Nexus among Regulatory Framework, Economic Growth and Sustainable Development: Insights from Structural Equation Modeling Approach

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Abstract

The concept of sustainable development holds immense importance for both current and future generations. This study investigates the manner in which economic growth acts as a mediator in the relationship between sustainable development and the regulatory framework. We have utilized the structural equation modeling technique to investigate the direct and indirect impacts of exogenous and endogenous variables. We executed this investigation using a sample of 24 countries that accounted for about 65% of global greenhouse gas emissions between 2000 and 2019. According to empirical results based on direct effects, the regulatory framework hinders sustainable development and economic growth. The empirical findings indicate that the regulatory framework has a noteworthy and favorable indirect influence on sustainable development, with economic growth serving as a mediating factor. Furthermore, because of the positive indirect effect, the regulatory framework's negative direct effect on sustainable development outweighs its total adverse effect. In the end, legislators should give utmost importance to creating a balanced regulatory framework that promotes economic expansion while incorporating concepts of environmental, social, and economic sustainability to ensure the well-being of present and future generations.

Keywords: Regulatory Framework, Economic Growth, Sustainable Development, Structural Equation Model

JEL Codes: Q56, O44, K32

1. Introduction

The average global temperature on Earth has increased by at least 1.9° Fahrenheit (1.1° Celsius) since 1880, as per NASA's Goddard Institute for Space Studies (GISS). For the well-being of current and future generations, sustainable development has emerged as a supreme concern in the global world. Sustainable development, at its core, aims to meet the needs of the present without compromising the ability of future generations to meet their own needs (Sulehri, 2024; Sulehri et al., 2024). The idea of sustainable development includes creating a balance among various dimensions like environmental, social, and economic sustainability. So, as the world is dealing with multiple complex challenges such as climate change, social inequalities, and resource depletion, sustainable development has become an increasingly urgent concern to be investigated. The Earth's temperature has witnessed a steadily increasing trend due to the emission of greenhouse gases during the last 70 years (Balaram, 2023; Sulehri et al., 2024).

Furthermore, the triple bottom line idea places significant emphasis on the equitable consideration of the environmental, economic, and social dimensions of sustainability. While social sustainability promotes diversity, equality, human rights, and the preservation of cultural identities, economic sustainability involves long-term growth without negative environmental effects (Audi et al., 2020; Audi & Ali, 2023; Audi et al., 2024). Environmental sustainability guarantees the quality of the environment for economic activities and improves people's quality of life (Brundtland, 1987; Audi et

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al., 2022; Audi & Ali, 2023). Achieving equilibrium among these fundamental elements is vital for the attainment of sustainable development; however, it is a challenging task, as each element must uphold the concerns of the others in order to avoid disparities (Ali, 2022; Audi & Ali, 2023; Audi et al., 2023; Ali et al., 2023). The process of development as a whole depends heavily on ecological sustainability in particular (Mangukiya & Sklarew, 2023; Carter & Rogers, 2008; Jenkins & Bauman, 2010; Klarin, 2018; Ali, 2022; Ali & Audi, 2023).

By considering serious repercussions, the United Nations developed the Millennium Development Goals (MDGs) in September 2000 to address global poverty and other important concerns by the year 2015. According to Pogge (2004), the objectives encompassed in this framework consist of the elimination of poverty, the attainment of universal primary education, the advancement of gender equality, the reduction of child mortality, the enhancement of maternal health, the mitigation of diseases, the assurance of environmental sustainability, and the promotion of global partnerships. The United Nations introduced the "2030 Agenda for Sustainable Development Goals" in September 2015, aligning with the Millennium Development Goals (MDGs). The 2030 Agenda for Sustainable Development aims to address a number of sustainable development issues, such as eradicating poverty, promoting universal peace and partnership, protecting the environment, and implementing transformative actions for a sustainable future (Ali & Afzal, 2016; Johnston, 2016).

Despite the allocation of substantial resources to promote social and environmental causes, achieving economic sustainability remains a crucial aspect towards achieving sustainable development. Most policymakers consider economic growth, which is the increase in the production and consumption of goods and services within an economy, as a significant substance for progress and development. However, the pursuit of economic expansion has historically been linked to adverse outcomes such as the depletion of resources, damage to the environment, and social disparities, which raises concerns about its alignment with the principles of sustainable development. In recent times, there has been significant focus from financial analysts, policymakers, and researchers on the relationship between economic growth and sustainable development. The fundamental idea driving the discussion is the recognition that economic development by itself cannot produce sustainable outcomes and, in the absence of adequate policy and regulatory support, could worsen unsustainable behaviors. As a result, there is an increasing agreement that we must redirect economic policies and practices toward more sustainable approaches that align economic goals with environmental and social concerns (Dempere et al., 2023; Ali et al., 2022; Ali & Audi, 2016; Zhang, 2016).

Regulatory framework is essential in shaping the relationship between economic growth and sustainable development. Regulatory framework encompasses a set of laws, rules, policies, and institutions that establish a system for governing economic activities and their impact on environmental and social sustainability. The establishment of rights, duties, and incentives for various stakeholders has a substantial influence on the behavior of entrepreneurs and the advancement of sustainable outcomes (Acosta-Smith et al., 2022). Despite the acceptance of regulatory framework as vital for advancing sustainable development goals, there is an absence of empirical research that properly examines their influence on the link between economic growth and sustainable development. This study aims to investigate the role of economic growth as a mediator in the relationship between regulatory framework and the achievement of sustainable development targets. This study aims to provide valuable insights for policymakers, financial analysts, practitioners, and scholars facing the complex challenges of promoting sustainability in a rapidly evolving world by examining the mechanisms by which regulatory framework impacts economic growth and, consequently, sustainable development.

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2. Literature Review

Fundamentally, the notion of sustainable development is based on socioeconomic and financial development, with some consistent ecological restrictions and the redistribution of resources to ensure the quality of life for present and future generations (Sharpley, 2000). Balaram (2023) emphasizes the increasing threat of climate change resulting from the release of greenhouse gas emissions, particularly carbon dioxide (CO_2) from fossil fuels. This has increased the occurrence of severe weather phenomena such as heat waves, wildfires, and flooding. This has sparked apprehensions over the long-term viability of human society, intensified by escalating sea levels and interrupted agricultural practices. To tackle this issue, immediate measures are required to shift towards a low-carbon economy through the gradual elimination of technology reliant on fossil fuels and the adoption of renewable energy sources. Strategic approaches encompass the allocation of resources towards the development of hydro, wind, solar, and nuclear power, as well as the use of emerging technologies such as hydrogen fuel cells and electric vehicles, with comprehensive reforestation initiatives. Stoenoiu (2022) investigates the indicators of Sustainable Development Goals No. 9, which include achieving sustainable industrialization, increase research and innovation, and create a resilient infrastructure. In empirical analysis, only nine indicators used to measure the situation of eight Eastern European countries during 2013–2019 to signal improvements or deteriorations in situations. After empirical results, countries ranking categories obtained as real, moderate, and low progress towards sustainable development.

In his study, Ademokoya (2020) investigates the correlation between Nigeria's banking industry and the achievement of sustainable development. The researcher investigates the effects of banking, stock market, and insurance activities on sustainable development indicators, utilizing data spanning from 1986 to 2015. The results indicate that there is a positive correlation between the banking and stock market sectors and sustainable growth, although insurance has a limited impact in the short run. In addition to adding to a thorough knowledge of the financial sector's role in Nigerian sustainability initiatives, the study highlights policy actions to enhance these sectors for sustainable development in Nigeria.

Sulehri & Ali (2020), Audi et al., (2023), Kyriacou (2022), Audi et al., (2022) mentions that gross domestic products, fiscal policy, monetary policy, economic misery, and exchange rates influence the macroeconomic environment. However, Olubiyi (2023) Okunbanjo et al. (2022) and Caro (2017) investigate the macroeconomic environment's characteristics and the availability of small business loans in Nigeria. The study employs a longitudinal research approach using secondary data sources and robust least squares statistical analysis. The data indicate that the exchange rate has no substantial effect on small business credit, but the lending rate and liquidity ratio have significant impacts. The study shows that lending rate and liquidity ratio are the factors and predictors of credit to small businesses in Nigeria. Therefore, the study suggests that the Nigerian economic growth controllers should take actions to stabilize the country's foreign exchange.

Li (2023) conducts a comparison of the macroeconomic circumstances, monetary, fiscal, and trade policies of China and the United States. The author talks about how the new Tesla Model 3 might do better in China than in the US. Although the US-China trade war has somewhat increased the Model 3's price, expanding the Giga plant in China could potentially resolve these issues by lowering taxes and fees. Both the US and China have a stable and healthy macroeconomic

environment for investors like Tesla, according to data from 2010 to 2019. In conclusion, China has a greater comparative advantage due to its higher GDP growth rate, well-maintained interest rate, and easing monetary policy, all of which promote business activity and are anticipated to accelerate economic growth.
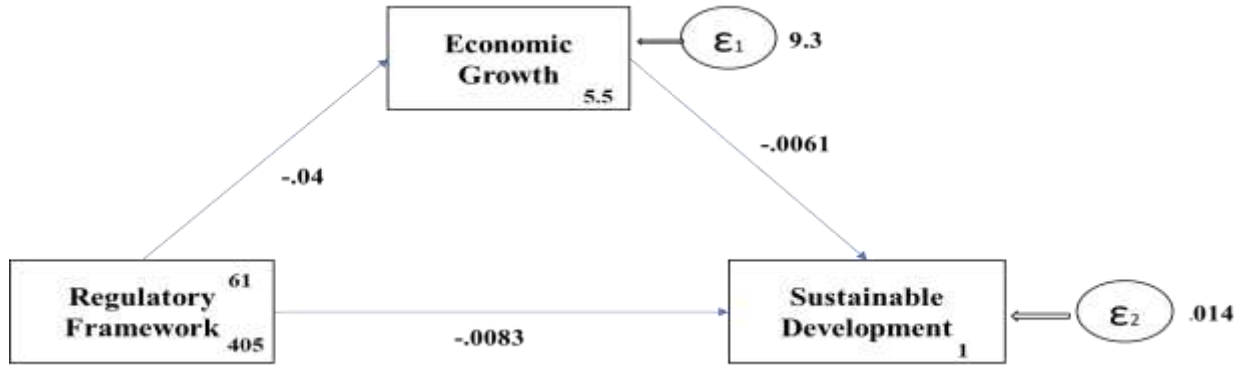
To clarify the relationship between the macroeconomic environment and tax income, Ali and Audi (2018) analyze the impact of economic indicators on Pakistan's tax revenue from 1975 to 2016. The results of the study are quite fascinating, as unemployment has a positive and significant effect on tax income. In Pakistan, the link between money supply and tax revenues is positive and considerable, whereas the association between inflation and tax revenues is negative and significant.

Zhang (2016) delves into the complexities involved in cleaning up China's electrical sector, a significant contributor to global greenhouse gas emissions, and examines the relationship between regulatory frameworks and sustainable development within the sector. The report recognizes the importance of both supply- and demand-oriented solutions but emphasizes the ongoing obstacles that impede their effective implementation. Conflicting authorities and tensions between central and local governments characterize China's regulatory framework. However, the existing regulatory policies and instruments have proven ineffective in effectively addressing these obstacles. Therefore, the Chinese electrical sector faces significant challenges in achieving sustainable development objectives due to the incomplete realization of the full benefits of pollution-control measures.

While investigating the role of country governance, Wu (2021) examines the moderating role of country governance in determining firm performance of the world's top 1,000 firms. The researcher uses CEO duality and the percentage of independent directors as indicators of board independence and tests the influence of board independence on firm performance as well as the moderating effects of country governance, focusing on regulatory quality and rule of law, with multi-level modeling. The author develops four hypotheses based on compensation and agency theories and finds that CEO duality and the percentage of independent directors exert negative and positive influence, respectively, on firm performance. Furthermore, regulatory quality and the rule of law positively moderated the negative effects of the former and negatively moderated the positive effects of the latter.

3. Theoretical and Conceptual Framework

The emergence of the idea of sustainable development occurred during the latter part of the 1970s, prompting concern regarding the potential consequences of economic growth on both environmental degradation and social disparities. The theoretical basis of this subject is supported by a range of academic fields, including economics, ecology, sociology, and political science. Holling (1973) presents resilience theory and explains how systems might adapt to shocks like climate change and natural disasters. But Brundtland (1987) provides three pillars for sustainability, i.e., economic development, environmental protection, and social equity, to consider in the "Our Common Future" report produced for the World Commission on Environment and Development. Later, Wackernagel and Rees (1998) point out how ecological footprints link the utilisation of natural resources with waste absorption. Following Holling (1973), Brundtland (1987), Ashiq et al., (2023), Ali (2022), Kyriacou (2022), Ali and Audi (2018), Ali (2015), Zhang (2016), and Wu (2021) the conceptual model of this study becomes:

Economic Growth 5.5

ε_1 9.3

-.04

-.0061

Regulatory Framework 61 405

-.0083

Sustainable Development 1

ε_2 .014

Following the theoretical and conceptual ideologies, the mediation econometric models can be written as:

$$EG_{it} = \beta_0 + \beta_1 RF_{it} + \varepsilon_{it1} \qquad (1)$$

$$SD_{it} = \delta_0 + \delta_1 EG_{it} + \varepsilon_{it2} \qquad (2)$$

$$SD_{it} = \gamma_0 + \gamma_1 RF_{it} + \gamma_2 EG_{it} + \varepsilon_{it3} \qquad (3)$$

SD= Sustainable Development

RF = Regulatory Framework

EG = Economic Growth

4. Methodology

Karl Gustav Joreskog, a renowned statistician from Sweden, proposed the concept of structural equation modeling (SEM) in 1969. The social sciences employ structural equation modeling (SEM) as a comprehensive statistical approach to analyze complex relationships among variables (Jöreskog, 1969). This study conducted empirical analysis on a sample of twenty-four countries, which together contribute to approximately 65% of global greenhouse gas emissions. The countries included in this list are the United States, the United Kingdom, Japan, Germany, Switzerland, Hong Kong, Singapore, France, Canada, Australia, China, South Korea, India, Brazil, Mexico, Russia, Netherlands, Italy, Spain, South Africa, Indonesia, South Arabia, Turkiye, Poland, Pakistan, and Argentina. In addition, we gathered data spanning from 2000 to 2019, before the outbreak of the COVID-19 pandemic. A study in this article uses structural equation modeling (SEM) to look at the real-world connection between the regulatory framework, sustainable development, and economic growth as a mediating variable. To assess the model's goodness of fit, we have used a variety of methods, including the standard root mean square residual (SRMSR), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and comparative fit index (CFI) (Jenatabadi, 2015; Cain, 2021).

4.1. Measurement of Variables

The detailed measurement methodologies of the sustainable development index and ecological impact index have been given as follows:

i. Sustainable Development Index

We measure the ecological efficiency of human development by evaluating the need to achieve optimal development within the limits of the planet. We obtain the sustainable development index by dividing the human development index by the ecological impact index. The human development index includes a life expectancy index, an education index, and an income index with a sufficiency threshold.

The SDI formula can be described as follows:

$$SDI = \frac{\text{Development Index}}{\text{Ecological Index}}$$

The ecological impact index has been computed using the following formula:

ii. Ecological Impact Index

Ecological Impact Index $= 1 + \frac{e^{AO} - e^{1}}{e^{4} - e^{1}}$

If AO greater than 4, then EII = AO – 2

$$A0 = 2\sqrt{\left(\frac{MF}{\text{Boundary}} \geq 1\right) * \left(\frac{CO2}{\text{Boundary}} \geq I\right)}$$

MF=Material footprint

CO2=Carbon emission

AO=Average overshoot

e=exponential function

This technique assures that the sustainable development index (SDI) is a reliable predictor of long-term sustainability. Countries cannot utilize low ecological impact to compensate for poor human development performance. Data for the components of the development index has been taken from the United Nations Development Programme; data for material footprint has been taken from the UN International Resource Panel Global Material Flows Database; and for CO2 emissions, the data has been taken from the EORA MRIO database with PRIMAP (Hickel, 2020).

iii. Economic Growth

It is defined as the increase in an economy's production and consumption of goods and services over time. Changes in the gross domestic product (GDP), which measures the total value of a country's goods and services, typically assess economic growth. We have sourced the economic growth data from the World Bank database.

iv. Regulatory Framework

A governmental or regulatory authority develops a regulatory framework, also known as a nation's regulatory structure, which is a compilation of legal acts, regulations, guidelines, and standards. The primary objective of this entity is to supervise and manage various aspects of a specific industry, sector, or the overall national economy. We have sourced the data pertaining to the regulatory framework from the Index of Economic Freedom, which includes indices related to property rights, judicial effectiveness, and government honesty (Dempere et al., 2023; Zhang, 2016).

5. Results and Discussions

The results presented in Table 1 of structural equation modeling show the correlations between important factors, including economic growth, the regulatory framework, and sustainable development. Economic growth may decrease in countries where there are strict regulations that may increase compliance costs related to environmental degradation and social disparities. Moreover, institutional barriers and reduced levels of flexibility for businesses to promote innovation and expansion can decrease economic growth. Complex regulatory processes for obtaining permissions or licenses may hinder investment and economic activities, hence negatively affecting total growth. Initially, the empirical results demonstrate a negative relationship between regulatory framework and economic growth, with a coefficient value

of -.0399658 and a p-value of 0.000 highly significant, indicating that regulatory framework reduces economic growth due to a strict set of regulations and lessened flexibility for organizations, which reduces economic activities and growth. It also highlights the importance of designing balanced regulations that incorporate mechanisms for innovation and adaptability that can foster economic growth (Dempere et al., 2023). Furthermore, economic growth is thought to be a key factor in human development, but it tends to place less emphasis on social justice, environmental sustainability, and institutional capacity building. So, stronger economic growth may not necessarily contribute to sustainable development. The empirical findings demonstrate a statistically significant inverse correlation between economic growth and sustainable development, as evidenced by a coefficient value of -.0060972 and a p-value of 0.001. This suggests that a decrease in the consideration of ecological limits and environmental sustainability leads to a reduction in sustainable development (Mushafiq & Prusak, 2023; Bashir & Rashid, 2017).

Table 1: Structural Equation Model

Endogenous Variables

Observed: EG, SD

Exogenous Variable

Observed: RG

Number of Observations = 480

Estimation Method = Maximum Likelihood (ML)

Log likelihood   = -2998.6167

	Coefficient	OIM Std. Error	Z	P>|z|	[95% Conf. Interval]	
Structural						
EG <-						
RF	-.0399658	.0069042	-5.79	0.000	-.0534978	-.0264339
Cons	5.464513	.4420058	12.36	0.000	4.598198	6.330828
SD <-						
EG	-.0060972	.0017941	-3.40	0.001	-.0096136	-.0025809
RF	-.0082829	.0002807	-29.51	0.000	-.0088331	-.0077328
Cons	1.031162	.0199492	51.69	0.000	.9920618	1.070261
Var (e.EG)	9.25609	.597478			8.156104	10.50443
Var (e.SD)	.0143011	.0009231			.0126015	.0162298

Furthermore, rules that are excessively intricate or lack consistency have the potential to impede entrepreneurship and innovation, which are crucial drivers for achieving sustainable development. Regulatory obstacles may also impede economic growth by discouraging investment and causing uncertainty for companies. To tackle these difficulties, authorities must precisely strike a balance between regulatory goals and the imperative to promote economic growth, innovation, and social advancement. Long-term sustainable development depends on creating regulatory frameworks that support sustainability while reducing negative effects on economic activity and entrepreneurship. So, statistical

analysis shows a highly significant and adverse relationship between regulatory framework and sustainable development, with a coefficient value of -.0082829 and a p-value of 0.000, indicating that regulations reduce sustainable development (Zhang, 2016; Adedoyin et al., 2020). To formulate policies, all stakeholders and policymakers should consider these results before adopting an inclusive approach that includes economic, social, and environmental aspects. As per Table 2, the regulatory framework and economic growth do not have an indirect link, as indicated by structural equation modeling (SEM). The negative direct relationship between the regulatory framework and economic growth indicates the need for a balanced set of rules to foster sustainable economic growth. Whereas, the presence of an indirect relationship implies that a balanced regulatory framework may have a significant impact on promoting economic growth, making a valuable contribution towards achieving sustainable development goals while simultaneously focusing on social and environmental sustainability. Effective rules can encourage investment, promote innovation, and improve market efficiency by offering a stable and transparent corporate environment. In addition to promoting the rise of income and employment, this economic dynamism also produces the funds required to meet social needs and fund environmental sustainability projects. The empirical results reveal a noteworthy and favorable indirect influence of the regulatory framework on sustainable development through economic growth mediation, with a coefficient value of.0002437 and a p-value of 0.003, indicating a balanced regulatory framework ultimately promotes sustainable development (Adedoyin et al., 2020). There is a partial mediation between the regulatory framework and sustainable development, as evidenced by the direct and indirect influences of the former on the latter. However, policymakers and authorities should prioritize the establishment of a balanced regulatory framework that fosters robust economic growth, placing particular emphasis on the principles of environmental, social, and economic sustainability.

Table 2: Indirect Effects

	Coefficient	OIM Std. Error	Z	P>|z|	[95% Conf. Interval]	
Structural						
EG <-						
RF	0	(no path)				
SD <-						
EG	0	(no path)				
RF	.0002437	.0000831	2.93	0.003	.0000807	.0004066

Table 3 shows the convergence of a direct impact, with a negative coefficient value of -.0082829, and an indirect impact, with a positive coefficient of.0002437, yields the total effect. It displays the total effect of the regulatory framework on sustainable development with coefficient value of -.0080393 (-.0082829 +.0002437), and the p-value is 0.000. This suggests that a more restrictive regulatory framework has a negative influence on sustainable development. However, because of the favorable indirect effect, the regulatory framework's direct impact on sustainable development offsets its total effect. To safeguard the well-being of present and future generations, policymakers should develop a

comprehensive package of policies that foster economic growth while prioritizing environmental, social, and economic sustainability (Zhang, 2016; Adedoyin et al., 2020).

Table 3: Total Effects

	Coefficient	OIM Std. Error	Z	P>|z|	[95% Conf. Interval]	
Structural						
EG <-						
RF	-.0399658	.0069042	-5.79	0.000	-.0534978	-.0264339
SD <-						
EG	-.0060972	.0017941	-3.40	0.001	-.0096136	-.0025809
RF	-.0080393	.0002746	-29.27	0.000	-.0085775	-.007501

Table 4 presents the results of the overall goodness of fit in which the Root Mean Squared Error of Approximation (RMSEA) value is 0.000, which is less than 0.05, suggests that the model is an excellent fit for the data. In addition to this, Tucker-Lewis Index (TLI) and Comparative Fit Index (CFI) values are 1.000 shows that the model is defined as a good fit for the specific data. The Standardized Root Mean Squared Residual (SRMR) value of 0.000, significantly lower than the threshold of 0.05, suggests an excellent fit in terms of residual variability (Jenatabadi, 2015).

Table 4: Overall Goodness of Fit

Fit Statistic	Value	Description
Population error		
RMSEA	0.000	Root mean squared error of approximation
90% CI, lower bound	0.000	
upper bound	0.000	
pclose	1.000	Probability RMSEA <= 0.05
Baseline comparison		
CFI	1.000	Comparative fit index
TLI	1.000	Tucker-Lewis index
Size of residuals		
SRMR	0.000	Standardized root mean squared residual
CD	0.668	Coefficient of determination

6. Conclusions

The present study presented that regulatory framework has an adverse impact on economic growth because strict regulations frequently hinder economic activities and innovation, which hinders the growth of the economy as a whole. Moreover, the research emphasizes that although economic expansion is essential for human development, it does not

consistently result in sustainable development. There is an unfavorable relationship observed between economic growth and sustainable development, indicates concentrated focus only on economic growth may unintentionally ignore the importance of social justice and environmental sustainability which ultimately reduce sustainable development. In addition to this, empirical findings reveal an inverse correlation between regulatory framework and sustainable development, indicates that due to strict set of regulations firms face higher compliance cost which hinder their capacity to invest in sustainable practices and innovation which have adverse effect on sustainable development. The promotion of sustainable development requires the establishment of balanced regulatory framework approach that effectively focus on economic, social and environmental sustainability equally. The study also highlights how economic growth mediates indirect influence of regulatory framework on sustainable development. The well-balanced regulatory framework promotes economic growth that ultimately make substantial contribution towards sustainable development by giving significant importance to environmental and social sustainability. The empirical results show that there is a significant and favorable influence of regulatory framework on sustainable development through economic growth mediation. Furthermore, the model's high degree of goodness of fit demonstrates the reliability and validity of the findings from the empirical investigation.

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