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The Nexus of Energy, Finance, Governance and Remittances with Economic Complexity and Ecological Footprints in SAARC Economies

Nusrat Jahan Pria[1], Md Jobayer Alam[2], Abu Hurira[2], Md Juyel Rana[2], Md. Kamrujjaman[2], S. M. Rukaya Akhter[2], Md. Farid Dewan[1], Md. Golam Kibria[1]*, Imran Hossain[1]

[1]Department of Economics, Noakhali Science and Technology University, Noakhali, Bangladesh, [2]Management Information Systems, Lamar University, Beaumont, Texas, USA. *Email: kibria.econ@nstu.edu.bd

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ABSTRACT

This assessment delves into the intensity of SAARC's government effectiveness, financial development, renewable energy, remittances, and GDP on the country's ecological footprint and economic complexity. Data applied to the economic complexity (EC) and ecological footprint (EFP) model covers 1995-2021. Judging by the Discoll-Kraay Standard Error analysis, financial development itself and its indices, including financial Institutions and the financial market amplifies ecological footprint and economic complexity in the SAARC economies but unfortunately, elevation of ecological footprint is undesirable for the environment. Nevertheless, the economic complexity and ecological impact of SAARC are being heightened by government effectiveness, remittances, and GDP. Renewable energy increases economic complexity, despite its reduced EFP. Moreover, the interactions among government effectiveness, remittance and financial development have a positive influence on the both models. Evidently, the validity and credibility of the findings are confirmed by the Panel-Corrected Standard Errors (PCSE) and Feasible Generalized Least Squares (FGLS) model. The authority should continue stable financial institution and market, proper allocation of remittances, effective government duties to make sustainable economic enhancement.

Keywords: Renewable Energy, Financial Development, Remittance, Ecological Footprint, Economic Complexity, SAARC
JEL Classifications: Q42, G18, Q56, O31

1. INTRODUCTION

The significant changes in the global economy over recent decades have generated a dual landscape of opportunities and challenges for developing nations, particularly concerning economic advancement and environmental sustainability. Recent studies indicate that globalization and industrialization foster elevated levels of production and consumption, which serve as significant factors in environmental degradation and climate change (Ahmed et al., 2020; Ahmed and Wang, 2019). Concurrently, nations endeavor to enhance their productive capacities by transitioning towards more knowledge-centric and technology-focused economic frameworks that enable them to sustain competitiveness in the global marketplace (Mealy and Teytelboym, 2022). While certain developed nations have successfully adapted to evolving conditions and capitalized on the prospects of economic advancement, other regions, such as South Asian Association for Regional Cooperation (SAARC), have struggled to navigate these changes, facing mounting challenges in sustaining growth rates while safeguarding environmental integrity. Consequently, aligning growth with environmental conservation has emerged as a crucial concern in the contemporary global development agenda.

In today's increasingly complicated and globalized economic system, embracing innovative methods of production and value generation has become crucial to remain competitive on a global scale. Recently, a novel body of work on what is termed "economic complexity" (EC) has surfaced, highlighting the importance of enhancing productive capacities and diversifying product offerings as drivers of economic growth (Yalta and Yalta, 2021). EC denotes the quantity of knowledge that is embodied within the product system of an economy (Hausmann et al., 2014). The literature underscores that EC reflects the developmental stage of the economy, signifying its capacity to produce and export increasingly sophisticated products (Lapatinas, 2019). Hidalgo and Hausmann (2009) observed that GDP indicators merely represent the standing of each nation within the global economy; however, this singular metric fails to elucidate the trajectory by which each country attains this standing. Consequently, they developed the EC index, positing that a nation can only manufacture a specific product and establish its comparative advantage when it possesses certain capabilities.

South Asia has experienced numerous natural disasters, ranking it among the most susceptible regions worldwide, and has confronted significant climate changes in recent times (Mahmood et al., 2021). Nonetheless, there exists a substantial body of research worldwide dedicated to the analysis of environmental conditions through various proxies of pollution across temporal dimensions. The emission of greenhouse gases (GHGs) holds significant relevance (Baloch et al., 2019a). However, from the standpoint of sustainable development, a more comprehensive proxy, the ecological footprint (EFP), is increasingly employed to assess environmental risks and sustainability (Bello et al., 2018). Rees (1992) posits that EFP delineates the earth's carrying capacity, and given its intrinsic forward-looking aspect, it serves as a metric for sustainability as well. They assert that it represents the ability of a shared ecological space to generate the resources utilized by the participants in an economic activity, while concurrently possessing the capacity to assimilate the waste generated by those participants. Subsequently, this definition faced scrutiny from Wackernagel and Monfreda (2004). They assert that EFP quantifies the bio-capacity required for the functioning of an economic system.

Several factors have been identified as critical determinants of economic complexity and environmental quality, including innovation (Wang et al., 2024; Frenken, 2006), globalization (Ahmed et al., 2021), economic growth (Kongbuamai et al., 2021), remittances (Ali and Ali, 2024; Piras, 2023), institutional quality (Uzar, 2021; Li et al., 2024), foreign direct investment (Rahman et al., 2019; Mao and An, 2021), and financial development (Chu, 2020; Baloch et al., 2019). Despite the fast expansion of studies on these factors, the role of financial development in influencing economic complexity and environmental quality remains largely neglected. Only a limited number of studies (Karasoy, 2022; Nguyen and Su, 2021) have explicitly examined how financial growth facilitates nations' transition to more complex and sophisticated economic frameworks.

Financial development (FD) refers to the enhancement of financial systems, including financial markets, banks, and different financial intermediaries, in terms of quality, quantity, and efficiency. The output reflects the depth, accessibility, and efficiency of the financial system (Huang and Wang, 2017). FD is a crucial element for both development and ecological sustainability. In the realm of sustainability, FD enhances environmental quality by recruiting and facilitating environmentally friendly projects via research and development. It may also promote investment in clean technology. Investment in renewable energy grows, which is more environmentally beneficial and aids in reducing EFP. Likewise, FD may enhance economic efficiency by reducing capital risk and financial expenses. Furthermore, foreign direct investment (FDI) may stimulate research and development initiatives and investments in clean technology by expanding FDI inflows, stock market operations, and banking activities (Majeed and Mazhar, 2019).

Conversely, the financial sector bolsters industrial operations and infrastructure development, potentially stimulating economic progress (Baloch et al., 2019). In the pursuit of policies aimed at enhancing economic growth, nations often achieve elevated incomes, but at the expense of a rise in the EFP, since economic expansion escalates energy consumption, subsequently exacerbating environmental degradation (Ahmed and Wang, 2019). Furthermore, the increase in FDI, prompted by a robust financial system, significantly exacerbates environmental deterioration (Sarkodie and Strezov, 2019). Besides, there is a significant relationship between FD and economic sophistication. Firstly, it promotes investment in high-tech and innovative sectors by increasing enterprises' access to money. Complex systems in industrialized nations tend to focus on industries that rely on outside funding (Beck et al., 2018). To explain why businesses with limited access to capital often make subpar goods, Fan et al. (2015) provide the quality sorting model. Economic agencies in a financially developed nation are likely to have access to more affordable funding (Canh and Thanh, 2020), which should encourage them to invest more in research and development (Maskus et al., 2012) and innovation (Hsu et al., 2014) in order to raise the quality of their products. Secondly, enterprises' production capacity and export diversification are boosted by lessened liquidity limitations, which further increases economic complexity. Ebireri (2014) cites heterodox ideas that suggest financial liberalization might skew technical advancement, leading to less sophisticated exports and a decline in technological diversity. The growth of economic complexity, however, may be impacted by FD (Dutta and Sobel, 2018). The aim of this work is outlined as below:

a. To identify the intensity of financial development on economic sophistication and ecological footprint in the SAARC nations
b. To explore the influence of government effectiveness, renewable energy, remittance, and GDP on economic sophistication and ecological footprint
c. To reveal some significant policies that may confirm economic development with sustainability.

This study adds to the existing body of knowledge by comprehensively expanding previous research on the financial development, growth, and environment nexus for SAARC nations from 1995 to 2021. Firstly, in contrast to other time series or panel studies for SAARC nations that focused on a single response variable, our analysis included both economic complexity and ecological impact as dependent variables. Since EFP is the most cutting-edge environmental statistic, it is utilized in place of CO_2 and SO_2 emissions. It is also thought of as a good sign for the SDGs. Hence, the real-world situations will be investigated. EC, on the other side, compared to GDP, GNP, and other economic metrics provides a more thorough picture of a country's efforts to improve its knowledge-based productive capacity.

Moreover, this article uses the financial development index as an independent variable and for broader perspective it explores the impact of sub-indices of FD (financial markets and institutions) on EC and EFP separately. In addition, this study aims to provide a profound understanding by integrating various interaction effects on response variable. Furthermore, for econometric estimation of coefficients, we employ Driscoll-Kraay standard error (D-K SE) method because D-K SE is useful method for dealing with heteroscedasticity or longitudinal and serial dependence within the paradigm of fixed effects. PCSE and FGLS tests are also used here as a robustness test. Thus, this study will provide more accurate outcomes. Lastly, the policy directions are examined in relation to the Sustainable Development Goals (SDGs), which would be optimal for the SARRC nations to fulfill their commitments to these goals.

2. LITERATURE REVIEW

2.1. Impact of Financial Development, Remittance, Government Effectiveness, Renewable Energy, and Economic Growth on Economic Complexity

A study by Nguyen and Su (2021) showed that financial markets (FM) and financial institutions (FI) positively intensifies economic complexity (EC), with FI's influence being greater than FM's. Yu and Qayyum (2021) posited that a positive correlation exists between financial openness and EC across 120 economies from 1996 to 2016. Njangang et al. (2021) used GMM and D-K SE to examine the impact of FD on EC using a panel dataset including 24 African states spanning 1983-2017. The results show that the complexity of Africa's economy is growing in tandem with the development of the continent's financial sector. Geographical analysis shows that this effect has a smaller impact on states in Sub-Saharan Africa. Chu (2020) employed a system-GMM and a dataset of 94 economies to find a positive correlation between economic complexity and FD. Using data from 71 emerging economies between 1995 and 2019, Imam et al. (2025) analyzed the non-linear connection between FD and EC. FD improves EC only up to a point; this threshold effect is shown by the results of a dynamic panel threshold model. Once we pass this point, the level of EC decreases as a result of more FD. However, Aslam et al. (2022) revealed that financial development had a somewhat negative effect on EC. However, the impact was shown to be positive when the interaction term "institution" was included.

Remittances are recognized as vital to economic growth by enhancing household income and facilitating investments. It continually stimulates the economy positively. According to current evidence, Piras (2023) established a positive association among economic complexity, economic advancement, and remittances across 78 countries from 2006 to 2020. Saadi (2020) conducted an analysis regarding the influence of remittances on economic complexity, revealing a noteworthy positive correlation with the intricacy of products exported by emerging and developing nations between 2002 and 2014. Ajide and Osinubi (2024) looked at the role of migrant remittances and financial development as policy instruments for raising economic sophistication in Africa. The research analyzed panel data from 21 African nations from 1996 to 2017 using panel ARDL, a new technique of moment-quantile regression (MM-QR). Findings show that financial development and migrant remittances are powerful instruments for raising Africa's economic complexity level.

Additionally, Vu (2022) sought to establish a connection between EC and effective government institutions. Using data from as many as 115 nations, this research was able to quantify the favorable impact of GOE on EC with high precision. Using yearly data gathered from 1996 to 2021, Mini et al. (2025) estimated panel GMM regressions with 8 distinct metrics of governance quality for both linear and kinked regressions. Most indices of governance, institutional quality, and EC have a positive linear connection, according to the baseline estimates. An effort to investigate how good governance affects EC was made in the study by Hoang and Chu (2023). From 2002 to 2017, they used system GMM in 98 nations. A high quality of governmental institutions is positively associated with economic sophistication. According to Nguyen et al. (2023), who examined 89 nations between 2002 and 2016, trade openness, governmental entity quality, and internet growth are the main factors influencing economic complexity. However, in their study, Hartmann et al. (2017) discovered that EC is negatively impacted by political stability, but government effectiveness, regulatory quality, and voice & accountability show no significant impacts.

A country's EC determines how easy it is to ensure the energy infrastructure is efficient and transition to renewable energy. Increased investment in environmentally friendly technology leads to greater usage of renewable energy sources where economic complexity is efficient. So, it stands to reason that EC and REC are correlated. The short-run connection between the REC, GDP, trade openness, and industrialization across income-based groupings of countries from 1998 to 2021 is investigated by Anwar et al. (2024) using Granger causality. With the exception of low-middle income countries, they found that EC shows bidirectional causation among all the economies they looked at. Nonetheless, the desire for renewable energy sources verifies the two-way causation in all of the chosen economies. Additionally, Kartal (2024) investigated the connection between economic complexity and energy consumption in 25 EU member states and Türkiye from 1995 to 2020. Economic complexity and energy usage are inversely related, as they demonstrated. According to Lorente et al. (2023), renewable energy sources and EC are causally related, but only in one direction. When Adekoya et al. (2023) examined 94 countries, they found that EC impedes the transition to REC and energy efficiency.

In conclusion, in the context of EC and GDP nexus, Vinci and Benzi (2018) investigated the relationship between a country's economic fitness (EF) and its GDP. For moderately wealthy nations, they demonstrated, by use of the Takens' theorem, that

GDP and EF are causally correlated. This is unlike the situation in economically disadvantaged nations where there is no discernible correlation between EF and GDP. The correlation between EC and development was experimentally studied by Mao and An (2021). If the EC were to rise by only one point, middle- and high-income nations' levels of development might rise by almost thirty percent. Zhu and Li (2017) examined the effect of EC and human capital on GDP growth, and they used the reflections approach to evaluate EC in 210 countries. The complexity of high-income economies is greater than that of low- and middle-income economies, according to the measurement findings. The results show that both short-term and long-term growth are positively impacted by economic complexity and varying degrees of human capital. While there is a plethora of studies that look at how EC affects GDP, this one fills a gap in the literature by investigating how GDP affects EC. Focusing on the existed literature, this assessment formulates the following hypothesis:

Null Hypothesis (H_1): Financial development, remittance, government effectiveness, renewable energy, and economic growth do not influence economic complexity in SAARC nations.

2.2. Impact of Financial Development, Remittance, Government Effectiveness, Renewable Energy, and Economic Growth on Ecological Footprint

Numerous scholarly investigations have explored the correlation between environmental degradation and economic expansion, using various methodologies and characteristics in their examination of this subject. The literature offers two opposing viewpoints on the matter. One viewpoint asserts that an advanced financial sector may lead to resource consumption via multiple avenues, such as dependence on conventional energy sources, the hastening of industrialization, and detrimental environmental effects, notwithstanding its role in improving economic efficiency and significantly fostering national growth. The opposing viewpoint asserts that financial growth would alleviate environmental harm by increasing resources for research and development, together with foreign direct investment (Baloch et al., 2019; Ashraf et al., 2022). Yang et al. (2021) concluded that FD adversely affects environmental quality. Kihombo et al. (2021a) further stated that FD deteriorates ecological conditions by intensifying its environmental impact. Rahman et al. (2019) established a positive association between EFP and FD. Utilizing the ARDL approach, Saud et al. (2020) discerned a favorable correlation between EFP and FD. However, Majeed et al. (2019) demonstrated that all financial development indicators significantly enhance environmental quality by lowering ecological footprints.

Yadou et al. (2024) examined 30 African nations to determine the impact of remittances on ecological footprint from 2000 to 2021. According to the study's results, remittances accelerate environmental deterioration by raising the EFP. From 1990 to 2021, Ali and Ali (2024) found that REM enhanced EFP in Bangladesh. According to Meyer and Shera (2017), a surge in remittance inflows increases demand on financial institutions, which in turn may lead to a worsening of environmental degradation, even though remittances are known to be essential for economic development. In contrast, by using PMG-ARDL, Umair et al. (2023) revealed remittances have a negative impact on CO_2 and ecological footprint in Top 50 remittance-receiving countries between 1991 and 2018. Remittances have a positive influence on the environment in Pakistan, Sri Lanka, and the Philippines, according to Rahman et al. (2019), but only a tiny effect in India and China. Another study by Neog and Yadava (2020) examined the link between remittance and environmental sustainability during 1980-2014. Their finding revealed that negative shock of remittance enhances environmental degradation.

Recent scholarly inquiries have increasingly examined the significance of governance in shaping environmental outcomes, with mixed evidence across regions and methodological approaches. To reduce environmental deterioration, the government must successfully provide high-quality public services, implement policies, and enforce laws. In order to achieve ecological sustainability in the long run, many research show that strong governance systems are essential. For example, government effectiveness significantly improves the natural environment, according to a study by Li et al. (2024) that examined 152 countries between 2002 and 2018. They also stated that nations with strong systems of government have stricter environmental laws and run initiatives to encourage sustainable practices like renewable energy and careful use of resources. Similarly, the results of the study of Ahmad et al. (2021) also revealed that government effectiveness enhances environmental sustainability by influencing the relationship between economic complexity and ecological degradation. Uzar (2021) found that GOE lowers the EFP in E-7 nations based on the long-term estimates from the AMG and CCEMG estimators. According to Addai et al. (2024), in N-11 nations, the positive impact on environmental outcomes is caused by the efficiency of government institutions.

Energy use is seen as a driver for social and economic advancement, although it also has a notable effect on environmental conditions (Alola et al., 2019). Generating energy from green sources enhances environmental quality and supports sustainable development by not compromising the Earth's self-renewal capacity (Dogan et al., 2022). Destek and Sarkodie (2019) tried to find the associations between EFP per capita and green energy from 1977 to 2013 in 11 new industrialized countries. By employing the AMG estimator, they found that an increase in the REC reduces the EFP. A panel OLS and panel quantile regression approach was used in a research for the BRICS country between 2010 and 2014 by Cheng et al. (2019), which showed that using green energy sources increase environmental quality. Mujtaba et al. (2022) employed the NARDL and ARDL models to show the impact of rising REC on the environment in 17 OECD nations from 1970 to 2016, both models demonstrated that increased REC reduces the EFP. However, Danish et al. (2020) conducted a study in which they employed FMOLS and DOLS to explore the relationship among REC, urbanization, real income, and rent of natural resources in BRICS nations between 1992 and 2016. The findings of the investigations between EFP and REC revealed a positive association.

Expanding economies contribute to environmental degradation, particularly during the initial years of progress. The connection between GDP and its effects on the environment has been the subject of a great deal of study. For instance, Ahmad et al. (2022) conducted an analysis utilizing data from the G7 nations, covering the period from 1985 to 2017, to assess the relationship among environmental legislation, GDP, and EFP. The empirical findings of this study indicate that GDP promotes the advancement of EFP. Utilizing the augmented mean group (AMG) estimator for the timeframe spanning 1977 to 2013 across 11 newly industrialized nations, (Destek and Sarkodie, 2019) illustrated an inverted U-shaped relationship between GDP and EFP. Ashraf et al. (2022) discovered that the rising GDP growth rate has adverse effects on environmental health. Kongbuamai et al. (2021) established that economic development, renewable energy consumption, and industry positively correlate with the EFP in BRICS nations. In contrast, Imamoglu (2018) demonstrated that economic production enhanced environmental quality between 1970 and 2014, employing the FMOLS and DOLS methodologies. Table 1 reports the past works.

Focusing on the existed literature, this assessment formulates the following hypothesis:

Null Hypothesis (H_2): Financial development, remittance, government effectiveness, renewable energy, and economic growth do not influence ecological footprint in SAARC nations.

2.3. Literature Gap

Based on previous studies, it seems that the financing common in a country determines whether financial expansion promotes or diminishes EFP. Similarly, remittances may have both beneficial and negative effects on the environment. On top of that, several studies have shown different results for these selected parameters in terms of economic complexity. Research that independently investigates the intensity of financial development on EC and EFP is lacking. Little is known, however, about how the FD and its components affect EC and EFP. When dealing with datasets marked by autocorrelation or heteroscedasticity, the Feasible Generalized Least Squares (FGLS) method offers many benefits over traditional Ordinary Least Squares (OLS) regression, which is used in this work. By taking into account the unique features of the error structure, FGLS produces more accurate and efficient estimates in these settings, and it also shows how these selected parameters affect levels of quality of life over the long run. Unlike previous research, this one looks at how environmental and developmental regulations are really put into action in underdeveloped countries, where enforcement is often lacking. This study takes a look at a theoretical issue and gives policymakers some practical advice on sustainability.

3. COCEPTUAL FRAMEWORK

In the previous literature, no formal theory is available on the association between financial development, ecological footprint, and economic complexity. Notwithstanding, in recent times, studies such as Yang et al. (2021), Latif and Faridi (2023) and Rahman et al. (2019) have originated theoretical explanations about these selected variables. This framework can be useful in conceptualizing the linkages between financial development, environmental quality, and economic complexity in Figure 1.

When a country achieves its sustainability financially, it improves human capital and restructures its governmental institutions (Abaidoo and Agyapong, 2022). When government become more effective and institutions functions properly then it invests in green technology and rises the use of renewable energy that in return decrease the ecological footprint (Idroes and Hardi, 2024) and influence economic complexity (Anwar et al. (2024). But, when a country cannot utilize its fossil fuel excessively and mostly relies on green energy, it hampers the productive capacity and might lower

Table 1: Past literature

Authors	Period	Country	Method	Result
Impact of financial development, remittance, government effectiveness, renewable energy, and economic growth on ecological footprint				
Baloch et al. (2019)	1990-2016	59 Belt and Road countries	Driscoll-Kraay	FD↑EFP
Sun et al. (2023)	2000-2018	South Asian	CS-ARDL	FD∩EFP
Yadou et al. (2024)	2000-2021	30 African countries	Two-Stage Least Squares	REM↑EFP
Umair et al. (2023)	1991–2018	Top 50 remittance-receiving countries	PMG-ARDL, FMOLS	REM↓EFP
Ali and Ali (2024)	1990-2021	Bangladesh	NARDL	REM↓EFP
Sadekin (2025)	2000-2021	South Asia	ARDL, MMQR	REM↓EFP
Umair et al. (2023)	1991-2018	Top 50 remittance-receiving countries	PMG-ARDL	REC↓EFP
Sahoo and Sethi (2021)	1990-2016	Developing countries.	MG, AMG, and DCCE	REC↓EFP
Idroes and Hardi (2024)	1965-2022	Indonesia	FMOLS, DOLS	REC↑EFP
Azimi and Rahman (2023)	2000-2022	G20 countries	LIML	GOE↓EFP
Uzar, (2021)	1992-2015	E-7 countries	AMG and CCEMG	GOE↓EFP
Kongbuamai et al. (2021)	1995-2016	BRICS countries	DSUR	GDP↑EFP
Impact of financial development, remittance, government effectiveness, renewable energy, and economic growth on economic complexity				
Yu and Qayyum (2021)	1996-2016	Selected 126 economies	GMM	FD↑EC
Chu, (2020)	1968-2015	94 countries	GMM	FD↑EC
Njangang et al. (2021)	1983-2017	24 African countries	GMM and Driscoll-Kraay	FD↑EC
Yu and Qayyum (2023)	1996-2016	120 economies	GMM	FD↑EC
Piras (2023)	2006-2008	78 countries	Drisoll - kraay	REM↑EC
Ajide and Osinubi (2024)	1996-2017	21 African countries	MM-QR	REM↑EC
Li et al. (2024)	2003-2022	BRICS	Quantile Regression	GOE↑EC
Can and Ahmed (2023)	1990-2017	14 European Union countries	AMG, DOLS	REC↑EC
Canh and Thanh (2022)	1996-2014	70 economies	GMM	EC↑GDP

economic complexity as well as economic growth, especially in developing countries like Bangladesh and the Maldives. Besides, the revenue generated from a momentary sector such as remittance enhances the propensity for household consumption and savings, a phenomenon that has been empirically examined by (Azizi, 2020; Sobiech, 2019; Ngoma et al., 2021). De and Ratha (2012) claim that as aggregate demand rises, industrial production also rises. Although more manufacturing stimulates economic growth, it also raises energy consumption (Irons, 2019). The massive demand for energy use may be detrimental to the environment, according to Ahmad et al. (2022) and Yang et al. (2020). Conversely, as economic expansion progresses, the export basket gets increasingly broad and sophisticated, increasing economic complexity.

4. DATA AND METHODOLOGY

4.1. Data

This article uses a panel dataset of SAARC (Bangladesh, India, Pakistan, Nepal, Srilanka) countries over the period 1995 to 2021. The data on financial development are taken from the IMF, economic complexity is from ATLAS, ecological footprint is collected from Global Footprint Network (GFN), and all remaining variables are extracted from WDI (Table 2). Moreover, Figures 2 and 3 reveal the graphical representation of EFP and EC. Table 3 depicts the result of descriptive statistics.

4.2. Methodology

This article employs Driscoll-Kraay Standard Errors (DK-SE) model as T>N. Regarding the pre-diagnostic assessment, this paper applies slope heteroscedasticity and cross-sectional dependency (CSD) test. As the weight varies from country to country, it is necessary to check the slope heterogeneity problem when using panel data (Pesaran and Yamagata, 2008). Also, CSD test is application due to the heightened economic integration, decreasing trade barriers, and globalization (Bello et al., 2018). CSD needs to address for consistent and valid outcomes (Grossman and Krueger, 1995). CSD scheme is developed by Pesaran (2004). Moreover, multicollinearity, autocorrelation and heteroscedasticity tests are assessed in this article (Wooldridge, 2000). To identify whether the variance of the error term is constant or not, this study uses the Modified Wald test (Baum, 2001).

Accordingly, to figure out the stationarity of the model, this article employs the second generation unit root test of Cross-sectionally Augmented Dickey-Fuller (CADF) and Cross-sectionally Augmented Im-Pesaran-Shin (CIPS) tests which are developed by Pesaran (2007). In the evaluation, first generation unit root test is avoided due to its weak size property and tendency to over-reject the null hypothesis when CSD and slope heterogeneity are existed. However, this article uses the panel cointegration test proposed by Pedroni (1999). One major benefit of this approach is how

Figure 1: Conceptual linkage of this research

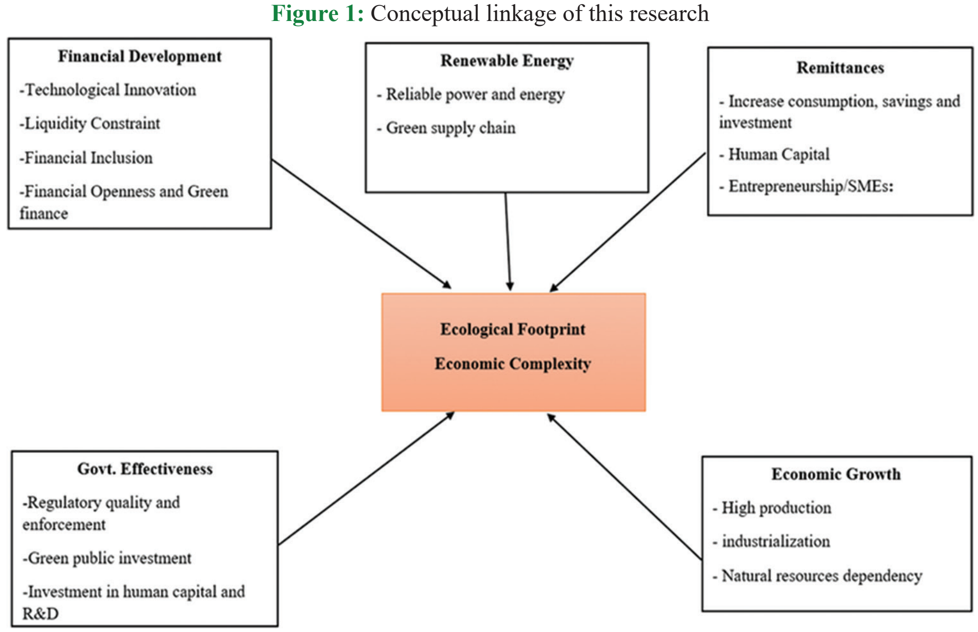


Table 2: Details of the variables

Variables	Synoptic terms	Descriptions	Source
Ecological Footprint	EFP	Ecological Footprint per person (Gha)	GFN
Economic Complexity	EC	Economic Complexity	MIT
Economic Growth	GDP	Gross Domestic Product (constant 2015 US$)	WDI
Renewable Energy	REC	Consumption of Renewable energy (% of total final energy consumption)	WDI
Remittance	REM	Personal remittances, received (% of GDP)	WDI
Financial Development	FD	Financial Development index	IMF
Financial Institutional Index	FII	Financial Institutional Index	IMF
Financial Market Index	FMI	Financial Market Index	IMF
Government Effectiveness	GOE	Government Effectiveness	WDI

GFN: Global Footprint Network

Figure 2: Ecological Footprint trend in SAARC countries

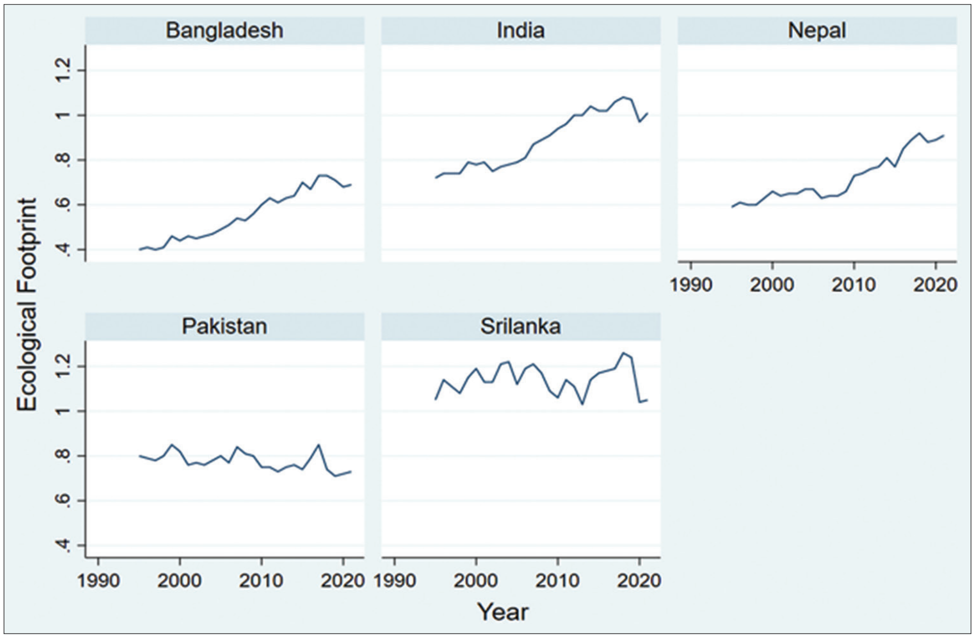


Figure 3: Economic Complexity trend in SAARC countries

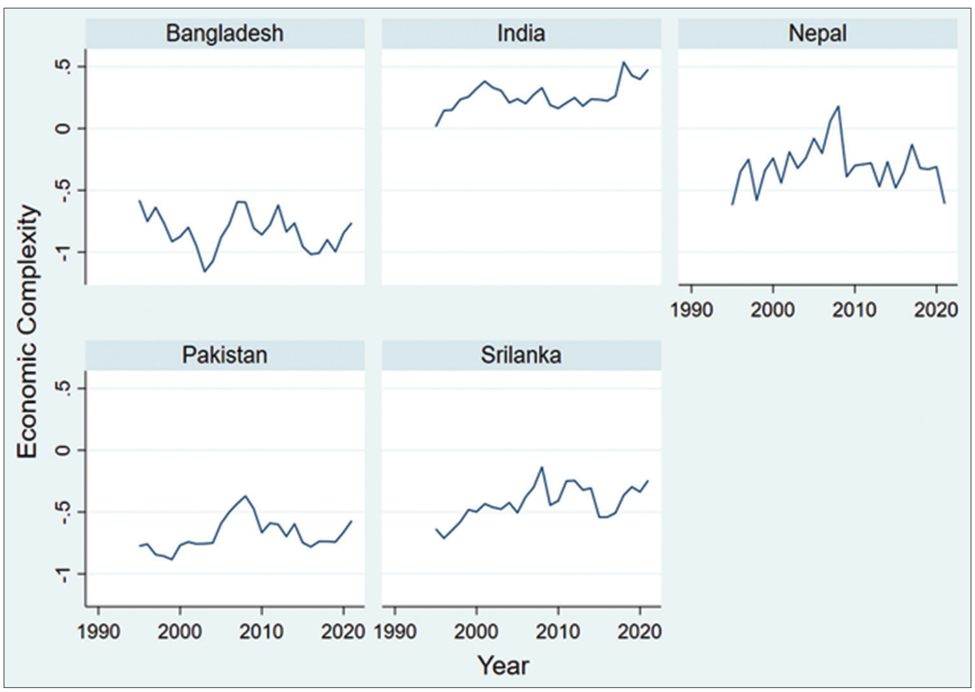


Table 3: Descriptive statistics

Variance	n	Mean	Max.	Min.	Standard Deviation	Kurtosis	Skew.	JB
EC	135	−0.394	0.5365	−1.157	4066	2.294	0.5243	8.98*
EFP	135	0.8167	1.26	0.400	0.2166	2.280	0.2133	3.93
GOE	135	−0.6193	0.374	−1.136	0.3621	2.506	0.7533	11.64***
REC	135	55.258	91.7	25	18.127	2.499	0.6742	11.64***
REM	135	7.3695	27.62	0.97665	6.387	5.3290	1.774	101.4***
GDP	135	1409.9	952.7	477.74	4495.7	5.8793	1.826	121.7***
FD	135	0.2577	0.5387	0.0694	0.112	2.596	0.7568	13.8***

well it hand les panel heterogeneity. Additionally, we employ the first generation Westerlund test (Westerlund, 2005) which takes slope heterogeneity and cross-sectional dependency in the panel into consideration.

Empirically, to investigate the intensity of FD, REM, REC, GDP, and GOE on EFP and EC, this paper uses DK-SE method developed by Driscoll and Kraay (1998). When used on large datasets with cross-sectional and temporal relationships, it proves to be quite useful. The methodology is suitable for long panels with temporal dimensions greater than cross-sectional dimensions, and it includes control for computing stand ard errors when autocorrelation and heteroskedasticity are present, as well as nonparametric estimation for reliable estimation in various situations (Sultana and Rahman, 2024). When compared to fixed-effects and pooled OLS approaches, Hoechle (2007) showed that it was better using Monte Carlo simulations. He emphasized that it consistently handled difficulties like autocorrelation, heteroscedasticity, and CSD well, and it did so even when missing data was present. Furthermore, in the presence of CSD, the Driscoll-Kraay estimator outperforms White's (1980) and Rogers' (1994) techniques in terms of simulation outcomes (Arellano and Bover, 1995). In addition, the DKSE estimator is applicable to balanced and unbalanced panel data, and it can hand le missing values as well. According to Khan (2021), the DK technique may be used to construct a stand ard error that counteracts CD in data by averaging the products of independent variables with residual, and then using the resulting values in a weighted HAC method. To make sure the findings are reliable and trustworthy, this research used the Driscoll-Kraay, as shown in Equation 1:

$$y_{i,t} = x_{i,}^{'} t^{\beta+\varepsilon_i} \cdot t \quad (1)$$

Where, i = 1………… N, t = 1……N. $y_{i,t}$ is the dependent variable (EFP and EC) and x_i, t denotes the explanatory variables (FD, REM, REC, GDP, and GOE).

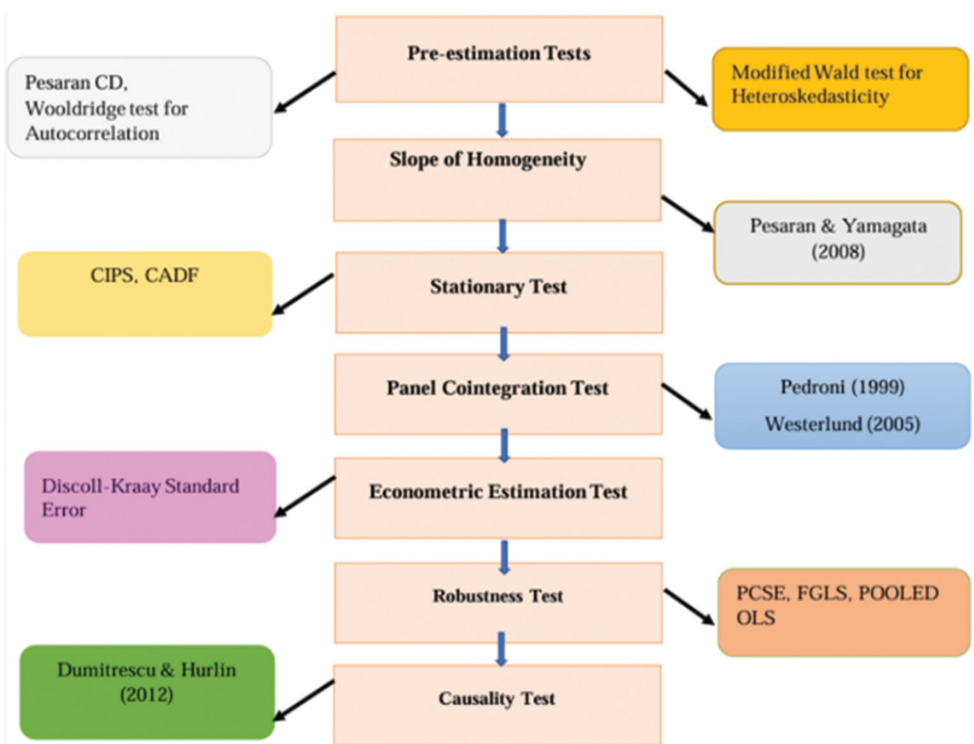
Future, this research uses PCSE and FGLS tests as a robustness check that proposed by Beck (2001) and Parks (1967), respectively. The PCSE method is typically employed to address the long-standing issues of heteroscedasticity and autocorrelation in panel data analysis, respectively. On the other hand, FGLS provides more robust parameter estimates when these complications are present, as it is an extension of the traditional Ordinary Least Squares (OLS) method. Moreover, when panel data shows sign of cointegration, it is crucial to determine the direction of causality. To determine the link among our relevant variables, we use the enhanced panel causality test developed by Dumitrescu and Hurlin (2012a) causality test, is used in this work. This is a result of taking the mean of all cross-sectional units and using the Wald test for non-causality. Figure 4 visualizes the methodological flow of the paper.

5. RESULTS AND DISCUSSION

This study tests the multicollinearity among the variables through VIF, and the results are shown in Table 4. The findings of this test shows that the value of mean VIF is 2.69 and all individual value of VIF is lower than 4.50, thus we can conclude that multicollinearity might not exist in this exploration.

The next section of this empirical study presents the findings from the tests for autocorrelation, heteroskedasticity, and CSD, as shown in Table 5. The findings show that there is no CSD issue for the model of EFP whereas the remaining model shows a CSD problem. A modified Wald test was used to investigate the heteroscedasticity issue further. Both models have an issue with variance changes, as shown by the results of the Modified Wald

Figure 4: Methodological flow



test. In addition, by using the Wooldridge test we identify the issue of autocorrelation for both model since the null hypothesis of no first-order autocorrelation is false.

Table 6 displays the findings of the test for slope homogeneity. The null hypothesis, which states that the slope coefficients are homogeneous, will be rejected since the P-value shows a significance threshold of 1%. Therefore, the coefficients are not uniform for both of the models.

Because of structural break problems and cross-sectional dependencies, first-generation unit root tests don't always yield reliable results; hence, we use CIPS and CADF, two second-generation unit root tests. The outcomes of these tests are shown in Table 7. While the other variables are stationary at first difference, the CIPS unit root tests demonstrate that EC is level stationary. The results of the CADF test reveal that none of the variables are stationary at the level, and with the exception of GDP, all variables exhibit stationarity characteristics at the difference.

Table 8 illustrates the findings of the cointegration tests. The results support the alternative hypothesis of long-term cointegration at the 1% significance level which states that GDP, FD, REC, GOE, and EFP all exhibit an equilibrium connection over time. Both experiments show that EC also has a similar equilibrium relationship over time.

Table 9 displays the results of DK-SE, with the P-values and coefficients of each variable. GOE has a significant coefficient value of 0.4583 at the 1% significance level, according to DKSE results, indicating that EC will rise by 0.4583 units for every 1-unit increase in GOE. The protection of private property, the encouragement of risk-taking business owners, and the enhancement of productive capacity are all goals of inclusive institutions. Coordinating the diversification of production capacities via the construction of new institutions and agencies is crucial for strategically unlocking the knowledge potential in the production process. Governance and institutional quality are key in this regard. Investments in human and physical capital, as well as creative activities, are mostly driven by well-functioning government institutions. Therefore, it is more likely that long-standing institutional features account for the large and consistent variations in economic complexity across nations. Results that are in agreement with our findings were also found by Hassanein et al. (2024), Li et al. (2024), and Vu (2022).

The results also reveal a positive correlation between EC and REC, which is statistically significant at the 1% level. A one-unit increase in REC will result in a 0.0123-unit increase in EC, according to the findings. REC growth generates new businesses such as solar panel manufacture, wind turbine building, and biofuel production, which broadens the economic base outside conventional sectors. This might explain the observed relationship. In addition, developing renewable energy sources increases nations' access to cutting-edge technologies by expanding our understanding of materials, improving energy storage, and improving grid management. This positive association is also supported by Anwar et al., (2024). Table 9 displays a strong positive correlation between EC and REM, suggesting that EC will grow by 0.180 units for every 1-unit increase in REM, and vice versa. The interaction term (GOE*REM) shows that government efficacy along with remittances become insignificant. If migrant remittances are invested productively, they help developing nations' economies grow; therefore, the positive impact seems reasonable. Additionally, remittances aid in the acquisition and adaptation of state-of-the-art technology, which boosts economic capacity by introducing innovation to the sectors in which recipient countries participate. Even though

Table 4: Multicollinearity test

Variables	VIF
FD	4.08
GOE	3.37
RME	1.94
GDP	1.30
REC	2.75
Mean VIF	2.69

Table 5: Result of CSD, heteroskedasticity, and autocorrelation tests

Dep. Var:	Tests	Statistics	P-value
EC	Pesaran CD	4.431***	0.000
	Modified Wald test for Heteroskedasticity	12.91**	0.024
	Wooldridge test for Autocorrelation	9.344**	0.0378
EFP	Pesaran CD	1.557	0.1195
	Modified Wald test for Heteroskedasticity	54.85***	0.0000
	Wooldridge test for Autocorrelation	38.709***	0.0034

Table 6: Result of slope homogeneity test

Slope homogeneity tests	Δ statistic	P-value
	Dependent Variable: EC	
$\check{\Delta}$ test	3.376***	0.000
$\check{\Delta}_{adj}$ test	3.922***	0.000
	Dependent Variable: EFP	
$\check{\Delta}$ test	8.06***	0.000
$\check{\Delta}_{adj}$ test	9.37***	0.000

Table 7: Result of Panel unit root test

Variables	CIPS		CADF	
	At Level	At Diff.	At Level	At Diff.
EC	−2.4895***	−2.489***	−0.599	−4.905***
EFP	−0.023	−6.574***	0.491	−4.971***
GOE	−0.4289	−6.532***	0.576	−5.222***
REC	2.0405	−13.371***	2.352	−2.803***
REM	0.1296	−5.607***	0.655	−2.357***
GDP	8.5203	−3.640***	0.812	0.054
FD	0.0916	−5.817***	0.241	−4.351***

Table 8: Result of cointegration test

Pedroni Cointegration	EC		EFP	
Estimator	Statistic	P-value	Statistic	P-value
Modified Phillips-Perron t	1.1457	0.1260	0.5973	0.2752
Phillips-Perron t	−2.6723	0.0038	−3.3222	0.0004
Augmented Dickey-Fuller t	−1.8481	0.0323	−3.7816	0.0001
Westerlund test				
Variance ratio	2.6937	0.0035	−1.5509	0.0605

Table 9: Outcomes of Driscoll-Kraay standard errors (Economic complexity)

	Driscoll-Kraay standard errors					
Variable	**1**	**2**	**3**	**4**	**5**	**6**
GOE	0.4583*** (0.001)	0.5560*** (0.000)	0.6875*** (0.000)			0.9972*** (0.000)
REC	0.0123*** (0.000)	0.0090*** (0.000)	0.0092*** (0.000)	0.166*** (0.000)	−0.0010 (0.675)	0.0047** (0.023)
REM	0.0180*** (0.001)	−0.0026 (0.555)	0.0302*** (0.000)		0.0121** (0.032)	
GDP	0.00008*** (0.000)	0.00001 (0.715)	0.0001*** (0.000)	0.0002** (0.027)	0.0001*** (0.000)	0.0001*** (0.002)
FD	2.931*** (0.000)			4.112*** (0.000)		
FII		3.745*** (0.000)				
FMI			1.402*** (0.000)			
GOE*REM				0.046 (0.100)		
GOE*FD					3.255*** (0.000)	
REM*FD						0.1671*** (0.000)
Constant	−1.800*** (0.000)	−1.601*** (0.000)	−1.202*** (0.000)	−2.459*** (0.000)	−0.181*** (0.006)	−0.449*** (0.000)
Observation	135	135	135	135	135	135

migrant remittances don't always cause economic complexity, they can boost an economy's ability to produce and diversify goods and services by fostering innovation, human capital creation, and higher levels of education. Others, such as Ajide (2022), Saadi (2020), Piras (2023), and Ajide and Osinubi (2024), have also shown a beneficial relationship between REM and EC.

The GDP coefficient exhibits a positive and small relationship with EC, suggesting an enhancement of 0.00008 units in EC for each unit increase in GDP. As a country's economy develops, its consumption and output levels rise, creating a sizable market. As a result, the fixed cost of introducing more complex sectors into economies is reduced. A more prosperous nation can afford to pour more resources into Rand D and infrastructure. In this way, a nation may produce a wider range of goods, increase its management expertise, and keep quality standards high. When a country's GDP is high, it can afford to invest in vocational training and contemporary technology, allowing it to mass-produce high-quality goods that boost exports. The observed positive connection is consistent with the findings reported by Vinci and Benzi, (2018). Finally, FD's coefficients reveal a strong positive correlation with EC, suggesting that a one-unit rise in FD will lead to a 2.931-unit increase in EC. When the two *sub*-indices of financial development (FII and FMI) are considered separately (DK-SE 2, DK-SE 3) the positive effect on EC is greatest for financial institutions, even though the effect is statistically significant for financial markets as well. This demonstrates the need for a wide-ranging and inclusive financial system in order to increase EC. A favorable correlation is also seen in the interaction term between FD and GOE. The observed positive relationship could be because developing a country's financial sector allows firms to engage in a wider variety of relatively complex productive activities, which in turn promotes a country's productive knowledge. Njangang et al. (2021), Chu (2020), and Yu and Qayyum (2021) all reach similar conclusions, which supports this research. Figure 5 exhibits the graphical presentation of the findings.

Table 10 shows the outcomes of the DK-SE where ecological footprint is incorporated as dependent variables. The coefficient of GOE indicates that 1-unit increase in GOE raises EFP by 0.173 units. Degradation of the environment in SARRC nations is therefore the fault of the GOE. Because high-income nations' policies are focused on the environment, an increase in governance performance leads to beneficial environmental consequences. On the other hand, developing countries prioritize economic development over environmental protection, which in turn increases the environmental resources extraction. Because better governance only benefits capital owners and investors looking to grow their investment prospects, it follows that any improvement in governance ultimately leads to environmental degradation. Similarly, research by Swain et al. (2020), Halkos and Tzeremes (2013), and Gök and Sodhi (2021) has shown that indices of governance and institutional quality have a detrimental impact on the environment.

The EFP is increased by 0.0076 units for every one-unit increase in remittance inflow, as shown by the coefficient of remittance, which is 0076. In addition, D-K (6) model shows REM*FD terms have shown a favorable effect on environmental deterioration for SARRC nations. This beneficial relationship is supported by several reasons. One possible explanation for the uptick in remittances is that more and more investment products and consumer durables are being used, which in turn causes more and more environmental damage. In addition, a large body of research suggests that remittances contribute to financial development by expanding access to credit, which is particularly helpful for businesses and industrialization. Therefore, remittances may indirectly lead to a rise in pollution levels as they help establish

Table 10: Findings of Driscoll-Kraay standard errors (Ecological footprint)

	Driscoll-Kraay standard errors					
Variable	1	2	3	4	5	6
GOE	0.17310*	0.2369**	0.2047***			0.2699***
	(0.063)	(0.029)	(0.008)			(0.000)
REC	−0.00291**	−0.0016	−0.0025**	−0.0045***	−0.00015	−0.0017***
	(0.011)	(0.144)	(0.017)	(0.000)	(0.794)	(0.000)
REM	0.0076**	0.0016	0.0025**		0.0044	
	(0.022)	(0.144)	(0.026)		(0.146)	
GDP	0.0001***	0.0001***	0.0002***	0.0001***	0.00020***	0.0002***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FD	0.5607**					
	(0.030)					
FII		0.3859				
		(0.414)				
FMI			0.3133**			
			(0.028)			
GOE*REM				−0.0021		
				(0.169)		
GOE*FD					0.7035***	
					(0.002)	
REM*FD						0.0615***
						(0.000)
Constant	0.2841*	0.4408**	0.3684***	0.0355***	0.5863***	0.5127***
	(0.058)	(0.015)	(0.004)	(0.001)	(0.000)	(0.000)
Observation	135	135	135	135	135	135

Figure 5: Graphical presentation of the intensity on EC

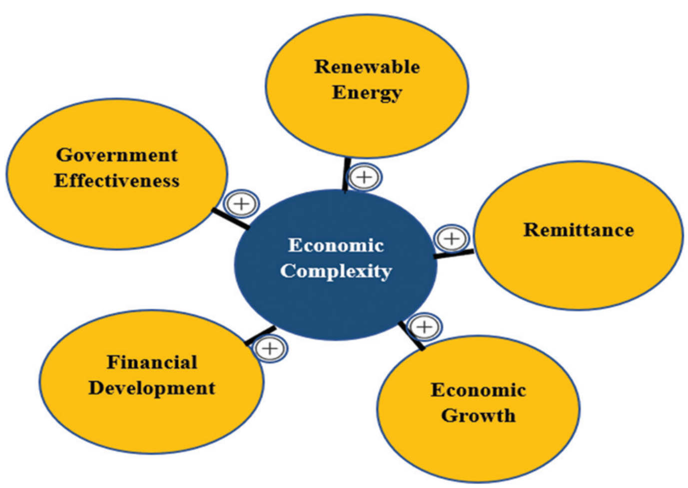
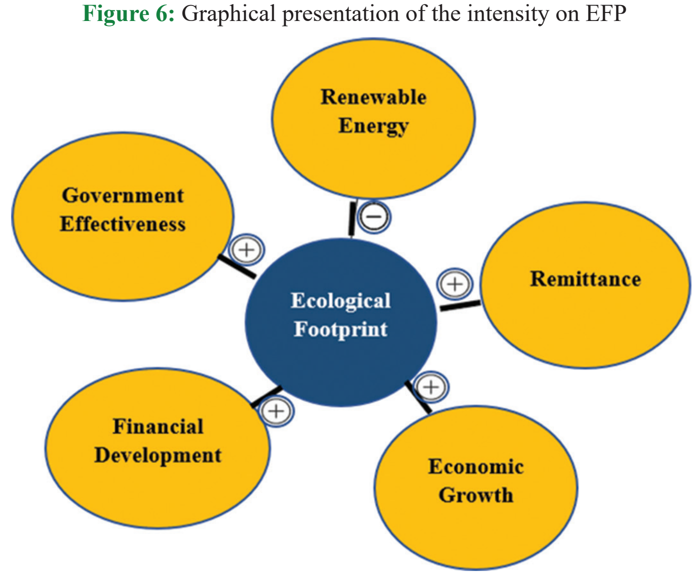


Figure 6: Graphical presentation of the intensity on EFP



new firms and expand old ones. The findings reported by Yadou et al. (2024), Ahmad et al. (2019), and Yang et al. (2020) are consistent with the found negative association. Conversely, Sadekin (2025) and Ali and Ali (2024) found instances when REM improved environmental quality.

Also, there is a positive correlation between GDP and EFP, suggesting that for every one-unit increase in GDP, EFP would rise by.0001 units. Potentially explaining the observed positive correlation might be the fact that economically stable countries are more likely to use their resources to their full potential, eventually depleting their biological resources. In addition, manufacturing has rapidly surpassed agriculture as the primary priority of SARRC nations. So, environmental degradation occurs as a result of activities related to manufacturing, such as production processes, using heavy machinery capable of burning large amounts of fossil fuels, producing electricity from coal and other fossil fuels, transporting goods from the production site to the end user in trucks that release carbon dioxide into the air through their exhaust pipes, and disposing of waste into water bodies. This study's conclusions are supported by previous research showing that nations experiencing rapid economic expansion often see a rise in environmental degradation (Kongbuamai et al., 2021; Ahmad et al., 2022; Alola et al., 2019).

A REC coefficient of −0029 indicates that for every 1-unit increase in REC, there is a 0.0029 unit drop in EFP. According to these results, the main cause of environmental deterioration is the use of conventional energy sources. By transitioning away from noxious fossil fuels and toward renewable energy sources, nations can meet their net carbon emissions goals more rapidly

Table 11: Robustness check

Variable	EC			EFP		
	FGLS	Polled OLS	PCSE	FGLS	Polled OLS	PCSE
GOE	0.4583***	0.4583***	0.4583***	0.1731***	0.2369***	0.1731***
	(0.000)	(0.000)	(0.000)	(0.000)	0.009	(0.001)
REC	0.0123***	0123***	0.0123***	−0.0029***	−0.0016	−0.0029***
	(0.000)	(0.000)	(0.000)	(0.001)	0.144	(0.001)
REM	0.0180***	0.0180***	0.0180***	0.0076***	0.0063***	0.0076***
	(0.000)	(0.000)	0.000	(0.000)	0.000	(0.000)
GDP	0.0001***	0.0002***	0.0001***	0.001***	0.0001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FD	2.9315***	2.9315***	2.9315***	0.5607***	0.3859	0.5607***
	(0.000)	(0.000)	(0.000)	(0.001)	0.414	(0.001)
Constant	−1.800***	−1.800***	−1.800***	0.2841***	0.4408***	0.2841***
	(0.000)	(0.000)	(0.000)	(0.003)	(0.015)	(0.003)
Observation	135	135	135	135	135	135

(Breyer et al., 2023). The abundant sunbelt in South Asia accounts for a large portion of the region's REC, particularly solar power. Businesses and people in South Asia have made the switch to RE sources like solar photovoltaics as their cost drops relative to fossil fuels. Government subsidies to businesses and investments in RE sources like wind and solar might speed up the transition if the necessary funds were made available. In light of these results, a more effective and all-encompassing strategy to decrease EFP is necessary to achieve environmental sustainability in South Asia. Other studies have reached the same conclusion; for example, Donkor et al. (2025), Ulucak and Khan (2020), Doğan et al. (2021), and Destek and Sarkodie (2019).

Finally, there is a favorable correlation between EFP and FD in the DK-SE results as well. Since financial institutions and markets provide a wealth of capital to people and companies in SARRC nations, FD heightens EFP since environmental regulations do not exist to regulate the ecological consequences of this capital in developing countries. When companies take on more projects, they use more energy, land, and water. Construction of massive infrastructure projects—including roads, seaports, buildings, and railways—which take up a lot of space and use a lot of resources, is likely to amplify this impact. Unfortunately, the SARRC nations aren't exactly known for their ecologically friendly FD practices. As a result, their economies are being ravaged by profit-driven financial institutions and markets. The results of Majeed et al. (2019), Kihombo et al. (2021a), Baloch et al. (2019), Ashraf et al. (2022), and Rahman et al. (2019) are consistent with this discovery. Figure 6 exhibits the graphical presentation of the findings.

We employ three distinct robustness tests—FGLS, Pooled OLS, and PCSE for the dependent variable economic complexity and ecological footprint—to verify the validity of our earlier study. Table 11 shows the results of these tests. GOE, REC, REM, GDP, and FD are positively correlated with EC according to FGLS, Pooled OLS, and PCSE estimates. All three tests also demonstrate that the coefficients are statistically significant, with a significance level of 1% or above. In the context of EFP, on the other hand, GOE, REM, GDP, and FD all of the variables decrease environmental quality whereas REC works in opposite manner. Therefore, the outcomes of PCSE, FGLS, and Pooled OLS are in the same direction as the D-K SE baseline regressions.

Table 12: Result of D-H panel causality test

Null Hypo.	W-bar	Z-bar	Z-bar tide	Decision
EFP≠FD	1.966	2.263***	2.095***	Bidirectional
FD≠EFP	2.469	5.741***	6.501***	
EFP≠GOE	0.926	3.115***	2.226***	Unidirectional
GOE≠EFP	1.455	0.720	0.483	
EFP≠REC	5.281	6.725 ***	5.631***	Bidirectional
REC≠EFP	3.386	4.534 ***	3.893***	
EFP≠REM	2.831	2.137***	3.987***	Unidirectional
REM≠EFP	1.722	1.142	0.841	
EFP≠GDP	1.610	5.690***	4.554***	Bidirectional
GDP≠EFP	3.672	3.968***	3.132***	
EC≠FD	3.067	3.268***	2.645***	Bidirectional
FD≠EC	3.684	4.243***	3.473***	
EC≠GOE	1.247	0.4362	0.2423	Unidirectional
GOE≠EC	3.463	3.895***	3.177***	
EC≠REC	1.139	2.220	3.059	Unidirectional
REC≠EC	0.550	0.710	0.7303	
EC≠REM	1.322	0.509	0.3042	Unidirectional
REM≠EC	2.084	2.714***	1.927**	
EC≠GDP	3.977	3.034***	2.157***	Bidirectional
GDP≠EC	1.728	2.429***	3.492***	

In Table 12, the findings of D-H causality test show a two-way causation between EFP and REN, since the null hypothesis is ruled out in both instances. A similar causal relation also found between EC and GDP; EFP and FD. However, the remaining relationship shows unidirectional causal relationship. Furthermore, EC shows a two-way relationship with FD and GDP and a one-way causal relationship with GOE, REC, and REM.

6. CONCLUSIONS AND POLICY SUGGESTIONS

The objective of this article is to identify how GDP, REC, GOE, REM, and FD influence society's ability to produce specialized, knowledge-intensive goods and environmental quality in SAARC countries. The findings confirm that EFP and EC are affected differently by various factors. One way in which good governance, REM, GDP and FD contributes positively to both EC and EFP. However, REC has a negative impact on EFP. This paper also employs PCSE, FGLS and Pooled OLS to check the validity and found similar result to DK-SE method. Finally, the D-H causality test reports a bidirectional causality between EFP and REC; EFP and GDP; EC and FD; EC and GDP, and remaining variables show a unidirectional relationship.

This article unveils a good policy finding for the government and decision-makers to address the environmental contamination with targeted and synchronized efforts. The empirical results led to the following policy recommendations:

a. Our research shows that economic activities reduce environmental quality but increase EC. The SAARC area's authorities should, therefore, put an emphasis on the manufacturing sector. Green technology-based equipment should be integrated into the manufacturing process to increase production while also protecting the environment. To safeguard the planet's environment, it is optimal to promote a recycling system within the production process.
b. The government must be more flexible with its immigration policies; this would make it easier for people to leave the nation with the right paperwork, which will reduce the number of cases of illegal travel. In addition, the government has to take the initiative and plan how to maximize the remittances sent back by the diaspora. In terms of environment quality, government should import more sophisticated technology itself and encourage other private organizations since remittance improve BOP, which in return make import cheaper and affordable through increasing the value of currency.
c. Given that renewable energy has the potential to enhance environmental quality with maintain high EC, so policymakers need to prioritize its use in mitigating the environmental damage caused by energy consumption—primarily from fossil fuels like oil, fuel, and coal. Moreover, government and others organizations should provide any cash and non-cash incentives to those sectors who are on considering environmental issues. The government may provide households with interest rate discounts, reimbursements for taxes, and subsidized loans to purchase goods that would utilize renewable energy in everyday life.
d. Similarly, by considering government effectiveness, legislators may implement measures like digital single windows to ease commerce, create strong competition regulations, and supervise the administration of state-owned enterprises (SOEs). On a weekly or monthly basis, legislators also give subsidies and incentives to investors, discover green nearby goods, and deal with renewable energy and economic complexity in an appropriate way.

Regarding the limitations of the article, the scholars may incorporate the environmental sustainability index (ESI) to promote environmental degradation. While this study uses a specific area and time period, there is room for future research to investigate the effects of other factors over a wider range of locations and time periods. Future attempts need to investigate BRICS, G7, or E7 nations instead of SAARC. Moreover, ECI+ is another useful metric that researchers might utilize in the future.

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