development variables are interrelated and mutually reinforcing in building a robust and efficient financial system.

There is a moderately strong and statistically significant correlation in the GDP per capita and FIND and the coefficient of the relationship is 0.6388. This implies that the more economically productive the countries, the more developed the financial systems are. Similarly, the GDP is correlated with FINI (0.5799) and FINM (0.6064), meaning that the more developed countries have to have the more developed financial institutions and markets. Nevertheless, these correlations are not as strong as correlation between financial variables themselves, which seems to imply that as much as GDP is relevant, the financial variables correlate with each other much better than with GDP.

The positive relationship between the GDP per capita and the development of the financial sector is also supported by previous research. According to Adegunle & Ayeni (2023) and Mlambo (2024), the development of the financial sector leads to investment, the development of the real sector and efficiency in resource allocation, which further promote the economic growth in the long term. There are, however, studies which have reported that the benefit of such relationship can depend on the country context and the current degree of financial sector development (Osei & Kim, 2023; Siddiki & Bala-Keffi, 2024).

The correlation between trade openness (TRADE) and GDP in this paper is 0.3437 which means that the relationship is moderate and positive. This is an indication that the more open-economies are the higher the level of GDP will be. Onafowora & Owoye (2024), confirm this finding as they noted that trade openness is more apt to benefit economic growth and its efficacy may be limited in those countries with poor institutions or unfriendly economic policies.

The same trend can be observed in the correlation between FDI and TRADE which is 0.2803. Although the correlation is positive, it is quite weak, that means trade openness alone cannot be a strong predictor of FDI

inflows. Diallo (2024) came to the conclusion that however, trade liberalization may help bring about FDI, its impact is small unless the domestic conditions are in place.

FDI, conversely, has a very low or insignificant correlation with most of the other financial and economic variables in this dataset. This finding is consistent with Haque et al. (2022), that concluded that although FDI inflows may have a positive impact on the growth, there is a weak direct correlation between them and the development of a domestic financial sector. Effects of FDI are more reliant on the domestic policies, the quality of the institution and the organization of the financial markets in the country. A section below provides the aggregate scores and the indicators that are corresponding to them as is presented in Table 4.

Table 4 Financial Development for Sustainable Development Performance

Indicator	OLS		Fixed Effects		2SLS		Sys GMM	
	Coef	t-value	Coef	t-value	Coef	t-value	Coef	t-value
Constant	0.58 (0.18)	3.14***	0.77 (3.45)	0.23	1.60 (0.34)	4.72***	4.74 (1.34)	3.52***
ESG _{t-1}	0.78 (0.06)	12.84***	0.37 (0.06)	6.15***	0.18 (0.09)	1.84	0.03 (0.29)	0.11
FIND	-0.63 (0.23)	-2.67**	-0.88 (0.26)	-3,38***	0.30 (0.06)	4.63***	0.93 (0.53)	1.74
GDP	0.13 (0.37)	0.36	0.58 (0.41)	1.41	-0.08 (0.03)	-2.89***	-0.52 (0.15)	-3.40***
TRADE	-0.23 (0.16)	-1.38	-0.38 (0.18)	-2.13**	0.09 (0.04)	1.99**	0.49 (0.17)	2.83***
FDI	-0.16 (0.02)	-0.80	-0.02 (0.02)	-0.86	0.04 (0.03)	1.37	0.02 (0.14)	0.17
Time effect		Yes		Yes		Yes		Yes
R ²		0.50		0.50		0.22		
Sargan-Hansen stat.								0.98
AR(2)								0.82
# of countries		50		50		44		44
# of observations		257		257		202		202

Note: *, **, *** indicate significance at the 10%, 5%, 1% respectively. Brackets are standard errors

Source: Processed by the authors

The regression results can be linked to the financial sector's role in fostering financial development to achieve sustainable growth. This is particularly relevant to the sector's contribution to sustainability, economic progress, and development. The following paragraphs offer a detailed explanation of each variable and its relevance in this context.

Statistical tests indicate that ESG has a strong positive impact on sustainable development, particularly in the OLS and fixed-effects models. ESG demonstrates that sound environmental, social, and governance practices are essential for long-term economic sustainability. From an economic development perspective, a high ESG score signals investment in human capital, institutional quality, and social welfare, leading to more resilient and inclusive growth. This observation is in line with the financial intermediation framework, according to which strong ESG practices help increase risk management, improve resource allocation, and reduce information asymmetries, thereby helping the financial sector direct capital to productive and sustainable operations.

Further, it is arguable that ESG-oriented financial systems are capable of decoupling economic growth and environmental degradation, according to the environmental Kuznets curve (EKC) hypothesis, since they encourage fewer polluting technologies and more socially responsible behavior by companies. This finding can be compared to the previous research by Chen et al., (2023) and Lin (2024) which highlight that ESG factors are not only important to allow firms to cope with the social and environmental factors, but also to promote the more stable and sustainable economic growth through improved risk management and resource efficiency.

Sustainable finance can be improved by more awareness and integration of ESG principles into financial systems; this is an investment decision that considers the environmental and social factors (Berg et al., 2022). It is also quite applicable in regards to the realization of the sustainable development goals (SDGs), since the sustainability of the financial sector allows financing these environmentally friendly projects, enhances social equity, and improves the governance.

The outcome of the regression indicates that there is a positive effect of financial development in both the 2SLS and System GMM models, with positive coefficients of financial development in these regressions. Conversely, the regression has shown a negative relationship in the OLS and fixed effects models. The positive coefficients in both the 2SLS and System GMM models clearly suggest that, in the long term and when potential endogeneity is accounted for, financial development does support sustainable development. The negative results observed in the OLS and fixed effects models imply that simple analyses may fail to capture the dynamic

nature or real-world relationship between financial development and sustainable development, potentially due to model bias.

One of the roles played in facilitating distribution of resources towards practices that facilitate sustainable development is the financial sector development. This is aligned to the previous studies which prove the financial intermediation theory and the economic development model (Ibrahim et al., 2024; Turhan et al., 2023). Properly performing financial systems can make the process of capital allocation more efficient by mobilizing savings, lowering transaction costs, and making it easier to diversify risk and, therefore, make finance more available to both households and businesses. These mechanisms within the economic development perspective help to promote productive investment, generation of jobs and enhanced standards of living, which are key elements of inclusive growth. Besides, according to the hypothesis of the environmental Kuznets curve (EKC), financial development may lead to the greater economic activity in the beginning but then the further enhancement of the environmental results as financial resources may be directed to cleaner technologies, environmentally oriented projects, and sustainable business operations. These interrelated channels show that taking into account the endogeneity and dynamic effects, financial development can enhance access to sustainable finance that is significant in promoting long-term economic development, particularly in developing economies. Qurat-ul-Ain & Maqsood (2024) confirm the importance of financial development in promoting economic growth and social sustainability in the long-term, and the fact that more sophisticated estimation methods, such as Sys-GMM, generate more consistent results in terms of identifying causal relationships.

The poor performances in both OLS and fixed effects could indicate that, in the absence of dynamics and endogeneity, the development of the financial sector continues to encounter difficulties in terms of unequal access to funding or inefficient distributions of funds, as was the case in previous studies done by Cao et al. (2023). It is therefore imperative that more advanced estimation techniques, e.g., 2SLS or System GMM, be used to take these factors into consideration.

The effect of GDP in the 2SLS and System GMM model is much negative. This observation aligns with the results of Hickel & Kallis (2020), which claimed that economic growth that has aimed at increasing the GDP at the cost of the environmental sustainability will harm the latter, particularly in the long run. Likewise, Acheampong (2018), based on a Sys-GMM model concluded that an increased level of GDP can adversely affect economic and social sustainability in the absence of relevant policies. In the view of the environmental Kuznets curve (EKC) hypothesis, this outcome provides the possibility that economies can stay in the upward sloping section of the curve where economic growth increases environmental pressure to a point where it turns. This is an example of diminishing returns, where economic growth does not necessarily lead to improved results of sustainable development (Hickel, 2020).

The economic imbalances can be caused by financial development that nurtures and grows the GDP without any sustainability concerns (Dikau & Volz, 2021). Consequently, the financial industry needs to endorse comprehensive and sustainable development that will mean that economic growth should not be limited to numerical values but environmental sustainability and social well being.

The international trade has both positive and negative outcomes with the 2SLS and the system GMM models showing a positive relationship. This inconsistency indicates the difference between those models which consider endogeneity and models that do not. This is not an exceptional case, and more advanced models (e.g., 2SLS and System GMM) are in a better position to consider endogeneity and latent variables bias, making their estimates more precise (Qurat-ul-Ain & Maqsood, 2024). These findings indicate that trade may have a sustainable development as long as it is backed by proper policies. Economically, when properly managed international trade can strengthen resource allocation, productivity and increase income and thus sustain economic development. Nevertheless, again in line with the hypothesis of the environmental Kuznets curve (EKC), growth due to trade can also contribute to further environmental pressures where it lacks proper regulatory and institutional frameworks.

In this respect, the financial intermediation structure highlights how the process of financial development would facilitate sustainable international trade by encouraging the investment in green technologies, low-carbon commerce, and environmentally friendly business operations. The financial sector is crucial towards enabling access to finance in sustainable trade projects. Chen et al. (2026) studies emphasize the importance of the financial sector in facilitating the access to the funding of numerous economic activities, such as trade, thus, leading to a more inclusive and sustainable development.

FDI yields weaker and statistically insignificant results across all models, although they appear slightly positive in the 2SLS and System GMM models. This is common, as more advanced models are better at correcting endogeneity and bias caused by hidden variables often found in simpler estimation methods. Economically, this suggests that FDI-led growth may not always lead to gains in sustainability, particularly when investment flows are concentrated in sectors with low value added to the environment or social welfare. In line with the Environmental Kuznets Curve (EKC) hypothesis, FDI might initially support environmentally intensive production structures and later foster improvements in sustainability.

Although FDI may be a critical contributor to sustainable development, in the context of financial intermediation, its non-significance indicates that more policies should be implemented so as to guide foreign investments into such areas that promote sustainability, which include renewable energy, green infrastructure, and inclusive economic development. In the report published by Unctad (2023) the significance of proper policy in driving FDI to SDG-compatible areas is highlighted, as it is noted that although FDI can facilitate economic development, its systemic positive effect is linked to the ability to match investment flows and the sustainability agenda.

Based on the above interpretations, financial development (FIND) is very important for achieving sustainable development. A strong financial sector increases the resources required for long-term investments in the sectors that sustainability supports. Both the 2SLS and System GMM models confirm that sound financial development can enhance sustainable development, accounting for endogeneity and dynamic effects. Nevertheless, the financial sector should pay more attention to facilitating investments that balance social, environmental, and economic factors, and abandon growth models based on GDP growth at the expense of long-term sustainability.

When analyzing the relationship between financial institutional development and sustainable development, the outcomes of regression as shown in Table 5 have shown different results depending on the different models.

Table 5 Development of Financial Institutions for Sustainable Development

Indicator	OLS		Fixed Effects		2SLS		Sys GMM	
	Coef	t-value	Coef	t-value	Coef	t-value	Coef	t-value
Constant	0.54 (0.17)	3.11***	0.55 (3.64)	0.15	1.48 (0.30)	4.83***	2.33 (0.51)	4.58***
ESG _{t-1}	0.78 (0.06)	12.93***	0.40 (0.06)	6.43***	0.21 (0.09)	2.18**	0.36 (0.15)	2.43**
FINI	-0.06 (0.05)	-1.06	-0.10 (0.06)	-1.65*	0.33 (0.06)	5.21***	0.20 (0.18)	1.10
GDP	0.16 (0.37)	0.44	0.67 (0.43)	1.56	-0.07 (0.02)	-2.78***	-0.27 (0.05)	-4.56***
TRADE	-0.26 (0.16)	-1.60	-0.40 (0.18)	-2.18**	0.09 (0.04)	1.92*	0.33 (0.09)	3.53***
FDI	-0.01 (0.02)	-0.84	-0.02 (0.02)	-1.19	0.03 (0.02)	1.27	-0.03 0.07	-0.46
Time effect		Yes		Yes		Yes		Yes
R ²		0.75		0.45		0.24		
Sargan-Hansen stat.								0.27
AR(2)								0.26
# of countries				50				44
# of observations		257		257		202		202

Note: *, **, *** indicate significance at the 10%, 5%, 1% respectively. Brackets are standard errors

Source: Processed by the authors

The coefficient for financial institutions in the OLS model is -0.06, with a t-value of -1.06, indicating a negative but non-significant relationship. This suggests that the effect of financial institutions on sustainable development is not statistically significant. The same is reflected in the Fixed Effects model, where the coefficient is -0.10 and the t-value is -1.65, which is not significant enough to be considered statistically meaningful. This implies that these financial institutions may not be able to promote sustainability, as they have not yet adopted sustainability principles. However, the 2SLS model presents a different outcome, with a coefficient of 0.33 and a t-value of 5.21, indicating a significant positive relationship when endogeneity is addressed. This highlights that well-established financial institutions can play a key role in promoting sustainable outcomes, especially through green financing or providing financial services to all. Meanwhile, the System GMM model shows a positive coefficient of 0.20 and a t-value of 1.10, indicating a moderate yet statistically insignificant impact in the dynamic context. Nonetheless, it supports the idea that financial institutions may contribute to sustainable development over the long term by improving access to financial services. The regression analysis presented in Table 6 indicates that financial market development has a significant, though complex, correlation with sustainable development.

When the financial market variable is included in the OLS model, its coefficient (-0.15) is negative but not statistically significant in the short run, with a t-value of -1.90. The Fixed Effects model, however, indicates a stronger negative relationship, with a coefficient of -0.21 and a t-value of -2.22, which is statistically significant, suggesting that, in the long run, country-specific factors may hinder sustainable development in financial markets. Meanwhile, the 2SLS model shows a positive coefficient of 0.06 with a t-value of 1.77, hinting at a potential positive effect when considering endogeneity, but this result is not statistically significant. Lastly, the System GMM model presents a notable positive coefficient of 0.64 with a t-value of 2.32, implying that,

accounting for the dynamic relationship and endogeneity, financial market development could positively influence sustainable development outcomes.

Table 6 Financial market development for sustainable development

Indicator	OLS		Fixed Effects		2SLS		Sys GMM	
	Coef	t-value	Coef	t-value	Coef	t-value	Coef	t-value
Constant	0.35 (0.14)	2.35**	0.34 (3.58)	0.10	0.76 (0.28)	2.65***	0.99 (1.20)	0.83
ESG _{t-1}	0.79 (0.06)	13.01***	0.40 (0.06)	6.35***	0.18 (0.10)	1.80*	0.09 (0.24)	0.38
FINM	-0.15 (0.84)	-1.90	-0.21 (0.09)	-2.22**	0.06 (0.03)	1.77*	0.64 (0.27)	2.32**
GDP	0.19 (0.37)	0.53	0.68 (0.42)	1.60	-0.00 (0.02)	-0.39	-0.39 (0.11)	-3.49***
TRADE	-0.22 (0.16)	-1.34	-0.31 (0.18)	-1.99**	0.007 (0.05)	1.55	0.98 (0.32)	3.05***
FDI	-0.01 (0.02)	-0.93	-0.02 (0.02)	-1.11	0.02 (0.03)	0.91	0.25 (0.17)	1.46
Time effect		Yes		Yes		Yes		Yes
R ²		0.75		0.47		0.15		
Sargan-Hansen stat.								0.74
AR(2)								0.96
# of countries				50				44
# of observations		257		257		202		202

Note: *, **, *** indicate significance at the 10%, 5%, 1% respectively.

Source: Processed by the authors

Brackets are standard errors

Considering that this is a cross-country study, the results can be viewed in terms of heterogeneity in institutional quality, development levels, and financial system maturity. Financial development in developed economies, driven by greater depth of financial markets and improved governance, can better support ESG-oriented, sustainable investment and business practices. Conversely, in developing and emerging economies, institutional constraints, lower financial inclusion, and weaker regulatory frameworks may limit financial development and its sustainability impacts. These outcomes show that financial development alone is not enough. Institutional readiness and policy alignment are crucial in contributing to sustainable development, highlighting the importance of country-specific sustainable finance strategies rather than standardised policies.

CONCLUSION

Based on the analysis and findings, it is concluded that ESG factors positively influence short-term outcomes, but they require stronger policies to be effective in the long term. Traditional financial systems may hinder ESG performance, yet with proper regulatory guidance, they can support sustainability. The results clarify why regulators in Indonesia, particularly Bank of Indonesia (BI) and the Financial Services Authority (OJK), need to develop financial policies that go beyond traditional growth indicators and embed ESG principles. To align the country's financial development goals with sustainability objectives, it is essential to channel capital flows through targeted green finance instruments.

Furthermore, economic growth often conflicts with ESG goals, highlighting the necessity of finding approaches that help balance economic growth with environmental and social goals. International trade can enhance ESG outcomes, provided robust green trade policies underpin it. Conversely, FDI has not produced a statistically significant effect on ESG performance, implying that investment flows should be more predictive of sectors aligned with the aim of sustainable development.

Governments should strengthen their ESG policies, offer incentives, engage in sustainable finance using tools like green bonds and environmental risk assessments in the lending process, and align economic development with green industries through tax breaks and carbon trading schemes. Additionally, international trade and FDI systems ought to incorporate ESG standards. This can be effectively achieved through cross-sectoral cooperation, robust monitoring mechanisms, and adherence to international guidelines.

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