Comparative Analysis of GDP Per Capita, Logistic Performance, and Carbon Dioxide Emissions: A Case of SAARC Countries

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Abstract

This study investigated the association between economic growth, environmental sustainability, and social development in SAARC countries. The study uses robust and balanced panel data from 2008 to 2021. The advanced econometric techniques used for empirical analyses, specifically Dynamic Ordinary Least Squares (DOLS). It provided valuable observations on the relationships between economic and environmental factors. The independent variable logistic infrastructure, gross capital formation, labour force participation rate, and carbon dioxide emission significantly affect our dependent variable growth rate The study results showed that logistic infrastructure positively affected our GDP per capita. Similarly, LAB and GCF also directly impacted your GDP per capita while CO2 negatively impacted the GDP per capita of the projected economies. These findings suggest that policymakers must adopt holistic approaches that prioritize sustainable development goals, mitigate environmental degradation, and promote inclusive economic growth to ensure a prosperous and resilient future for all.

Introduction

Economic growth is a significant mechanism for generating employment opportunities, reducing poverty, and promoting living standards. Subsequently, it has become a primary focus of policy initiatives in third-world countries, particularly those with high poverty levels (Rahman et al., 2019). Within the South Asian region, poverty rates vary significantly among countries, with India showing the top occurrence of poverty, adopted by other nations in the area (World Bank, 2017). There are 17 Sustainable Development Goals (SDGs) charted in the 2030 Agenda, including comprehensive goals to address sustainable development's economic, environmental, and societal dimensions. (Abhiyan, 2017; Scholtz & Barnard, 2018). Many miscellaneous objectives of the jail include eradicating poverty and inequality, promoting inclusive economic growth, and protecting the environment. The SDGs are interdependent and emphasize the necessity of balancing financial, societal, and environmental considerations. Every government in this globalized world must work hard to minimize trade-offs between SDGs and their implementation (Scrucca et al. 2023; Aroro-Jonsson, 2023; Goubran et al., 2023).

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The continuous burning of fossil fuels and greenhouse gas emissions contribute to global warming and climate change. The state authorities must implement environmental sustainability policies to curb ecological degradation effectively (Liu et al., 2023). Various studies emphasized the need to examine social and environmental issues, noting concerns from communities and governments about the impact of global transportation and supply change operations (Yawar & Seuring, 2017). High pollution levels are associated with diseases such as asthma and lung functions and affect other human activities, especially society. Since the 1970s, global carbon emissions have increased by 90%, with fossil fuel burning and repaid industrialization responsible for about 78% of total CO2 emissions. The International Energy Agency (IEA) attributes carbon pollution primarily to electricity production (42%), transportation (23%), and industry (19%) (IEA, 2015). Global supply chains and transportation are heavily dependent on energy consumption. Therefore, transport sectors develop based on energy use. Various studies found a strong positive relationship between energy demand, logistics operations, and economic growth (An et al., 2021; Farooq et al., 2021).

Climate change significantly challenges the global social and environmental business environment, primarily due to the continued rise in CO2 and its potential impact on global warming and sustainability. The CO2 emissions necessitate collective efforts at international and regional levels, as more than individual actions are required (Kabir et al., 2023). Around 60% of the global population resides in Asia, with many dependent on fossil fuels for energy, leading to significant CO2 emissions. In the past two decades, emissions in the region have surged from 2002 to 5158 billion tons. As the World Health Organization reported, these emissions have dire consequences for human health, with approximately 2.4 million annual deaths attributed to air pollution in South Asia alone (WTO, 2023; Khezri et al., 2021). The region is experiencing increased temperatures, erratic precipitation, extreme weather events, and rising sea levels, all of which adversely affect economic growth and the lives of millions of people, particularly the impoverished. These impacts are not solely due to gradual changes but are exacerbated by more frequent and severe climate fluctuations, including floods, droughts, and hurricanes (Abbass et al., 2022; Zhang et al., 2022).

The South Asia region, buoyed by the South Asian Association for Regional Cooperation (SAARC), has expanded its global influence, fostering economic growth and social sustainability. Economic growth in South Asian countries has outperformed that of developing nations, with the World Bank reporting an increase from 6.2% to 7.5% between 2013 and 2016 (WTO, 2018). However, policymakers must prioritize setting sustainable long-term goals amidst continued growth, infrastructure, agriculture, and manufacturing investments. Rising temperatures, extreme weather events, and rising sea levels pose escalating challenges for the region. Despite these challenges, South Asian countries are reducing their dependence on limited land-based and non-renewable energy resources, with approximately 18% of energy now sourced from renewables. In particular, South Asia leads in renewable energy consumption compared to other Asian regions. Land and agriculture are vital for human livelihoods, supplying food, fresh water, and ecosystem services (Ikram et al., 2020; Khalili & Breyer, 2022; Yikun et al., 2021).

The SAARC countries, including Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka, have arranged sustainable development strategies since 1987, emphasizing the importance of regional cooperation focused on environmental challenges, including climate-related disasters (Anser et al., 2020). This study focuses on SAARC countries due to their significant population, with over 20% of the world's population residing in these nations, exposing 1.7 billion people to the risks associated with CO2 emissions (Chien et al. 2023). Despite efforts towards sustainability, fossil fuel demand continues to rise, driving economic growth. Non-renewable sources have substantially increased CO2 emissions, rising

by 6.26 and 7.45 billion metric tons between 1974 and 2014, and 2019 in Asian countries, respectively (Wang et al., 2023; IEA, 2019).
Climate change has adversely affected every sphere of the world and every human activity. The entire world trying to reduce the issue and save the future human. This study is also conducted on a regional basis and identifies those factors that adversely affect human activity. The study will be beneficial for policymakers and environmentalists.

Literature Review

Khan et al. (2019) examined the relationship between green logistics operations and the social, environmental, and economic indicators of SAARC countries. This study used GMM and FGLS methods to estimate heterogeneity, serial correlation, and heteroskedasticity. The study found that fossil fuel consumption is central to logistics operations, with increased use negatively impacting societal and environmental sustainability. They also found that poor transport infrastructure and logistics services are associated with higher fossil fuel practices, carbon emissions, and political instability. On the other hand, efficient customs procedures and better information sharing among supply chain partners enhanced trade opportunities and reduced carbon emissions. Therefore, green energy resources and practices mitigated negative social and environmental impacts while boosting economic performance, indicating that green logistics plays a crucial role in sustainable development for SAARC countries.
Sikder et al. (2024) They examined that the logistics industry, a strategic pillar of the Asian economic trade partnership, played a critical role in CO2 emission initiatives. They focused on the environmental risks associated with Asian free trade agreements and achieved global mitigation targets; evaluating the logistics sector's performance and carbon emission is essential. This study estimated that 16 countries within the Regional Comprehensive Economic Partnership and the SSARC used a balanced panel dataset from 2007 to 2018. The econometric approach GLS and GMM used. The study found that economic growth, foreign direct investment inflows, and international trade positively impacted logistics performance. The improved logistics services, efficient customs processes, and frequent shipments reduced transport CO2 emissions by 0.177%, 0.026%, and 0.014%, respectively. These results suggested that renewable energy sources mitigate the negative effects of logistics on carbon emissions while promoting economic growth and international trade.
Jain and Kaur (2023) examined the impact of Economic Freedom (EF), measured by government size and income inequality on environmental pollutants, alongside macroeconomic variables like per capita GDP and governance indicators. The study is based on the years 1981 to 2016 in Asian countries. The econometric method GMM used. The study results showed weak evidence for the Kuznets curve, suggesting that lower government size helped to reduce carbon emissions. A negative relationship exists between democracy and environmental quality, and greater income inequality is associated with higher emissions within a middle range of Gini coefficients. These results implied that smaller government interventions fostered sustainable green growth with equity, highlighting the need to reconsider the government's role in an era of liberalization and privatization.
Nayak et al. (2024) introduced the In-country Logistics Performance Index (ILP Index) by valuing and enhancing logistics competitiveness within emerging economies, specifically India. The outcomes showed that infrastructure quality, economic performance, and telecommunications were crucial for the logistics sector's growth. Gujarat, Tamil Nadu, and Maharashtra emerged as top performers, while Bihar, Jharkhand, Jammu, and Kashmir lag due to inadequate logistics infrastructure. This ILP Index offered a benchmarking tool for regional logistics capabilities, aiding policymakers and international investors in decision-making and promoting sustainable logistics practices.

Li et al. (2024) examined the importance of a robust low-carbon strategy for sustainable economic development in the BRIC region. The major cause of CO2 emission is rapid industrialization and international trade. It examined the relationship between energy, financial, and environmental sustainability in BRIC countries using a data envelopment analysis (DEA)-like composite indicator approach. The comprehensive indicators showed that China and Brazil lead in sustainability performance with an overall index score of 0.96. India ranks second with a steady score, followed by South Africa and Russia in fourth and fifth, respectively. The study found improved sustainability in the region and proposed enhanced cross-border trade in renewable energy to achieve long-term environmental sustainability.

Khan (2019) examined the relationship between green logistics indices and economic, environmental, and social factors in emerging Asian economies. This study used FMOLS and DOLS methods to examine endogeneity and serial correlation. The study results showed significant positive correlations between logistics operations, per capita income, manufacturing value-added, and trade openness. However, it also revealed a negative association between logistics operations and social and environmental issues such as climate change, carbon emissions, and human health impacts like smog and water pollution. Political instability, natural disasters, and terrorism further exacerbated economic and environmental challenges, particularly in regions with poor trade and logistics infrastructure. The study focused on the potential of renewable energy resources and green practices to mitigate these challenges without compromising economic growth.

In the past two decades, various studies conducted to examine the CO2 impact on growth worldwide. The region facing severe climate issues such as the African continent and other Asian regions. For this, variable logistic performance is not studied with labour participation rate on a regional base. For this purpose, this study is to fill the gap and add new literature as a contribution.

Methodology

Data Sources

Correct and true data is necessary for analysis. In this study, data used five variables: GDP capita, GDP per capita (constant 2015 US$ is a dependent variable), logistic performance index used proxy as a logistic infrastructure (LPIit), gross capital formation, labour force participation rate (LABit), and carbon dioxide emissions are explanatory variables the data period from 2008 to 2023. Parallel, the data was taken from the World Development Indicator (WDI). The study was conducted for the SAARC region. Through these variables and data period to evaluate explanatory variables on dependent variables.

Model Specification

GDP per capita = f(logistic infrastructure, Gross Capital Formation, Labor Force Participation rate, Carbon Dioxide Emissions)

Econometric Model

$GDPpc_{it}$ = f (LPI_{it}, GCF_{it}, LAB_{i}, $CO2_{it}$) $GDPpc = \alpha_i + \beta_1 LPI_{it} + \beta_2 GCF_{it} + \beta_3 LAB_{it} + \beta_4 CO2_{it} + \varepsilon_{it}$

Unit Root Test

A unit root test is used to stationary the data. Unit root test used in both data (time series and panel data. In panel data if time elements are higher than cross-sectional). A panel unit root test evaluates whether a unit root exists in the panel data. The Im-Pesaran-Shin (IPS) Test and the Levin-Lin-Chu (LLC) Test are frequently used in panel data. These tests, conducted in this study, help determine whether unit roots exist in the panel dataset, providing an understanding of the stationarity of the variables under consideration (Khan et al., 2023). The Levin-Lin & Chu (LLC) test, introduced by Levin and Lin in 1992 and expanded by Chu in 2002, extends the Dicky-Fuller unit root test. It consists of two steps to assess the stationarity of data. The first step allows for variation and lag coefficients of the dependent variable across different units, while the second step includes unit-specific time trends. This approach is valuable for analyzing divergence and lag coefficients within multiple units. The LLC test equation for the Augmented Dickey-Fuller (ADF) test statistic involves the first difference of the variable for entity I at time t, individual fixed effects, coefficient of time trend, coefficient of lagged dependent variable, coefficient on lagged differences, number of lagged differences, error term, and vectors of deterministic variables and coefficients for each model (Im et al., 2023)

Cointegration

Cointegration is a statistical concept indicating a long-term equilibrium relationship between two or more non-stationary time series variables. Even if individual variables are not stationary on their own, cointegration implies the existence of a stationary linear combination of these variables. Panel cointegration tests, such as the Pedroni, Kao, or Westerlund tests, evaluate the joint behavior of variables across entities and periods. These tests determine whether a linear combination of variables is cointegrated for the entire panel dataset. Panel cointegration suggests a common equilibrium relationship shared across the entities under consideration.

Pedroni Cointegration

The Pedroni cointegration test is a statistical method employed to assess cointegration in panel data, accounting for cross-sectional dependence and heterogeneity among entities. It expands upon the traditional Engle-Granger cointegration test to accommodate panel datasets. The test equation forms the basis of this analysis. The basic equation for the Pedroni cointegration test can be expressed as follows:

$\Delta Yit=\alpha i+\beta it+\delta iYi,\ t-1+\sum j=1p-1\gamma ij\Delta Yi,\ t-j+\epsilon it$

Where: ΔYit represents the first difference of the variable for entity and time t. αirepresents individual fixed effects. $\beta i$is the coefficient of the time trend. Therefore, $\Delta i$is the coefficient on the lagged difference of the dependent variable. Yit represents coefficients of lagged differences. P is the number of lagged differences, and ϵit is the error term. The Pedroni cointegration test (1999) examines long-term relationships between variables by considering their stationarity and unit root test results. Pedroni's approach incorporates various characteristics and individual outcomes in the context of panel data, accommodating cross-sectional interdependence. He developed seven cointegration tests, divided into the panel-v statistic and the panel rho-statistic. Some tests, such as the panel ADP test and the panel PP test, are part of the former group, while the remaining three tests extend beyond this dimension (Khan et al., 2023).

DOLS

Dynamic Ordinary Least Squares (DOLS) is an extension of the traditional OLS method, specifically developed to handle situations where variables exhibit non-stationary behavior. While conventional OLS regression assumes that variables are stationary (meaning their mean and variance remain consistent over time), economic datasets often contain variables with non-stationary patterns. This can lead to inaccurate regression results and interpretations. The main concept of DOLS is to transform non-stationary time series into stationary ones while preserving the fundamental long-term relationships between the variables (Raihan et al., 2023; Hardi et al., 2023).

Results and Discussion

Table 1: Residual Cross-Section Dependence (CSD) Test

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	16.40751	10	0.0885
Pesaran scaled LM	0.314728		0.7530
Pesaran CD	1.721127		0.0852
H0: No CSD (correlation) in weighted residuals			

Table 1 describes the outcomes of the residual CSD test. The test shows whether or not heteroscedasticity and residual CSD exist in the model. The H0 is no CSD in the residual, while HA exists CSD in the residual. The Pesaran Scaled LM and Pesaran CD tests show no CSD in the projected model because the probability value of both tests (0.7530 and 0.0852) exceeds the conventional significance level (at 5%), respectively. The Breusch-Pagan LM test also refers to evidence against the null hypothesis of homoscedasticity, with a relatively high probability value of 0.0885, indicating little heteroscedasticity. Overall, while there is some indication of potential cross-sectional dependence, the results do not strongly support the presence of either heteroscedasticity or cross-sectional dependence in the residuals. Thus, results show that there is no CSD in the existing model. When there is no CSD, move to the first-generation unit root test.

Table 2:Descriptive statistics

	$LNGDPpc_{it}$	LPI_{it}	$LNCO2_{it}$	LAB_{it}	GCF_{it}
Mean	7.350589	0.837598	3.004605	50.82996	1.6811
Median	7.247469	0.861097	2.888566	52.03000	4.1410
Std. Dev.	0.516383	0.209877	0.646819	5.937179	2.7711
Probability	0.243958	0.13215	0.332654	0.64216	0.0000
Observations	75	75	75	75	75

Descriptive statistics provide fundamental information about the data, such as central tendency and desperation. Means indicate the average value of the data. (Gul and Khan, 2021; Akhtar et al., 2020). The mean value of GDPpc is 7.350589, while the mean values of the logistics performance index (LPIit) and LNCO2 are 0.837598 and 3.004605, respectively. Similarly, the Labour (LABit) mean value is highest compared to other variables, while the GCFit mean is 1.6811. The variance shows the spread or dispersion of data from central values. High variability in the data shows high variance or high dispersion (Gul et al., 2023). The Labor force participation rate (LABit) has a slightly high variance of 5.937, which indicates a higher variance in the specific dataset. Therefore, the LPIitvariance has 0.2098 less variation and is close to the mean. The probability value shows that the given variable of the model is standard.

Table 3: Correlation

	LPI_{it}	$LNCO2_{it}$	LAB_{it}	GCF_{it}
LPI_{it}	1			
$LNCO2_{it}$	-0.588180	1		
LAB_{it}	+0.285729	-0.300130	1	
GCF_{it}	+0.635775	+0.564393	+0.196065	1

Correlation provides the specific relationship between variables, which supports theoretical frameworks by focusing on how changes in one variable are related to changes in another.

Parallel, it gives direction between two variables to help validate or refute the theoretical assumptions (Gul et al., 2023; Rehman et al., 2023). Table 3 shows the results of the correlation between the variables: Logistics Performance Index (LPIit), the logarithm of CO2it emissions (LNCO2it), labor force participation rate (LABit), and gross capital formation (GCFit). A moderate negative correlation between LPIit and LNCO2it indicates that higher logistics performance corresponds with lower CO2it emissions. Besides, weak positive correlations exist between LPIit and LABit and between LABit and GCFit, suggesting slight tendencies for labor force participation rates to increase alongside improvements in logistics performance and gross capital formation, respectively. Strong positive correlations are found between LPIit and GCFit, as well as between LNCO2it and GCFit, indicating that logistics performance and CO2it are associated with higher levels of gross capital formation. These conclusions provide valuable understandings of the interconnections among the variables, supporting theoretical frameworks and guiding further analysis and decision-making processes.

Table 4: LLC and IPS Unit root tests

	Level				**1st difference**			
	Intercept		Intercept & Trend		Intercept		Intercept & Trend	
Variable	**T-stat**	**p-value**	**T-stat**	**p-value**	**T-stat**	**p-value**	**T-stat**	**p-value**
$LNGDPpc_{it}$	2.463	0.99	-0.069	0.47	-2.189	0.01*	-4.056	0.00*
LPI_{it}	-2.077	0.01*	-3.112	0.00*	-3.625	0.00*	-4.715	0.00*
$CO2_{it}$	1.007	0.84	-8.135	0.00*	-5.824	0.00*	-15.21	0.00*
LAB_{it}	-0.742	0.22	1.355	0.91	0.398	0.65	2.774	0.00*
GCF_{it}	2.329	0.99	-0.852	0.19	-2.946	0.00*	-3.855	0.00*
IPS								
$LNGDPpc_{it}$	3.160	0.99	1.281	0.89	-1.155	0.12	-1.351	0.08***
LPI_{it}	-2.003	0.02**	-1.144	0.12	-1.769	0.03**	-1.053	0.14
$CO2_{it}$	3.794	0.99	-2.350	0.00*	-4.798	0.00*	-7.195	0.00*
LAB_{it}	0.252	0.59	0.527	0.70	-1.525	0.06***	-0.075	0.46
GCF_{it}	2.822	0.99	0.607	0.72	-1.973	0.02**	-2.026	0.02*

, ** and* indicates the stationary at 1%, 5% and 10% significant level respectively.*

Table 4 shows the outcomes of the LLC (Levin, Lin, & Chu) and IPS (Im, Pesaran, & Shin). Unit root tests are commonly used to calculate the stationarity of time series data. The results provided for each test include T-statistics and p-values for variables such as GDPpcit, LPIit, the logarithm of CO2it, LABit, and GCFit. In both LLC and IPS tests, the null hypothesis is that the series has a unit root, indicating non-stationarity, while the alternative hypothesis suggests stationarity. In LLC, LPIit and CO2it are stationary at a level under intercept and intercept and trend, respectively. While GDPpcit, LABit, and GCFit are non-stationary at the level, they are stationary at the first difference.

Table 5: Pedroni Cointegration test

Tests	Statistic	Prob.
P* v-S**	-4.081027	0.0000
P rho-S	-3.084768	0.0010
P PP-S	-6.945660	0.0000
P ADF-S	-4.234455	0.0000
G rho-S	-1.341459	0.0899
G PP-S	-2.496809	0.0063
GADF-S	1.859907	0.9686

P, S**, and G*** indicate Panel, Statistics, and group respectively. H0: No cointegration*

Cointegration is a concept that attracts attention from statisticians, econometricians, and economists due to its ability to confine the long-term relationships between variables. Various tests, such as the Pedroni Cointegration Test, measure Cointegration, particularly in time series and panel data analyses. In panel data analysis, commonly used tests include the Kao Cointegration Test. The Pedroni Cointegration Test evaluates the presence of Cointegration among variables (Khan et al., 2023). This test produces multiple statistics, each associated with p-values, crucial for assessing the null hypothesis of no cointegration. A common rule of thumb is to consider p-values below 0.05 as significant, indicating rejection of the null hypothesis and acceptance of the alternative hypothesis, suggesting that Cointegration exists among the variables. The table displays the outcomes of Cointegration among the variables in the specified model.

Table 6: Panel Dynamic Least Squares (DOLS)

DV	LNGDPpc			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LPI_{it}	0.080975	0.025957	3.119565	0.0033
$LNCO2_{it}$	-0.089266	0.039095	-2.283319	0.0277
LAB_{it}	0.123153	0.015157	8.125146	0.0000
GCF_{it}	0.045467	0.021227	2.141985	0.0390

Table 6 displays the outcomes of the Panel Dynamic Least Squares (DOLS) regression analysis. The model shows significant associations between projected variables such as GDPpcit, LPIit, LNCO2it, LABit, and GCFit. Therefore, LNGDPpcit is a dependent variable, while other explanatory variables are. The Logistics Performance Index (LPIit) shows a positive and statistically significant relationship with GDPPCit, indicating that higher logistics performance is associated with increased LNGDPpcit (Alnıpak et al., 2023; Jayathilaka et al., 2022; Karaduman et al., 2020). When 1 unit increases LPIit, the 0.08 index increases the GDPpcit of the specific region. On the other hand, the logarithm of LNCO2it demonstrates a negative but significant association with GDPpcit, suggesting that higher CO2it is associated with lower GDPpcit. Similarly, when CO2it increases by 1 unit, LNGDPpcit decreases by -0.08 percent in the same region. Parallel studies support the results and found a negative association between GDPpcit and CO2itin the same area. There are many reasons, such as low infrastructure, low education, high unemployment and inflation, and so on. Almost all countries in the region are developing countries (Pradhan et al., 2024; Selvanathan et al., 2021; Rahman et al., 2020; Parker & Bhatti, 2020; Afridi et al., 2019). Therefore, LABit is a robust predictor, showing a strong positive relationship with GDPpcit, indicating that an increase contributes significantly to higher GDPpcit. Additionally, GCFitshows a positive and statistically significant association with GDPpcit, indicating that higher levels of capital investment are linked with increased GDPpcit. These findings underscore the importance of logistics efficiency, labor force participation, and capital investment in fostering economic growth and development while highlighting the potential impact of CO2iton financial outcomes.

Conclusion

The study investigates the association between economic growth, environmental sustainability, and social development. Economic growth is extensively recognized as a mechanism for improving living standards, reducing poverty, and generating employment opportunities, particularly in third-world countries that struggle with high poverty rates. However, this growth often comes at the cost of environmental degradation, with the burning of fossil fuels and greenhouse gas emissions exacerbating climate change and posing significant risks to human health and economic stability. Efforts to address these challenges are underscored by international initiatives such as the Sustainable Development Goals (SDGs) and regional cooperation frameworks like the South Asian Association for Regional Cooperation (SAARC). These aim to balance economic development with environmental and social considerations, emphasizing the need for collective action and policy interventions at both global and regional levels. Furthermore, empirical analyses using advanced econometric techniques provide valuable insights into the relationships between economic, environmental, and social factors, highlighting the importance of logistics efficiency, labor force participation, and capital investment in driving economic growth while mitigating environmental impacts such as CO2 emissions. Overall, these findings underscore the imperative for policymakers to adopt holistic approaches that prioritize sustainable development goals, mitigate environmental degradation, and promote inclusive economic growth to ensure a prosperous and strong future for all. The study suggests, promoting sustainable economic growth while addressing environmental concerns, such as reducing reliance on fossil fuels and mitigating CO2 emissions. Therefore, make parallel government initiatives with international frameworks like the SDGs and regional cooperation agreements to ensure a balanced approach to economic, environmental, and social development.

References

- Abbass, K., Qasim, M. Z., Song, H., Murshed, M., Mahmood, H., & Younis, I. (2022). A review of the global climate change impacts, adaptation, and sustainable mitigation measures. *Environmental Science and Pollution Research*, *29*(28), 42539-42559.
- Abhiyan, W. N. T. (2017). Sustainable Development Goals: Agenda 2030. *India 2017: A Civil Society Report*.
- Afridi, M. A., Kehelwalatenna, S., Naseem, I., & Tahir, M. (2019). Per capita income, trade openness, urbanization, energy consumption, and CO 2 emissions: an empirical study on the SAARC Region. *Environmental Science and Pollution Research*, *26*, 29978-29990.
- Akhtar Gul, S. H., Ali, H., & Zahra, F. (2020). COVID-19 impact on poverty and unemployment levels: A case Pakistan. *Journal of Research and Reviews in Social Sciences Pakistan*, *3*(2), 879-893.
- Alnıpak, S., Isikli, E., & Apak, S. (2023). The propellants of the Logistics Performance Index: an empirical panel investigation of the European region. *International Journal of Logistics Research and Applications*, *26*(7), 894-916.
- An, H., Razzaq, A., Nawaz, A., Noman, S. M., & Khan, S. A. R. (2021). Nexus between green logistic operations and triple bottom line: evidence from infrastructure-led Chinese outward foreign direct investment in Belt and Road host countries. *Environmental Science and Pollution Research*, *28*(37), 51022-51045.
- Anser, M. K., Alharthi, M., Aziz, B., & Wasim, S. (2020). Impact of urbanization, economic growth, and population size on residential carbon emissions in the SAARC countries. *Clean Technologies and Environmental Policy*, *22*, 923-936.
- Arora-Jonsson, S. (2023). The sustainable development goals: A universalist promise for the future. *Futures*, *146*, 103087
- Chien, F., Sadiq, M., Li, L., & Sharif, A. (2023). The role of sustainable energy utility, natural resource utilization and waste management in reducing energy poverty: evidence from South Asian countries. *Utilities Policy*, *82*, 101581.
- Farooq, M. U., Hussain, A., Masood, T., & Habib, M. S. (2021). Supply chain operations management in pandemics: a state-of-the-art review inspired by COVID-19. *Sustainability*, *13*(5), 2504.
- Goubran, S., Walker, T., Cucuzzella, C., & Schwartz, T. (2023). Green building standards and the United Nations' sustainable development goals. *Journal of Environmental Management*, *326*, 116552.

- Gul, A., & Khan, A. W. (2021). The Effect of Small-Scale Industries on Employment Level in Pakistan. *Journal of Research and Reviews in Social Sciences Pakistan*, *4*(2), 1393-1404.
- Gul, A., Khan, S. U., & Abbasi, R. A. (2023). Vicious Circle of Health Expenditure: Time Series Evidence from Pakistan. *Journal of Contemporary Macroeconomic Issues*, *4*(1), 57-77. https://ojs.scekr.org/index.php/jcmi/article/view/99
- Gul, A., Sadiq, S., & Khan, S. U. (2023). Conflicts and The Structure of Economy: A Case of Trade in Pakistan. *Journal of Development and Social Sciences*, *4*(4), 23-42.
- Hardi, I., Idroes, G. M., Utami, R. T., Dahlia, P., Mirza, M. A. F., Humam, R. A., & Mahdani, R. (2023). Dynamic Impact of Inflation and Exchange Rate in Indonesia's Top 10 Market Capitalization Companies: Implications for Stock Prices. *Indatu Journal of Management and Accounting*, *1*(2), 51-59.
- Ikram, M., Zhang, Q., Sroufe, R., & Shah, S. Z. A. (2020). Towards a sustainable environment: The nexus between ISO 14001, renewable energy consumption, access to electricity, agriculture and CO2 emissions in SAARC countries. *Sustainable Production and Consumption*, *22*, 218-230.
- Im, K. S., Pesaran, M. H., & Shin, Y. (2023). Reflections on "Testing for unit roots in heterogeneous panels". *Journal of Econometrics*, *234*, 111-114.
- Jain, M., & Kaur, S. (2022). Carbon emissions, inequalities, and economic freedom: an empirical investigation in selected South Asian economies. *International Journal of Social Economics*, *49*(6), 882-913.
- Jayathilaka, R., Jayawardhana, C., Embogama, N., Jayasooriya, S., Karunarathna, N., Gamage, T., & Kuruppu, N. (2022). Gross domestic product and logistics performance index drive the world trade: A study based on all continents. *PloS one*, *17*(3), e0264474.
- Kabir, M., Habiba, U. E., Khan, W., Shah, A., Rahim, S., Patricio, R., ... & Shafiq, M. (2023). Climate change due to increasing concentration of carbon dioxide and its impacts on the environment in 21st century; a mini-review. *Journal of King Saud University-Science*, *35*(5), 102693.
- Karaduman, H. A., Karaman-Akgül, A., Çağlar, M., & Akbaş, H. E. (2020). The relationship between logistics performance and carbon emissions: an empirical investigation on Balkan countries. *International Journal of Climate Change Strategies and Management*, *12*(4), 449-461.
- Khalili, S., & Breyer, C. (2022). Review on 100% renewable energy system analyses—A bibliometric perspective. *IEEE Access*, *10*, 125792-125834.
- Khan, H. U., Khan, S. U., & Gul, A. (2023). The Dance of Debt and Growth in South Asian Economies: Panel ARDL and NARDL Evidence. *Quantic Journal of Social Sciences*, *4*(3), 112-123.
- Khan, M. Z., Khan, Z. U., Khan, A. U., & Gul, A. (2023). Unpacking Informality Dilemma in Private Equity Markets. *Journal of Applied Economics & Business Studies (JAEBS)*, *7*(2).
- Khan, S. A. R. (2019). The Effect of Green logistics on Economic growth, Social and Environmental sustainability: An Empirical Study of Developing countries in Asia.
- Khan, S. A. R., Jian, C., Zhang, Y., Golpîra, H., Kumar, A., & Sharif, A. (2019). Environmental, social and economic growth indicators spur logistics performance: from the perspective of South Asian Association for Regional Cooperation countries. *Journal of cleaner production*, *214*, 1011-1023.
- Khezri, M., Karimi, M. S., Khan, Y. A., & Abbas, S. Z. (2021). The spillover of financial development on CO2 emission: a spatial econometric analysis of Asia-Pacific countries. *Renewable and Sustainable Energy Reviews*, *145*, 111110.
- Li, H. A. O., Bhatti, Z., Abbas, Q., Ahmad, I. S. H. T. I. A. Q., Iqbal, N. A. D. E. E. M., & Aziz, B. A. B. A. R. (2024). Measuring low carbon energy, economic and environmental sustainability performance of BRICS. *The Singapore Economic Review*, *69*(01), 357-376.
- Liu, F., Su, C. W., Qin, M., & Umar, M. (2023). Is renewable energy a path toward sustainable development? *Sustainable Development*, *31*(5), 3869-3880.
- Nayak, N., Pant, P., Sarmah, S. P., & Tulshan, R. (2024). Development of in-country logistics performance index for emerging economies: a case of Indian states. *International Journal of Productivity and Performance Management*.

- Parker, S., & Bhatti, M. I. (2020). Dynamics and drivers of per capita CO2 emissions in Asia. *Energy Economics*, *89*, 104798.
- Pradhan, K. C., Mishra, B., & Mohapatra, S. M. (2024). Investigating the relationship between economic growth, energy consumption, and carbon dioxide (CO2) emissions: a comparative analysis of South Asian nations and G-7 countries. *Clean Technologies and Environmental Policy*, 1-19.
- Rahman, M. M., Saidi, K., & Mbarek, M. B. (2020). Economic growth in South Asia: the role of CO2 emissions, population density, and trade openness. *Heliyon*, *6*(5).
- Raihan, A., Muhtasim, D. A., Farhana, S., Rahman, M., Hasan, M. A. U., Paul, A., & Faruk, O. (2023). Dynamic linkages between environmental factors and carbon emissions in Thailand. *Environmental Processes*, *10*(1), 5.
- Rehman, R., Sadiq, S., Khan, S. U., & Gul, A. (2023). Long-Term Trends in Rainfall and Temperature Effects on Food Security in Pakistan: An Analysis of 75 Years (1947-2021). *Quantic Journal of Social Sciences*, *4*(3), 55-68.
- Scholtz, W., & Barnard, M. (2018). The environment and the Sustainable Development Goals:'We are on a road to nowhere. In *Sustainable Development Goals* (pp. 222-249). Edward Elgar Publishing.
- Scrucca, F., Ingrao, C., Barberio, G., Matarazzo, A., & Lagioia, G. (2023). On the role of sustainable buildings in achieving the 2030 UN sustainable development goals. *Environmental Impact Assessment Review*, *100*, 107069.
- Selvanathan, E. A., Jayasinghe, M., & Selvanathan, S. (2021). Dynamic modeling of inter-relationship between tourism, energy consumption, CO2 emissions and economic growth in South Asia. *International Journal of Tourism Research*, *23*(4), 597-610.
- Sikder, M., Wang, C., Yeboah, F. K., & Wood, J. (2024). Driving factors of CO2 emission reduction in the logistics industry: an assessment of the RCEP and SAARC economies. *Environment, Development and Sustainability*, *26*(1), 2557-2587.
- Wang, Q., Ali, A., Chen, Y., & Xu, X. (2023). An empirical analysis of the impact of renewable and non-renewable energy consumption on economic growth and carbon dioxide emissions: evidence from seven Northeast Asian countries. *Environmental Science and Pollution Research*, *30*(30), 75041-75057.
- Yawar, S. A., & Seuring, S. (2017). Management of social issues in supply chains: a literature review exploring social issues, actions, and performance outcomes. *Journal of Business Ethics*, *141*(3), 621-643.
- Yikun, Z., Gul, A., Saleem, S., Shabbir, M. S., Bilal, K., & Abbasi, H. M. (2021). The relationship between renewable energy sources and sustainable economic growth: evidence from SAARC countries. *Environmental Science and Pollution Research*, *28*, 33390-33399.
- Zhang, L., Xu, M., Chen, H., Li, Y., & Chen, S. (2022). Globalization, green economy, and environmental challenges: state of the art review for practical implications. *Frontiers in Environmental Science*, *10*, 870271.