



Environmental, Social, and Governance Drivers of Economic Growth: Investigating the Mediating Role of Human Capital in Developing Asia

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ARTICLE INFO

Article History:

Received: February 25, 2026

Revised: March 28, 2026

Accepted: March 29, 2026

Available Online: March 30, 2026

Keywords:

Environmental
Economic Growth
Developing Asia

Funding:

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ABSTRACT

In this study, we examine the impact of ESG factors on economic growth and investigate the mediating role of human capital in 22 developing Asian countries over the period 1996-2024. Using panel data, the study employs the System Generalized Method of Moments (SGMM) as the estimation technique. Environmental degradation, measured by CO2 emissions affects economic growth negatively. Conversely, human capital and institutional quality, proxied by the Human Capital Index and Rule of Law, exert positive and significant effect on economic growth. The results further show that the composite ESG index is positively correlated with economic growth. The positive interaction between ESG and human capital demonstrates that the growth-enhancing mediating effect of ESG factors is stronger in countries with higher levels of education, skills, and health. The findings also indicate that foreign direct investment and trade openness contribute to economic growth positively and significantly. Overall, the study concludes that sustainable economic growth requires an integrated development framework that combines ESG-oriented policies, institutional improvements, and, human capital development.

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1. Introduction

The acronym ESG captures a set of measurable activities related to the Environment, Social, and Governance of a country or an organization. ESG has three primary dimensions. First, the climate practice defines the environmental dimension and concerns policies and activities undertaken to mitigate climate change. Second, the social dimension analyzes the social dividends of the managerial practices of a firm or the government. Lastly, the governance practice analyzes the management of the firm and its overall governance. The ESG scores measure how countries perform at the environmental, social, and governance factors. The environment criteria may involve the government's environmentally friendly policies or steps to control environmental emissions. The social criteria represent the performance of governments to provide social benefits to the indigenous population. It includes the social contributions provided by the governments for the welfare of the people. The governance criteria evaluate the governance situation or how the country is being governed. The ESG pillars were introduced in 2004 to gauge governments' performance on environmental, social, and governance pillars. ESG performance is crucial in emerging market economies as it helps achieve sustainable growth.

The emergence of environmental issues, the greenhouse gas crisis, and the need for ecological diversity have given rise to environment-friendly investments. Better values of ESG indicators reduce country risks, enhance investor confidence, and mitigate macroeconomic fluctuation, thereby improving economic performance. This study examines the intersection between ESG performance, human capital and economic performance. The digital transformation initiative enhances environmental, social, and governance performance by elevating the skills of labor and producing high-quality human capital (He, Chen, & Zhu, 2025). Corporate ESG practices have evolved remarkably in China in recent years due to rational government initiatives, rising investor demand, and growing public awareness. The low information disclosure rate in Chinese businesses has been a significant problem in evaluating corporate ESG performance. To encourage vigorous ESG practices, the government of China has issued regulations and imposed some binding restrictions to disclose economy information. Tapscott and Tapscott (2016) believe that digital platforms augment stakeholder engagement by enhancing communication and getting feedback, which is vital for managing the social and governance landscapes of ESG. An economy having reasonable ESG enactment can provide better training, compensation, fringe benefits, and career development prospects. Motivated and high-quality labor raises an economy's corporate reputation. The findings suggest that ESG can heighten the efficiency of human capital investment in corporate sector.

The global attention towards ESG has accelerated concerning the relationship between economic growth and ESG factors. Given the increased environmental pressures, and the significant institutional voids within the region, it is crucial and timely to comprehend the impacts of ESG factors on economic growth within Asia. While most previous economic growth models focused primarily on the accumulation of capital, the increase of the labor force, and advancements in technology, it has become clear that such models need to integrate non-financial aspects, such as ESG factors, to ensure growth is sustainable and inclusive. These factors are critical in ensuring growth is inclusive and sustainable. The main objective of this study is to examine the impact of the ESG factors on economic growth. Our study is significant in the sense that most of the studies conducted deal with firm-level data, but we test this concept using macroeconomic data. Moreover, our empirical analysis incorporates the crucial role of human capita in the nexus between ESG and economic growth.

2. Literature Review

Some studies explored the effects of ESG factors individually on economic growth in the recent past. The panel data analysis has been used by (Huang, 2021). Luo and Tang (2014) explore that the economies and businesses that prioritize ESG factors face fewer regulatory challenges in achieving higher growth. Good governance can thus be viewed as a driver of economic performance. Diaye, Ho and Oueghlissi (2022) inspect the nexus between ESG enactment and economic development. A panel co-integration analysis for dataset on 29 OECD nations for the period 1996-2014 has been used. This study tries to create a distinction between short-run and long-run effects, but they find a long-term and unidirectional positive relation between ESG and GDP per capita, but it does not exist in the short-term connection. Only two countries benefited in the short run when allowing heterogeneity in the short-run. The ESG pillars were introduced in 2004 to gauge the performance of a country on environmental, social, and governance pillars for the better consciousness of all the stakeholders. The ESG performance of the economies is crucial in the developing economies as it influences for achieving sustainable growth by attracting investors and gaining reputation in the global market. In general, the BRICS and many other economies have achieved an intermediate level of ESG performance. As one of the World's most vibrant economic region, China is a prominent player in the global ESG market. Making some trend efforts to achieve the sustainable development, China has become the second largest green-bond market in the World. In a study by Irfan et al. (2022), it is examined that Japan has made significant improvement by reducing carbon emissions through material recycling by taking the data from 2005 to 2022. Due to the development of biomass energy and infrastructure, there is improvement through the research and development and result is statistically significant.

The study by Agustina et al, 2016 investigates the effect of ESG on how they can improve the economic performance. In this study the author used a data sample from two economies, including the Malaysia and Singapore for the period of 2010-14 data base of the data stream. In this study it was observed that the social and governance significantly impact the economic performance. The paper adds to the existing research on ESG (Environmental, Social, and Governance) practices and how they are related to economic performance. Digitalization and ESG performance is also an imperative factor in this regard. ESG and digitalization are two concepts that have received the interest of researchers and policy-makers over the past few years. Digitalization has changed the way business is done. Businesses need to focus on ESG to be able to compete successfully. ESG and digitalization relationship offers new business opportunities. Similar to Eccles, Lee and Strohle (2020), Khan and Liu (2023) mention that ESG and digitalization are relevant to each other. Digitalization is beneficial to ESG because it leads to the improvement of data collection and reporting, which increases the transparency of corporations. Conversely, good ESG performance has a positive influence on digitalization as it leads to the enhancement of stakeholder engagement and risk management (Henisz, Koller, & Nuttall, 2019). Digitalization helps in measuring and reporting ESG enactment.

According to Eccles, Lee and Strohle (2020), digitalization promotes accountability and transparency, which further enhance the enhancement of ESG disclosure. In the opinion of Henisz, Koller and Nuttall (2019), digitalization encourages innovation and creating sustainable products and services, which stimulates the growth of the company. A number of studies indicate the necessity to take into account ESG factors when planning the digitalization of corporations. The sustainable development goal can be achieved through the use of digitalization (Khan & Liu, 2023). According to Eccles, Lee and Strohle (2020), digitalization enhances social inequities, so, ESG should pay more attention to social aspects. Moreover, Bao, Jia and Xu (2023); Han et al. (2023); Tauseef Hassan et al. (2024); Zanjani, Soares and Macedo (2022) and Han et al. (2023). These studies have examined the individual impacts of ESG pillars on economic growth and found the favorable impact of ESG on economic growth. Xue and Chen (2025) considers A-share companies in agriculture and forestry in order to investigate the role of ESG on green development indicators like emission controls. The ESG performance has been found to be a strong predictor of green corporate performance. The impact of ESG is more common in those companies or countries that contain more trained human capital. The green finance also plays major role to improve environmental quality bringing green growth in an economy (Boukhris et al., 2025). Yue et al. (2021) tests the interlinkage of green finance, endowments of natural resources, environmental quality in Asian countries. Results indicate that the impact of green finance is that it improves the quality of the environment and growth in those areas where human capital and institutional capacity exists. This justifies the role of the interaction between the ESG and human-capital in economic performance.

2.1. Empirical methodology and data

The starting fact of the empirical methodology is the augmented Solow growth model, extended to incorporate ESG factors as core explanatory variables. The baseline functional form is specified as:

$$GDP_{it} = \alpha_i + \beta_1 ESG_{it} + \beta_2 HC_{it} + \beta_3 X_{it} + \varepsilon_{it}$$

Where:

- GDP_{it} = Economic growth proxied by real GDP per capita growth in a country i at time t
- ESG_{it} = Composite ESG index or sub-dimensions (Environmental, Social, and Governance scores)
- HC_{it} = Human capital index
- X_{it} = Vector of control variables (investment, trade openness, inflation, population growth, financial development, etc.)
- α_i = Country-specific fixed effects
- ε_{it} = Idiosyncratic error term

The expected sign of β_1 is positive, indicating that higher ESG performance contributes to long-term and sustainable growth through improved institutional quality, social inclusion, and environmental management. The data on 22 Asian developing economies including Armenia,

Azerbaijan, Bangladesh, Cambodia, China, India, Indonesia, Iran, Kazakhstan, Kyrgyzstan, LAO PDR, Malaysia, Nepal, Maldives, Pakistan, Philippines, Sri-Lanka, Tajikistan, Thailand, Turkey, Turkmenistan, Uzbekistan, and Viet Nam for the period 1996-2024. To assess the mediating role of human capital, the model follows a three-equation mediation structure (Hayes et al., 2025): Effect of both ESG and human capital on growth can be written as

$$GDP_{it} = \alpha_i + \delta_1 ESG_{it} + \delta_2 HC_{it} + \delta_3 X_{it} + u_{it}$$

The mediating effect of HC can be captured full by generating an interaction between ESG and human capital. Mediating *Effect* = ESG $\times$ HC

Hence, we can write above equation after including interaction as:

$$GDP_{it} = \alpha_i + \delta_1 ESG_{it} + \delta_2 HC_{it} + \delta_3 X_{it} + \gamma (ESG \times HC) + u_{it}$$

Where, real GDP per capita is used as a dependent variable. To keep concise, the three individual components of ESG are used, CO2 emissions, life expectancy, and law & order. Then, a composite ESG index of the individual variables has been constructed by using principal component analysis has also been considered in the estimation specifications. The notation X_{it} is a vector of control variables including gross fixed capital formation, trade openness and foreign direct investment. The notation i represents cross-section, and t denotes time. Considering endogeneity, and the possible dynamic feedback of ESG performance and growth, the analysis mainly relies upon the System-GMM approach. The GMM was introduced by Arellano and Bover (1995) and (Blundell & Bond, 1998). The System-GMM method is of particular importance for macro panel data with endogeneity in which explanatory variable(s) are correlated with the stochastic error term.

2.2. Empirical Results

The empirical results are presented in the following tables.

Table 1: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
GDP	667	7.808	.878	5.913	9.612
GFCF	623	3.224	0.304	1.84	4.055
LF	667	16.389	1.914	11.175	20.476
CO2	667	-0.329	.715	-2.312	1.477
HCI	667	2.214	.554	1	3
RL	575	-.591	.506	-1.648	.579
ESG	435	0	1.149	-3.326	2.555
ESG1	435	0	1.247	-3.285	2.61
Trade	648	4.214	.512	3.066	5.395
FDI	650	.736	1.23	-5.299	4.009
LIFE	667	4.243	.07	4.031	4.395

Table 2: System GMM (Baseline Regressions)

Variables	(1)	(2)	(3)	(4)
Lagged GDP	0.782*** (0.010)	0.729*** (0.046)	0.621*** (0.027)	0.911*** (0.014)
GFCF	0.268*** (0.016)	0.443*** (0.107)	0.328*** (0.038)	0.127*** (0.034)
LF	0.007 (0.006)	0.028 (0.028)	0.075*** (0.026)	-0.013** (0.006)
CO2		-0.509*** (0.097)		

HCI			0.907*** (0.202)	
RL				0.160*** (0.018)
Constant	0.714*** (0.099)	0.088 (0.550)	-1.366 (0.837)	0.592*** (0.055)
Observations	601	601	601	601
ABM.2 (p-value)	0.738	0.784	0.515	0.872
Hansen (p-value)	0.99	1.00	1.00	0.99

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10. Dependent Variable: Log Real GDP per Capita

These are the empirical results using system GMM. All variables are in log form except the indices.

Table 3: System GMM (Composite ESG index)

Variables	(1)	(2)
Lagged GDP	0.865*** (0.039)	0.742*** (0.032)
GFCF	0.134*** (0.047)	0.141*** (0.047)
LF	-0.016 (0.019)	-0.030 (0.021)
ESG	0.103*** (0.028)	
ESG1		0.162*** (0.025)
Constant	0.910*** (0.324)	2.102*** (0.507)
Observations	400	400
ABM2. (p-value)	0.536	0.615
Hansen (p-value)	0.99	0.71

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10. Dependent Variable: Log Real GDP per Capita

Table 4: System GMM (Mediating Role of Human Capital)

Variables	(1)	(2)	(3)	(4)	(5)
Lagged GDP	0.754*** (0.049)	0.608*** (0.042)	0.609*** (0.056)	0.711*** (0.0549)	0.699*** (0.059)
GFCF	0.122** (0.051)	0.035 (0.046)	0.025 (0.027)	-0.089 (0.0666)	0.063 (0.079)
LF	-0.018 (0.019)	-0.021 (0.021)	-0.056*** (0.021)	0.015 (0.0198)	-0.019** (0.009)
ESG	-0.108 (0.109)	-0.172 (0.117)	0.018 (0.055)	0.05 (0.0369)	-0.023 (0.038)
HC	0.227** (0.110)	3.824*** (0.775)	3.566*** (1.071)	3.48*** (1.11)	2.944*** (0.688)
Trade				0.171*** (0.037)	---
FDI				----	0.025** (0.010)
Interaction Term	0.083*** (0.025)	0.091** (0.044)	0.021 (0.014)	0.0116** (0.0051)	0.017* (0.009)
Constant	1.356*** (0.517)	-12.975*** (3.371)	-11.210** (4.461)	-13.25*** (4.475)	-10.007*** (2.864)
Observations	400	400	400	400	392
ABM.2 (p-value)	0.81	0.86	0.81	0.82	0.84
Hansen (p-value)	0.92	1.00	0.99	0.99	0.99

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Dependent Variable: Log Real GDP per Capita

2.3. Interpretations and Findings

Table 2 shows the System GMM estimation results show that the lagged endogenous variable is positively and significantly affects GDP thus supporting the notion that the countries converge towards equilibrium. Gross Fixed Capital Formation (GFCF) has been found to have a positive and

statistically significant impact on economic growth. Labor force does not work both ways so simply increasing labor quantity will never lead us out of recession without improving productivity & human capital as well. Environmental degradation, measured in terms of CO2 emissions, has a negative and significant effect on economic growth. On the other hand, HCI has a positive and statistically significant impact which highlights the importance of human capital such as health, education, and knowledge for sustainable economic growth. Institutional quality, measured by the Rule of Law is also positive and significant for economic growth showing that good governance, property rights protection and robust legal systems promote investments and efficient utilization of resources (Atiq-ur-Rehman et al., 2020). Moreover, international trade and FDI have a positive impact on economic growth due to the advantages of globalization, technological diffusion, and economic integration. To sum up, it can be stated that there are many factors which have contribute to economic growth of developing countries. These findings highlight a need for sustainable growth through social, ecological as well as organizational reforms to ensure holistic progress.

Table 3 shows that the lagged dependent variable is positive and highly significant in both regression models. Gross Fixed Capital Formation and labor are positively correlated with economic growth. It also demonstrates that the both composite ESG indices affect GDP growth positively and significantly. It indicates that an improvement in and governance performance leads to higher economic growth. The findings indicate that environmentally friendly policies lead to improved societal welfare as well as robust institutional structures which are conducive towards sustaining a vibrant economy through increased efficiency levels while simultaneously minimizing vulnerabilities associated with business operations thereby attracting more investments from both domestic sources along with foreign capital inflows too. Table 4 displays the System GMM results after incorporating mediation effect of human capital on the association between ESG performance and economic growth. Again, the lagged endogenous variables are positive and significant in each specification indicating robustness for a long-run trend that supports potential of an economy to converge under specific conditions. It shows how well-off people are today depends a lot on what they earned yesterday. Gross Fixed Capital Formation and labor force remain mostly insignificant. The human capital is found to be positive and significant. Trade liberalization and FDI boost economic growth through technological diffusion, market access, and liberalized financial flows. A positive coefficient on the interaction term between ESG and human emphasizes that how ESG accompanied by human capital facilitates economic expansion. The Diagnostic tests in regression models confirm that GMM instruments are valid and there is no higher order serial correlation present. In general, it is recommended that the Asian developing countries should invest more on people to achieve sustainable economic growth.

3. Conclusion

The ESG factors reflect how countries perform in the environmental, social, and governance domains. The ESG performance of a country is pivotal for its economic progress. This study explores the effect of ESG factors on economic growth by incorporating the mediating effect of human capital in 22 Asian developing countries for the period 1996-2024. The study uses panel data and the estimation technique applied is System Generalized Method of Moments. Economic growth is adversely influenced by environmental degradation measured CO2 emissions. The human capital and institutional quality measured by the Human Capital Index and Rule of Law have a positive and significant impact on economic growth. The results also indicate that there is a positive correlation between the composite ESG index and economic growth. The positive and significant relationship between ESG and human capital indicates that the mediating effect of ESG and human capital appears to be stronger in countries in which education, skills, and health are prioritized. The results further suggest that the openness of the economy and foreign direct investment are positive and significant for economic growth. In general, the study points out a need for an integrated mode of development both in the policy and institutional contexts, as well as in human capital development for achieving sustainable economic growth.

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