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THE ROLE OF ECONOMIC STRUCTURES AND POLICY DRIVERS IN SUSTAINABLE ECONOMIC GROWTH ACROSS EMERGING ECONOMIES

Sajjad Nawaz Khan*
Assistant Professor Department of Commerce & Economics, Emerson University Multan, Pakistan. Corresponding Author Email: Sajjad.nawaz@eum.edu.pk
Nadir Munir Hassan
Assistant Professor Department of Business and Public Administration, Emerson University, Multan, Pakistan. nadir.munir@eum.edu.pk
Dr. M Asghar Mughal
Assistant Professor. Management Sciences Department, Bahria University Karachi Campus. muhammadasghar.bukc@bahria.edu.pk
Mohsin Jamal
Lecturer Business Administration, NFC-Institute of Engineering and Technology, Multan. mohsinjamal1786786@gmail.com

Abstract

This study examines the interplay between economic structures and policy drivers in fostering sustainable economic growth across 20 emerging economies from 1991 to 2020. The Dynamic Common Correlated Effects (DCCE) estimation model analyzes the impacts of six key variables: agricultural value-added, industrial value-added, gross savings, energy transition index, quality of trade infrastructure, and human capital development. The findings reveal that each factor significantly contributes to sustainable economic growth in both the short and long term, emphasizing the critical role of modernization, infrastructure enhancement, and strategic policy interventions. The study highlights agriculture and industry as pivotal for economic diversification, while gross savings mitigate foreign debt reliance and bolster investments. Renewable energy adoption, trade infrastructure, and human capital development emerge as essential for economic resilience and innovation. By addressing methodological gaps in prior research, this work provides robust empirical evidence to guide policymakers in integrating structural reforms and sustainable practices, thereby balancing economic progress and environmental stewardship.

Keywords: Agricultural Value-Added, Industrial Value-Added, Gross Savings, Energy Transition Index, Human Capital Development, Sustainable Economic Growth

Introduction

Sustainable economic growth is a critical focus of global development, particularly in emerging economies that face the dual challenge of achieving economic progress while addressing environmental, social, and infrastructural deficits (McClean et al., 2021). Understanding the drivers and mechanisms underpinning sustainable growth has become essential as the global community progresses toward the United Nations Sustainable Development Goals (SDGs) (Lin & Zhou, 2022). Besides, agricultural structures, including agriculture and industry, are foundational pillars of any economy (Khan et al., 2022). The transition from subsistence farming to value-added agricultural practices can significantly boost GDP and create linkages with other sectors, fostering economic diversification (Wen et al., 2021). However, these benefits are often contingent on government policies and the level of agronomic transformation achieved (Haldar et al., 2023). Industrialization is vital to economic growth by enhancing productivity, creating jobs, and facilitating technological innovation (W. Fang et al., 2022). Gross savings represent the net income retained within an economy for investment purposes (M. Li, 2024). By bolstering domestic savings, emerging economies can reduce their reliance on foreign aid, improve capital accumulation, and finance critical infrastructure projects (Haldar et al., 2023).

Similarly, the energy transition index (ETI) represents a paradigm shift in addressing the energy-related challenges of economic growth (Balsalobre-Lorente et al., 2023). Renewable energy sources, measured through the ETI, are pivotal for reducing carbon footprints and promoting environmental sustainability (Saqib et al., 2023). Emerging economies, particularly those

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heavily reliant on fossil fuels, stand to gain significantly from transitioning to renewable energy—however, the high initial costs and infrastructural gaps associated with renewable energy adoption present significant hurdles (J. Fang et al., 2022).

Moreover, trade infrastructure quality is another essential component influencing economic growth. Efficient transport networks, modern ports, and streamlined border processes enhance trade competitiveness and reduce transaction costs (Sikder et al., 2022). Du et al. (2022) identify the pivotal role of trade infrastructure in fostering industrial development and facilitating regional integration. However, many emerging economies face physical and institutional infrastructure deficits, limiting their ability to leverage trade for sustainable growth (Zhao et al., 2022).

Furthermore, human capital development is the backbone of any economy's progress (H. Liu et al., 2022). Education, healthcare, and skill development investments enhance labour productivity, foster technological innovation, and reduce inequality (Zhou et al., 2018). However, disparities in access to education and healthcare and challenges like brain drain continue to hinder the full realization of human capital's potential in many developing nations (Yaqoob et al., 2023). The existing literature offers valuable insights into the individual impacts of various variables on economic growth; however, more comprehensive studies are needed to explore their interconnectedness within the framework of sustainable development. Most research tends to focus on isolated variables or specific regions, which creates a gap in understanding how these factors collectively influence sustainable economic growth in emerging economies. Additionally, the dynamic interplay between structural and policy-driven variables still needs to be explored, particularly in resource-constrained settings.

Moreover, methodological limitations in past research, such as insufficient consideration of cross-sectional dependencies and panel data heterogeneity, have hindered the reliability of findings. Integrating advanced

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econometric techniques, like Dynamic Common Correlated Effects (DCCE), presents an opportunity to address these methodological shortcomings and provide robust empirical evidence. This study aims to fill these gaps by employing a holistic approach that integrates multiple variables into a unified framework, focusing on their short-term and long-term effects on sustainable economic growth. By analyzing data from 20 emerging economies over 30 years, this research seeks to offer nuanced insights that can guide policy interventions and development strategies.

Objectives

- To examine the impact of economic structure factors on sustainable economic growth in emerging economies.
- To investigate the impact of policy drivers on sustainable economic growth in emerging economies.

Literature Review

Agriculture Value-Added and Sustainable Economic Growth

Value-added agriculture is the process that increases the value of primary agricultural products through manufacturing and marketing in the form of provided services (Mbotiji et al., 2023). This strategy will help to improve agricultural entrepreneurship and contribute to rural development through raising profits and market competitiveness (Mostefai, 2024). Etale et al. (2021) analyzed the contribution of agricultural value added to economic development in CEMAC economies between 1990 and 2020. The outcomes of the study indicated a positive association between agriculture value added and economic development. The study found that countries in the CEMAC sub region with better economic development tend to be those that have been more efficient in promoting agronomic transformation. The study also recommended policies that boost sustained economic growth and reduce poverty. According to Rita (2020), the study found that primary commodity production and exports contribute to growth in SSA, not value-added

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agriculture. It concluded that the effects of the agricultural sector on economic formation were more significant than those of non-agricultural sectors, which means that economic transformation was needed for developing countries.

Similarly, Ochada & Ogunniyi (2020) explored the effect of agricultural value added per worker on GDP per capita in the European Union. Linear co-integration and Granger causality tests were used to compare the role of agriculture in Southern and Northern EU countries. The study also found that agriculture drives growth and stabilizes and was even an engine of growth across economic crises. Awoyemi et al. (2017) studied the contribution of agriculture to poverty reduction, which was analyzed with regard to GDP per capita, agricultural added value, and some other variables. The results indicated that an increase in agricultural value increased individual wealth by 0.0594 of a thousand dollars, increased gross national saves by 0.185 thousand dollars and increased gross domestic product per capita and gross national saves.

Abdul & Awan (2015) investigated the influence of agricultural value-added and agricultural labour on Algeria's economic growth. The study used data from 1991 to 2022. The outcomes demonstrated a weak long-term impact ratio as well as a long-term impact on GDP only through a strong long-run effect on agricultural employment. The study stressed the significance of the agricultural sector diversification and government investment for sustainable development. Based on the above review of literature, the current study developed a hypothesis, which is mentioned below:

H1a: Agriculture Value added has substantial impact on Sustainable economic growth in short-run.

H1b: Agriculture Value added has substantial impact on Sustainable economic growth in long-run.

Industrial Value-Added and Sustainable Economic Growth

Industrial value added is the net output of an industry — that is, total revenue produced less the total cost of intermediate inputs — e.g. materials and labour

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(Lawrence, 2020). It results in the industry's share in the whole economy, which is accounted for by employee compensation, taxes on production, and gross operating surplus (Karami et al., 2019). According to Xu et al. (2023), Under business-financed R&D investment conditions, industrial value added has a greater impact on GDP growth in developed industrialized countries with high GDP per capita than in those with low GDP per capita. An industrialized country's economic development level affects the strength of the multiplier effect. The study implied that policymakers should aim to strengthen industry quality rather than drive up industry share in GDP. Wolde (2022) examined why industrial value-added has thus far played a minor role in the economies of low—and lower-middle-income countries. Using a literature review and panel data, the study identified key factors limiting industrial value added (IVA). Among the key elements are the levels of credit availability, net FDI, regulatory quality, political stability, exports, and GDP per capita. Finally, the research outcomes indicated policy implications, including increased manufacturing exports and GDP per capita income growth.

Bosco et al. (2022) investigated the impact of industrial value-added and firm foreign direct investment (FDI) on total factor productivity (TFP) and economic growth dynamics of 25 Sub-Saharan Africa (SSA) countries from 1980 to 2014. The results indicate that FDI and IVD positively impact GDP growth, GDP per capita, and real TFP but negatively impact real GDP and TFP. Significantly, value added to 3 economic sectors modifies FDI, with negative net effects on TFP and growth dynamics. Banelienė (2021) examined industrialization and its effects on economic growth in ten ECOWAS member states. It analyzed the relationship between fiscal policy, monetary policy, government spending, and GDP per capita. The results indicate that industrial value added positively promotes Nigeria's long-run economic growth. A flexible industrial and investment policy was advocated to enhance domestic production output and check inflation.

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Halkos et al. (2021) examined the effect of industrial value added on economic growth during deindustrialization in European economies. The associations between capital, force of labour, and technology with economic growth were examined. However, outcomes demonstrated that industrial value added, workforce and technology are associated positively with Provider performance, whereas results further reveal an inverse association with investment. The study recommended that policymakers should invest in increasing manufacturing productivity and employment to create job opportunities for sustainable, healthy, and competitive economic development. Based on the above review of literature, the current study developed a hypothesis, which is mentioned below:

H2a: Industrial Value added has substantial impact on Sustainable economic growth in short-run.

H2b: Industrial Value added has substantial impact on Sustainable economic growth in long-run.

Gross Savings and Sustainable Economic Growth

A key concept of gross savings in economic analysis measures how much the economy's savings, net of transfers, exceed consumers' income (Misztal, 2011). Trofimov & Aris (2024) investigated the effect of gross savings, GDP per capita, and urban population growth on economic growth in East Asian countries. The results indicated that high gross saving, urban population growth, and GDP per capita significantly affect annual GDP growth rates, with different effects in different income groups. According to Brueckner et al. (2023), Ethiopia's gross saving and real GDP growth relationship was analyzed causally from 1981–2017. The ADF unit root test, ARDL bound test and Granger test were three stages. The results indicated that domestic saving was not significant in the long run but adversely affected GDP per capita in the short run. The positive effect of the upward trend of GDP per capita on domestic saving in the short and long run. According to the study, the

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government should encourage investment to encourage saving and economic growth.

Ugochukwu et al. (2021) examined the relationship between gross savings and economic growth based on economic growth theory and empirical analysis. It explored the economic growth model and showed how gross savings influence its progress. The study found that gross domestic saving was a cause of real per capita economic growth, with the relationship between the two being reversed at different income levels. The results from the empirical model typing were as follows: public saving helps economic growth if it occurs, whereas private saving does not. Ribaj & Mexhuani (2021) explored the link between GDP per capita growth and national savings rate growth in 130 countries from 1960 to 2017. The study's findings confirmed that GDP per capita growth leads to higher national savings rates in poor countries and higher credit-to-GDP leads to lower national savings rates. The findings came from cross-country data.

Besides, Jagadeesh (2015) examined the association between economic growth and gross savings in Kosovo. The quantitative and qualitative research methodologies were utilized in this study. The results indicated that deposits enhance Kosovo's economic growth; they stimulate investment, production, and employment and lower the risk of volatile foreign direct investment. High savings also reduce the risk of volatile investment. Based on the above review of literature, the current study developed a hypothesis, which is mentioned below:

H3a: Gross saving has substantial impact on Sustainable economic growth in short-run.

H3b: Gross saving has substantial impact on Sustainable economic growth in long-run.

Energy Transition Index and Sustainable Economic Growth

The Energy Transition Index (ETI) is a global indicator assessing the performance of countries in moving to more sustainable energy, considering current conditions and the capacity of policies and actions to encourage clean practices (Zambrano-Monserrate, 2024). Adebayo et al. (2024) analyzed the effect of energy transition on economic growth in terms of G-7 countries from 1970–2018. Capital, technology, energy consumption, government expenditure, trade openness and CO_2 emissions were identified as key components determining economic growth. The feedback hypothesis was confirmed, and results showed one-way causality relations between GDP and these variables. Li et al. (2023) demonstrated that China is fighting environmental pollution, climate change and resource depletion, and it needs energy transformation (ET) to fight them. The study used a dynamic panel data model to examine how ET affects the economy and health from 2000 to 2020. Results indicated that in both central and eastern regions, ET increased economy and health, and economic equity values were between 0.8–1.5 and 0.7–2, respectively. Larger health equity was seen in the eastern region.

According to Murshed (2024), the Energy Extended Neoclassical Growth Model (EENGM) addressed the effect of decreasing fossil fuels, the decline in the fossil energy transition index, and the lower quality of renewable energy on economic growth. The presence of underperforming energy sectors hinders GDP growth and monopolizes investment. A sustainability strategy has been adopted to reduce the use of fossil fuels despite the high level of global warming. Liu et al. (2023) examined the correlation between green and low-carbon energy transition and high-quality economic and social growth in 30 Chinese provinces from 2010 to 2020. The study showed that high quality is yet to begin to influence regional growth, and imbalances and insufficiency remain in the developed and developing worlds. Energy resource centers provide higher energy transition efficiency compared to energy load centers. Low energy intensity/low carbon emissions and high renewable share can support high-quality economic-social development, but reducing per capita carbon emissions may not bring along some immediate positive externalities. Sarsar & Echaoui (2024) studied the

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relationship between the energy transition, economic growth, and CO2 emissions in Algeria from 1980 to 2018. The outcomes revealed that real GDP per capita tends to increase in the presence of human capital, physical capital stock, oil prices, and energy transition but is negatively determined by energy transition and exports, causing CO2 emissions to increase. In contrast, real GDP per capita decreases CO2 emissions and increases the contents of energy transition and exports. Based on the above review of literature, the current study developed a hypothesis, which is mentioned below:

H4a: Energy transition index has substantial impact on Sustainable economic growth in short-run.

H4b: Energy transition index has substantial impact on Sustainable economic growth in long-run.

Quality of Trade Infrastructure and Sustainable Economic Growth

A Quality Trade Infrastructure is a set of systems that contributes to governmental policy objectives aimed at industrial development, improvement of trade competitiveness in global markets, efficient use of natural and human resources, food safety, health, environment and climate change (Meka'a et al., 2024). Limb et al. (2024) analyzed the effect of institutional quality, border and transport efficiency, and the physical and quality trade infrastructure on intra-Africa trade across 44 African countries and their 173 trade partners from 2000 to 2014. The results showed that these factors make a big difference in trade flow, and the marginal effects tend to increase GDP per capita and decrease border and transport efficiency. Kumari & Singh (2024) evaluated the economic impact of seaborne trade on the quality and logistics performance of port infrastructure in 91 countries. It found using a structural equation model that improving port infrastructure was vital to developing countries if they wish to develop, as better logistics performance leads to higher seaborne trade and economic growth.

Ishfaq et al. (2024) examine the effect of quality trade infrastructure and institutional quality on economic growth. A large panel dataset was used from

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1980 to 2015. The findings of the study demonstrated that a positive and significant interaction between such factors, implying that institutional quality mattered for maximizing returns from the quality of trade infrastructure. Munim & Schramm (2018) investigated the effect of infrastructure quality on trade in ECOWAS countries. The study used the gravity model. It showed that the improvements in infrastructure quality raise bilateral trade and that this is the case even when the economies are large. The study emphasized the role of geographical and structural factors in intra-regional trade and concluded that increasing trade increased economic growth among ECOWAS countries.

According to Yushi & Borojo (2019), the quality of that infrastructure and how it affected a country's economic growth from 1980-2019 in 117 countries due to globalisation. The effect of globalisation was hypothesized to be different across groups with similar characteristics. However, the study indicated that countries with more quality infrastructure stand to gain from globalisation more than countries with less quality infrastructure. By extension, countries should improve their infrastructure quality in order to benefit from globalisation fully. Based on the above review of literature, the current study developed a hypothesis, which is mentioned below:

H5a: Quality of trade infrastructure has substantial impact on Sustainable economic growth in short-run.

H5b: Quality of trade infrastructure has substantial impact on Sustainable economic growth in long-run.

Human Capital Development and Sustainable Economic Growth

Nwokoye et al. (2024) investigated the relationship between human capital and economic growth and focused on Georgia. Based on econometric and artificial intelligence methods, it investigated the effect of spending on healthcare and the environment on GDP per capita and GDP growth. The study's findings showed that entrepreneurs and experts who thrive in a competitive global environment need adaptable and global best practices skills training for future orientation. According to Bekele et al. (2024), the

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Philippines lost learning because of the COVID-19 pandemic, affecting different sectors. Recovery relies on investing in human capital, but it can be expensive. The study investigated the impacts of human capital indicators on the GDP per capita of the Philippines from 1981 to 2020. The results indicated that seven of the sub-variables had a positive impact on GDP per capita, while others had a negative impact. The sectors Enabling Environment and Health deserve more assistance.

Another researcher, Miguel C.Barcelon et al. (2023), tested the hypothesized causal link between human capital and economic growth using data from Visegrad countries from 2000 to 2019. Gross domestic product per capita, innovative capacity and employee qualifications were found to have a positive relationship. Daňová & Šírá (2023) used economic-statistical methods and correlation-regression analysis, and a study found a connection between public funding and real GDP. However, countries such as Ukraine, Australia, and those in the full Commonwealth of Independent States were found to exhibit mixed results. The study implied that the uncertainty in economic processes discourages enhanced financial backing of human capital generation, which argues for new methods of public financing.

Chugunov et al. (2022) studied the link between human capital development indicators (spending in education, health, and total fixed capital) and growth in Saudi Arabia. The findings demonstrated that there are positive long-term relationships between these factors and economic growth and an inverse relationship between health spending and growth. The study suggested that the Saudi government should invest heavily in human capital for its benefit. Based on the above review of literature, the current study developed a hypothesis, which is mentioned below:

H6a: Human Capital Development has substantial impact on Sustainable economic growth in short-run.

H6b: Human Capital Development has substantial impact on Sustainable economic growth in long-run.

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Methodology

Conceptual Framework

A conceptual framework depicts the predicted connection of factors. The research process begins with formulating important objectives, which are then methodically integrated to provide cohesive and recommended results. "Agricultural value-added, industrial value-added, gross savings, energy transition index, quality trade infrastructure and human capital development" are independent variables. The analysis is expected to influence sustainable economic growth, a response or outcome variable.

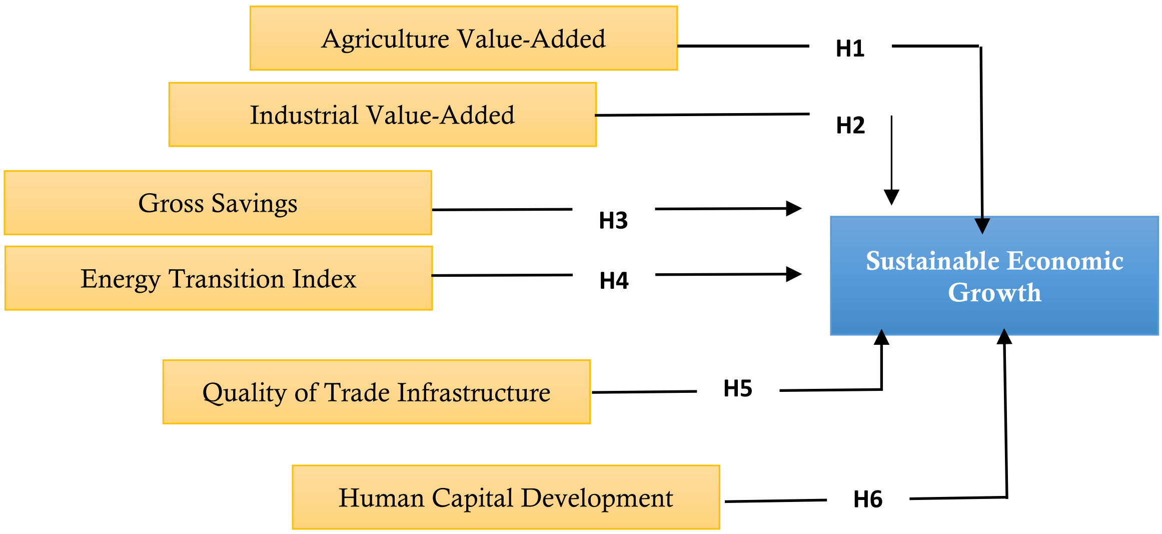

Figure 2: The Conceptual Framework (Source: Author)

Data and Variables Description

The current research investigates how economic structure and policy driver objectives such as agricultural value-added, industrial value-added, gross savings, energy transition index, quality trade infrastructure and human capital development affect sustainable economic growth in emerging economies between 1991 and 2020. Based on accessible data, 20 emerging nations were chosen. Sustainable economic growth was employed as a dependent variable, with GDP growth per capita as the indicator. The independent variables include agricultural value-added, industrial value-

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added, gross savings, energy transition index, quality trade infrastructure and human capital development. Because of their longitudinal scope, the present analysis favors agricultural value-added, industrial value-added, gross savings, energy transition index, quality trade infrastructure and human capital development on sustainable economic growth indicators over the World Bank Indicators (WDI). Furthermore, Table 1 shows the measurement and explanation of variables.

Table 1: ***Description and Measurement of Variables***

Variables	**Abr.**	**Description and Unit of Measurement**	**Data Source**
Sustainable Economic Growth	*SEG*	Sustainable economic growth is measured by GDP growth per capita.	WDI
Agriculture Value-Added	*AVA*	Agriculture Value-Added is assessed by agriculture, forestry and fishing value-added (% of GDP).	WDI
Industrial Value-Added	*IVA*	Industry (Including construction), value-added (% of GDP).	WDI
Gross Savings	*GS*	Gross Savings has measured by gross savings (% of GDP).	WDI
Energy Transition Index	*ETI*	Energy transition index has been measured by renewable energy consumption (% of total energy consumption)	WDI
Quality of Trade Infrastructure	*QTI*	Quality of trade infrastructure has measured by Trade (% of GDP).	WDI
Human Capital Development	*HCD*	Human capital development is measured by School enrollment,	WDI

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secondary (% net).

Econometric Model Estimation

Chudik and Pesaran (2015) introduced "Dynamic Common Correlated Effects" to overcome cross-sectional dependence. The DCCE means that an unobserved common factor impacts the regression variables, resulting in cross-sectional dependency across units. The DCCE technique is based on Pesaran and Smith's (1995) MG estimate, Pesaran et al.'s (1999) PMG estimate and Pesaran's (2007) proposed common correlated effects (CCE). According to Blackburne and Frank (2007), Pesaran's PMG technique pools and allows for group-specific intercept and error variances, as well as slope coefficients. The concern with PMG is that it allows for cross-national variance in short-run coefficients such as intercepts and adjustment speed. This reduces the stability of long-term slope coefficients across countries (Ditzen, 2021). To estimate, MG runs a country-specific regression and calculates the arithmetic average coefficients. This strategy is effective as long as the intercepts, slopes, and error variances differ across groups. The model's lagged dependent variable is endogenous; hence, MG estimates may be incorrect. Xue et al. (2021) discovered that the MG estimate does not account for cross-sectional dependence. CCE identifies unstudied components by cross-sectioning independent and dependent variables. CCE is resistant to autocorrelation, structural disturbances, and nonstationary, but its dependent variable is not homogeneous, rendering it unsuitable for dynamic panel data analysis (Chudik & Pesaran, 2015). However, DCCE estimators with longer cross-sectional average delays are more reliable. According to Ditzen (2021), the DCCE command modification may dynamically estimate heterogeneous panel data across both the long and short term. DCCE outperforms traditional techniques in addressing a number of key challenges. To avoid cross-sectional dependence, this technique computes logarithms and averages for all cross-sectional units. Second, parameter heterogeneity may be handled using DCCE's MG estimate components. Third, it assumes that one factor can explain all regression variables and calculates dynamic common-related effects while accounting for heterogeneity. The DCCE technique allows for nonstationary panel data and reduces estimated asymptotic bias due to regressor endogeneity (Chudik & Pesaran, 2015). The instrument set is generated using lagged DCCE variables. It performs well in endogenous regressor static and dynamic panel data models. According to Chaudhry et al. (2021), it considerably improves the estimator's small sample features in dynamic panel models with any regressor, whether highly exogenous, endogenous, or strictly exogenous. Instrumental variables are resistant to slope heterogeneity and cross-sectional dependencies. Baum et al. (2007) introduced the ivreg2 command, which facilitates instrumental variable regression in DCCE calculations. The Jackknife1 command facilitates DCCE with small samples. Despite panel data bias and structural flaws, the current study technique may provide valid results (Kapetanios et al., 2011). Given the above, the basic and DCCE models are shown below:

$$L_n(SEG_{t-1}) = \beta_0 + \beta_1 L_n(AVA_{t-1}) + \beta_2 Ln(IVA_{t-1}) + \beta_3 Ln(GS_{t-i}) + \beta_4 Ln(ETI_{t-1}) + \beta_5 Ln(QTI_{t-1}) + \beta_5 Ln(HCD_{t-1}) + \epsilon it \quad (1)$$

$$Y_{it} = \alpha_i Y_{it-1} + \delta_i X_{it} \sum_{p=0}^{pT} \gamma_{xip} \bar{X}_{t-p} + \sum_{p=0}^{pT} \gamma_{yip} \bar{Y}_{t-p} + \mu_{it} \quad (2)$$

In this research, the letters i and t signify cross-sections and time, respectively. Yit and Yit-1 denote the dependent and lagged variables, respectively. Cross-sectional averages lag behind the PT. Xit refers to the model's supplementary explanatory variables. "µit" denotes the residual term. Unobserved common factors are γxip and γyip. The models below employ multiple proxies for economic structure, policy drivers, and sustainable economic growth to enhance Equation (3) of the DDCE model.

$$LnSEG_{it} = \alpha_i YLnSEG_{it-1} + \delta_i X_{it} \sum_{p=0}^{pT} \gamma_{xip} \bar{X}_{t-p} + \sum_{p=0}^{pT} \gamma_{yip} \bar{Y}_{t-p} + \mu_{it} \quad (3)$$

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LnSEG represents sustainable economic growth in natural log form. In this approach, the lags of the dependent variables are employed as independent variables, and the dependent variables are used as independent. Furthermore, in natural log form, Xit is an independent variable that represents quality trade infrastructure, human capital development, energy transition index, gross savings, industrial value-added, and agriculture value-added. Furthermore, the research uses μit to represent the error terms in our models.

Analysis and Findings

Descriptive Analysis

Table 2 summarizes the descriptive statistics analysis findings for each variable. Therefore, all variables, such as sustainable economic growth, agriculture value-added, industrial value-added, gross savings, energy transition index, quality of trade infrastructure, and human capital development, are expressed as natural logarithms.

Table 2: ***Findings of Descriptive Analysis***

	Mean	Median	Maximum	Minimum	Std. Dev.
LN_SEG	1.119	1.322	2.613	-6.400	0.932
LN_AVA	2.085	2.149	3.456	0.656	0.694
LN_IVA	3.430	3.401	4.196	2.843	0.258
LN_GS	3.130	3.089	3.992	2.261	0.354
LN_ETI	2.572	2.656	4.416	-0.062	0.933
LN_QTI	3.962	3.932	5.395	2.621	0.556
LN_HCD	4.247	4.408	4.604	0.693	0.411

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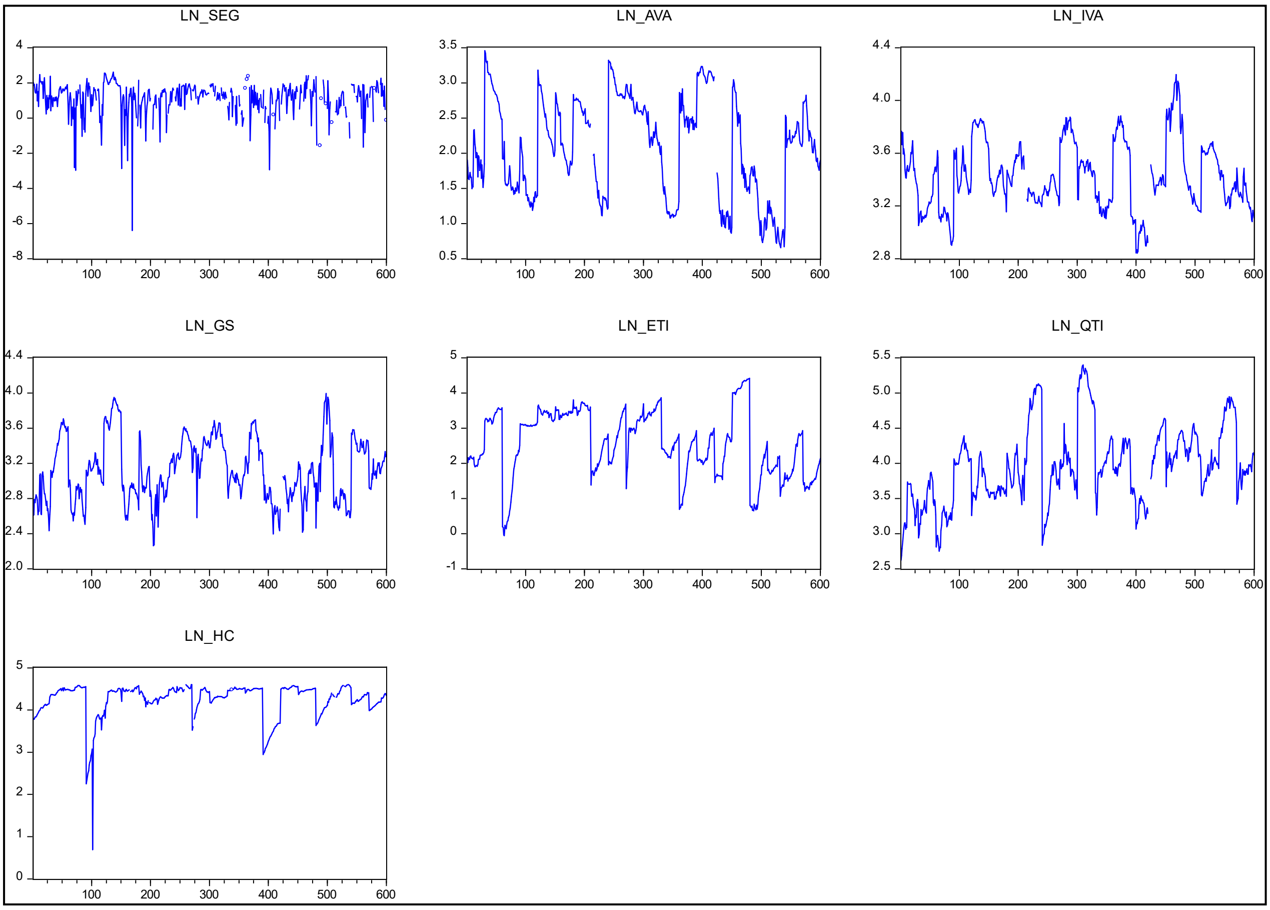

Figure 2: Variable Movement

Correlation Analysis

The current study employed the Pearson correlation test to examine the correlation among the variables. Therefore, one stands for a perfect positive relation between two data sets. It should be noted, however, that a coefficient of -1 means a perfect negative correlation. 0 refers to the absence of a correlation among the variables. Therefore, the findings of the correlation matrix indicate that there is a positive and negative correlation between sustainable economic growth, agriculture value-added, industrial value-added, energy transition index, quality trade infrastructure, and human capital development. The results showed a weak and moderate correlation—the results are displayed in Table 3.

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Table 3: ***Findings of Correlation Analysis***

	LN_SEG	LN_AVA	LN_IVA	LN_GS	LN_ETI	LN_QTI	LN_HCD
LN_SEG	1.000						
LN_AVA	0.144	1.000					
LN_IVA	0.211	0.059	1.000				
LN_GS	0.244	0.233	0.226	1.000			
LN_ETI	0.150	0.297	0.334	0.191	1.000		
LN_QTI	-0.051	-0.281	0.149	0.354	0.158	1.000	
LN_HCD	-0.012	-0.147	0.156	0.123	0.075	0.072	1.000

Cross-sectional Dependency

Table 4 shows the results of the Pesaran CD, scaled-LM, and bias-adjusted scaled-LM tests, which measure cross-sectional dependency in the country's panel. Cross-sectional dependence tests are useful for accurately estimating variables. This study disproves the null hypothesis by revealing that study panel countries have a cross-sectional dependency. Furthermore, the cross-sectional dependency test findings reveal the presence of cross-sectional dependency among the panel study countries; regarding this, the second-generation unit root tests are more appropriate for examining unit roots assuming cross-sectional independence while first-generation tests.

Table 4: ***Findings of Cross-sectional Dependency Test***

	Pesaran CD		Pesaran-Scaled LM		Bias Adjusted Scaled LM	
	Stat.	***Prob.***	***Stat.***	***Prob.***	***Stat.***	***Prob.***
LN_SEG	25.405***	0.000	14.530***	0.000	16.149***	0.000
LN_AVA	22.215***	0.000	17.350***	0.000	18.127***	0.000
LN_IVA	75.525***	0.000	11.440***	0.000	20.192***	0.000
LN_GS	28.315***	0.000	31.200***	0.000	72.124***	0.000
LN_ETI	58.815***	0.000	11.620***	0.000	33.169***	0.000
LN_QTI	24.665***	0.000	36.710***	0.000	28.129***	0.000

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LN_HCD	42.457***	0.000	12.012***	0.000	19.728***	0.000

Panel Unit Root Test

Im et al. (2003). Levin et al. (2002) and others still need to address cross-sectional dependency since they used first-generation unit root tests. This study used the CIPS and CADF tests, components of the second-generation unit root test developed by Pesaran (2007). Regarding cross-sectional dependence, the CIPS and CADF tests yield more trustworthy results. Table 5 shows that all variables have stationary behavior at the first difference.

Table 5: ***Findings of Unit Root Test***

CIPS						
	At Level			***At 1st Diff.***		
	t-Stat.	*Prob.*	*Sig.*	*t-Stat.*	*Prob.*	*Sig*
LN_SEG	-3.273	0.001	***	-13.677	0.000	***
LN_AVA	-0.854	0.346	no	-23.981	0.000	***
LN_IVA	-0.786	0.378	no	-23.045	0.000	***
LN_GS	-0.429	0.528	no	-24.318	0.000	***
LN_ETI	-1.397	0.151	no	-25.371	0.000	***
LN_QTI	-0.376	0.549	no	-25.415	0.000	***
LN_HCD	-0.347	0.56	no	-31.608	0.000	***
CADF						
	At Level			***At 1st Diff.***		
	t-Stat.	*Prob.*	*Sig.*	*t-Stat.*	*Prob.*	*Sig.*
LN_SEG	-15.122	0.000	***	-206.41	0.000	***
LN_AVA	-0.84	0.352	no	-23.981	0.000	***
LN_IVA	-0.781	0.378	no	-23.016	0.000	***
LN_GS	-0.375	0.549	no	-24.41	0.000	***
LN_ETI	-1.375	0.157	no	-25.365	0.000	***
LN_QTI	-0.342	0.562	no	-25.435	0.000	***
LN_HCD	-0.278	0.586	no	-32.83	0.000	***

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Homogeneity Test

Table 6 shows the results of the slope homogeneity test, which Pesaran et al. (2008) referred to as the heterogeneity test. This study investigates two hypotheses: that slope coefficients are homogeneous and that they are heterogeneous. The panel data from developing countries reveal country-specific variations. Therefore, the present research findings reveal that the t-statistic values of both the slope homogeneity test (Avg. Δ) and its bias-adjusted counterpart (Avg. Δ adj) are significant. Thus, the present research findings refute the null hypothesis of slope homogeneity.

Table 6: ***Findings of the Slope Homogeneity Test***

	Avg. Δ	Avg. Δadj.
Model	18.493***	7.491***

Cointegration

The Westerlund (2007) test is more reliable because it assesses all three criteria. It is known as the second-generation cointegration test. Table 7 shows a strong correlation between the variables (Panel-Ʈ, Panel-α, Group-Ʈ, Group-α) over a long period. Therefore, the presence of cointegration among the variables indicates that there is a long-term relationship between the variables, which is consistent with the findings of this study (Meo et al., 2020)

Table 6: ***Findings of Unit Root Test***

Stat.	Value	Z-value	P-value
Group- Ʈ	-4.543	-12.812	0.000
Group- α	-16.110	-6.419	0.000
Panel- Ʈ	-11.719	-6.292	0.000
Panel- α	-11.917	-7.670	0.000

DCCE Estimation Results

Table 8 shows the findings of the DCCE estimate model for developing countries. Sustainable economic growth is the dependent variable, and all explanatory variables significantly influence it. The study found that the value

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added to agriculture, forestry, and fishing in developing countries has short-term and long-term positive and statistically significant influence on sustainable economic growth. At the 1% significant levels, H1a and H1b were accepted, as results which are demonstrated by the short-run and long-run coefficient values of 0.261 and 0.204, respectively, and the t-values of 2.680 and 2.712 respectively. The industry value added has favorably impacted short-run and long-run sustainable economic growth in developing countries. The t-values of 2.294 and 4.660, respectively, and coefficient values of 0.167 and 0.335, respectively, suggest that H2a and H2b are accepted at the 5% and 1% significance levels. Gross saving has a favorable impact on sustainable economic growth in the short and long term. The coefficient values are 0.258 and 0.218, respectively, with t-values of 3.073 and 3.582, indicating that H3a and H3b are accepted at the 1% significance level.

Further, the findings show that the energy transition index influences sustainable economic growth in developing nations in both the short and long term. At the 1% significance level, hypotheses H4a and H4b are accepted, as results demonstrated by coefficient values of 0.321 and 0.313, respectively, and t-values of 3.254 and 4.497. The quality of trade infrastructure influences sustainable economic growth in developing nations in the short and long run. The coefficient values are 0.184 and 0.584, respectively, with t-values of 2.468 and 3.294, indicating that H5a and H5b are accepted at 5% and 1% significant levels. Finally, human capital development influences sustainable economic growth in developing nations in the short and long run. The coefficient values are 0.255 and 0.305, respectively, with t-values of 2.739 and 3.117, indicating that H6a and H6b are accepted at 5% and 1% significant levels.

Table 8: ***Findings of DCCE Estimation Model***

Variable	Coeff.	Std. Error	t-Stat.	Prob.
Short-run Estimation				
D(LN_SEG (-1))	-0.113	0.041	-2.724	0.007

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D(LN_AVA)	0.261	0.096	2.712	0.026
D(LN_IVA)	0.167	0.073	2.294	0.042
D(LN_GS)	0.258	0.084	3.073	0.008
D(LN_ETI)	0.321	0.099	3.254	0.000
D(LN_QTI)	0.184	0.075	2.467	0.034
D(LN_HCD)	0.255	0.093	2.739	0.017
Long-run Estimation				
SEG(-1)	0.113	0.042	2.680	0.008
LN_AVA	0.204	0.069	2.974	0.009
LN_IVA	0.335	0.072	4.660	0.000
LN_GS	0.218	0.061	3.582	0.000
LN_ETI	0.313	0.070	4.497	0.000
LN_QTI	0.584	0.177	3.294	0.000
LN_HCD	0.305	0.098	3.117	0.007

Stability Test

The cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests ensure the stability of both long-run and short-run estimates. The results of CUSUM and CUSUMSQ (Figures 3-4) show that both short-term and long-term estimates are stable and accurate.

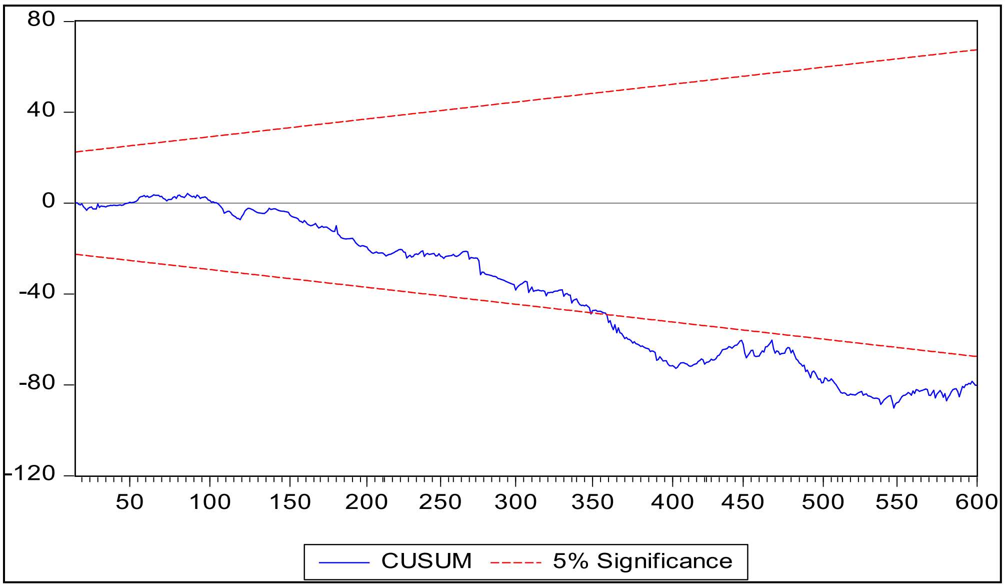

Figure 3: CUSUM

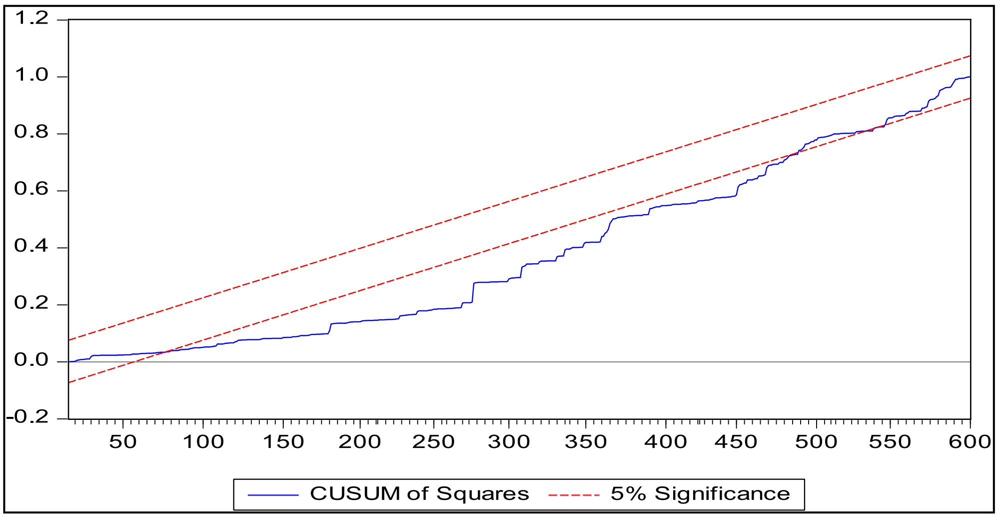

Figure 4: CUSUM Square

Discussion

Agriculture value-added (% of GDP) has significantly contributed to sustainable economic development in developing countries. Therefore, results indicate, H1a and H1b were accepted. Thus, the findings of this research are harmonized with prior investigations (Etale et al., 2021; Mbotiji et al., 2023; Mostefai, 2024; Ochada & Ogunniyi, 2020). Therefore, agriculture value-added (% of GDP) contributes to sustainable growth to the extent of

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developing countries in many ways, such as creating employment for the citizens, food security and promoting industrialization. This sector contributes to a good proportion of GDP and enhances overall economic turnover, employment opportunities, food security, eradication of poverty, and industrialization. It also boosts associated sectors like food processing, agribusiness, and textiles, which, in turn, promotes economic diversification. Besides, it also increases export diversification and minimizes dependence on the export of materials rather than final goods, stabilizing the economy. Agriculture conservation practices include agroforestry, organic farming, efficient water use for irrigation, etc., a way that resources can be conserved but productivity can be attained. Other sectors of the economy also benefit from expenditures made on infrastructure for agriculture. Likewise, there is a broad agreement that added agricultural value can enhance sustainable economic development in developing countries due to employment opportunities, food security, and, usually, fostering industrialization.

Further, industrial value added (% of GDP) has significantly contributed to sustainable economic development in developing countries. Therefore, results indicate that H2a and H2b were accepted. Thus, the findings of this research are harmonized with prior investigations (Bosco et al., 2022; Wolde, 2022; Xu et al., 2023). Therefore, industrial divisions, especially manufacturing, construction, mining, and utilities, are among the most important growth segments of developing countries' economic portfolios. They enhance efficiency, creativity and the spread of a wide range of activities to sustain growth. They eliminate overreliance on agriculture and natural resources by promoting structural change towards development. They also generate employment chances, enhancing per capita income and decreasing poverty. Industrialization leads to infrastructure improvement in support of the economy, with technology improvement and dissemination. Industrial production also increases export competitiveness and the earnings of foreign

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exchange. Industrialization entails urbanization, regional development, and investments, and flexing innovation is encouraged.

Moreover, gross savings (% of GDP) have significantly contributed to developing countries' sustainable economic development. Therefore, results indicate that H3a and H3b were accepted. Thus, the findings of this research are harmonized with prior investigations (Brueckner et al., 2023; Ribaj & Mexhuani, 2021; Trofimov & Aris, 2024; Ugochukwu et al., 2021). Therefore, in developing countries, gross saving rates as a percentage of GDP are important for financing investment and capital accumulation. They assist in decreasing dependence on foreign credit, improving financial intermediation, and contributing to sustainable economic growth. The investment will create infrastructure and education; financial and technology know-how can support growth and future benefits. They also support the growth of the private sector, where businesses are assisted to grow and modernize. The third right, achieved through increased savings, is improved economic security in households, enabling them to take care of insurance against rainy days. Thus, the procedure measures for increasing the gross sav-ings are improving the quality of financial institutions, promoting the concept of inclusive sav-ings, empha-sizing savings-consumption synch, initiating high productive use of-savings, and using infla-tion control to increase savings. Civil liberties, good policies, and balanced development strategies will ensure that the following advantages come to fruition: Therefore, gross saving per cent of GDP is crucial in achieving a high economic growth rate in developing nations.

The energy transition index has also significantly contributed to sustainable economic development in developing countries. Therefore, results indicate that H4a and H4b were accepted. Thus, the findings of this research are harmonized with prior investigations (Adebayo et al., 2024; Q. Li et al., 2023; P. Liu et al., 2023; Murshed, 2024; Sarsar & Echaoui, 2024; Zambrano-Monserrate, 2024). Therefore, the share of renewable energy sources in the total energy consumption is the sustainable economic development indicator,

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expressed as the energy transition index. Integration of renewable energy sources in developing countries has numerous advantages, such as increased energy security, increased cost over time, attraction of high investments, green employment, combating climate change, increased rates of rural electrification, and compliance with international sustainable development goals. Some challenges of renewables are the following: high initial cost, infrastructure and grid, policy and regulatory, technological, and intermittency barriers. Suppose the energy transition is to yield optimal results. In that case, suggestions drawn from the literature include providing subsidies, designing supportive policies, supporting R&D in the local domain, improving infrastructure quality, supporting public-private partnerships, and building capacity.

Similarly, trade quality infrastructure has significantly contributed to sustainable economic development in developing countries. Therefore, results indicate that H5a and H5b were accepted. Thus, the findings of this research are harmonized with prior investigations (Ishfaq et al., 2024; Kumari & Singh, 2024; Limb et al., 2024; Meka'a et al., 2024; Munim & Schramm, 2018; Yushi & Borojo, 2019). A quality trade infrastructure is particularly important for developing trade between countries, especially developing ones, such as transport networks, telecommunication, and information technology, which constitute the physical and soft infrastructure like roads, ports, and airports. Upgrading the trade web bears the potential benefits of giving a desirable impulse to trade costs, competition, structural diversification, industrialization, regional integration, FDI, labor market and poverty reduction, government revenues, technology transfer, and sustainable development goals. These strategies are availing infrastructure finance, streamlining trade formalities, developing regional linkages, emphasizing sustainability, repairing institutional structures, and mobilizing international assistance.

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Finally, human capital development has significantly contributed to sustainable economic development in developing countries. Therefore, results indicate that H6a and H6b were accepted. Thus, the findings of this research are harmonized with prior investigations (Bekele et al., 2024; Chugunov et al., 2022; Daňová & Širá, 2023; Gulcemal, 2020; Miguel C.Barcelon et al., 2023; Nwokoye et al., 2024). Therefore, human capital development, such as knowledge, skills, health and abilities, is important for economic growth, especially in developing countries. They increase labor efficiency, encourage the introduction of new technology, help diversify an economy, and help cushion an economy from shocks. This research explores how strong human capital enhances economic growth through poverty and inequality reduction, attracting investments, and bolstering institutions. Human capital also fosters demographic dividends and resource mobilization for sustainable development through green industries' participation. That said, there are some challenges: poor education and healthcare, the loss of skilled people, lack of proper training and education and the gender gap.

Conclusion

Economic structures and policy drivers to foster sustainable economic growth across emerging economies are highlighted in this research. The agricultural and industrial value has significantly boosted GDP growth, creating employment, improving productivity and promoting economic diversification—an analysis of gross savings as a critical solution to reducing foreign debt dependency and supporting domestic investments: the high cost and infrastructural challenges associated with renewable energy pale compared to their environmental benefits. The energy transition index emphasizes sustainability. Quality of trade infrastructure, which encompasses transport networks and streamlined logistics, directly improves trade competitiveness, industrial development and regional integration. Human capital development (via investments in education and healthcare) played an important role in increasing labour productivity, fostering innovation and

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lowering inequality. The study confirms these factors' short- and long-term impacts on sustainable growth by using advanced econometrics methods, filling the methodological gap in previous literature. The findings highlight the importance of coordinated policy interventions that combine structural changes with targeted investments to support long-term economic and environmental goals. This study, therefore, presents robust empirical evidence that can be drawn to inform policymakers in developing economies with their comprehensive strategy of sustainable development.

Policy Implications

The results of this research underline the importance of targeting policy interventions to facilitate sustainable economic growth in emerging economies. Therefore, agricultural modernization and industrial development investment should be policymakers' priorities to increase productivity, employment, and economic diversification. Establishing robust financial systems to mobilize domestic savings could reduce the need for external debt to finance critical infrastructure. Subsidies, public-private partnerships and infrastructure improvements are associated with policies encouraging renewable energy adoption. A combination of regional integration and competitiveness can be further enhanced by increasing trade infrastructure, particularly transport networks and smoother flow in and through goods stores. Furthermore, governments should invest in human capital development through education, health, and skill-building programmes to enhance labour efficiency and innovation. Enacting integrated development strategies centred on structural reforms, technological advancement, and sustainable practices is crucial for balancing economic development and environmental stewardship, enhancing resilience and realizing long-term development aspirations.

Limitations and Future Directions

This study has some limitations. First, data derived from 20 emerging economies over 30 years is substantial but might only cover some region-

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specific dynamics or the heterogeneity in the wide range of emerging markets. Secondly, some variables, such as human capital development and energy transition index, may exhibit nuances which need to be fully described given the constraints on data collection or measurement proxies. Furthermore, the methodology applied presents an advanced approach, but more is needed for all unobservable further factors that affect sustainable economic growth. The geographical and temporal scope is future research; one should consider expanding the geographical and temporal scope and examining specific sub-regional contexts of a more diverse set of economies. By combining these methods, it is possible to go further. In addition, future studies may examine how new technologies, digital transformation, and climate policies shape sustainable economic growth from a broader and more holistic perspective on the drivers of emerging economic sustainability.

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