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RESEARCH ARTICLE

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Investigating the Impact of Environmental Policy Stringency on Renewable Energy Consumption

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Abstract: This study investigates the impact of stringent environmental regulations on the adoption and expansion of renewable energy across twelve Asian countries over the period 2012 to 2021. The primary objective is to assess whether stronger regulatory frameworks contribute to a transition toward cleaner and more sustainable energy sources. The empirical findings reveal a significant and positive relationship between environmental laws and renewable energy utilization, indicating that stricter regulations encourage investments in green technologies and reduce reliance on fossil fuels. These results suggest that well-designed environmental policies can serve as effective instruments for promoting sustainable energy transitions in developing and emerging Asian economies. Furthermore, the findings are consistent with prior empirical and theoretical research, reinforcing the argument that regulatory pressure plays a crucial role in accelerating renewable energy adoption. Overall, the study highlights the importance of policy-driven approaches in achieving long-term environmental sustainability and energy security in the Asian region.

Keywords: Environmental Policy Stringency, Renewable Energy Adoption, Sustainable Energy Sources

Introduction

The need to curb CO_2 emissions has resulted in a significant rise in government as well as non-government spending on energy transition initiatives (ETIs) recently. Over the past fifteen years, the private sector has developed new methods for financing efforts to adapt to and mitigate climate change. According to Rehman et al. (2024), the stringency of environmental policies (EPS) is defined as the amount to which governments utilize policies to limit carbon emissions and other detrimental activities, as well as the promotion of renewable energy. In other words, the EPS measures the degree to which governments prioritize the development of renewable energy.

Environmental issues are becoming a common occurrence. Issues such as global warming, depletion of energy resources, and overuse of natural resources are posing threats to the environment and the health of the world. The environmental problems that the world is facing have become more complicated in recent years. Even though there are a number of factors that have contributed to the problem, the use of different energy resources, particularly fossil fuels, can be said to be the cause of environmental problems. The mining, processing, and use of different energy resources lead to air pollution, which is the main cause of climate change. The primary driver of climate change and global warming is the usage of fossil fuels, which releases various pollutants and dangerous substances into the atmosphere.

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The empirical analysis of the economic impacts of environmental policies is becoming more and more reliant on the challenge of capturing stringency. Stringency is linked to policy instruments and environmental policies overall, as pollution and other harmful activities contribute to associated costs. However, the challenge of capturing this variable has continued to hinder the efficiency of cross-national studies.

The research that has already been conducted reveals that there are certain gaps in the research. One such gap is that the research fails to consider the relationship between environmental regulations and the development of renewable energy. Rather, it considers the overall environmental impacts. The second limitation is that a significant number of empirical studies do not conduct cross-national comparisons over an extended period of time, which restricts the generalizability of the results. The third limitation is that research frequently fails to adequately examine the connections between country-specific variables and various environmental policies.

Through the examination of the impact of globalization on the achievement of the zero-carbon objective, taking into consideration technical patents and the level of environmental legislation throughout the green transition, the purpose of this study is to provide a bridge between the current body of literature and the knowledge gap that exists. This study makes use of the theoretical framework known as Stochastic Impacts by Regression on Population, Affluence, and Technology (STIRPAT) in order to provide a fresh viewpoint on the connection between political globalization and the participation of technology and policy in the process of attaining the energy transition.

Previous studies have shown that earnings per share (EPS) doesn't directly affect renewable alternatives. The reason is that other countries have their ways of formulating and putting into practice policies.They may also have different levels of support structures, such as the availability of infrastructure for the power grid or funds for new ideas. It seems that there is a lack of research on the relationship between earnings per share (EPS) and the use of renewable energy resources. The current state of literature is primarily concerned with more general topics related to the environment, such as innovation and carbon emissions, and not with the link between financial performance and the use of renewable energy resources. Therefore, the relationship between the use of renewable energy resources and the effect of stringent environmental policies on their development has remained unclear. Hassan et al. (2024) recognize the absence of such research and encourage further studies to develop models that are tailored to suit the utilization of renewable energy resources, using data and policy indicators that are applicable to different categories of renewable energy resources. In this study, the authors have attempted to empirically investigate the relationship between the uptake of renewable sources of energy among the OECD countries and the severity of environmental laws put in place to curb environmental problems. The major aim of this research is to identify if there is a recognizable relationship that exists between the strictness of environmental laws and the rising usage of renewable energy. The expected outcomes of this study are sure to play a pivotal role in providing policy makers with great benefits.

This study will assist the nations, which are members of the OECD, to explore alternative energy sources, lessen their intake of fossil fuels, and seek improved methods of addressing climatic change.

1. What is the impact of being tough on environmental policy as far as the production of renewable energy is concerned?
2. The second goal is to look into how strict environmental policies affect the use of renewable energy.

The purpose of the study is to contribute to the body of research that has been evolving hitherto, through exploring how demanding environmental policies affect the uptake of renewable energy in OECD member countries. Studies carried out in different nations nowadays have not clearly established whether strict environmental laws are associated with the slow uptake of renewable energy. This paper will address a considerable gap in the literature. It will thoroughly analyze the effects of various levels and forms of policy stringency on the outcomes of energy transition, starting with general theoretical frameworks down to

empirically tested outcomes (Fatima et al., 2024). Findings of this study will be important in promoting this goal.

The importance of this research is that it will give OECD countries a chance to learn how to make evidence-based policies that will help them switch to a sustainable energy system. This study looks into how strict environmental rules affect the use of renewable energy. The findings will provide us with valuable insight into how various policies operate, and how effective and strict they should be in order to move people towards using more renewable energy. More studies on this topic and provide people with valuable information with which to continue the debate on whether environmental policies influence a shift in the sources of energy may also begin with the results.

The key aim of the study is to explore the influence of stringent environmental regulations on renewable resources across a range of twelve Asian countries during a 9-month period of 2012-2021. Countries covered in this study are Thailand, Philippines, Pakistan, Malaysia, the Maldives, Lebanon, the Kyrgyz Republic, Jordan, Japan, India, Israel and Iraq. In this work, I attempt to examine the importance of matching policy interventions by emissions and I contend that high-emission countries and developing countries must adopt the European Union approach to the reduction of emissions in order to deliver superior outcomes.This research utilizes sophisticated econometric techniques, including the Driscoll-Kraay (DK) method, correlation matrix, descriptive statistics, and the Feasible Generalized Least Squares (FGLS) approach, to analyze the relationship between sustainable economic growth and the identified variables.

Literature Review

Li et al. (2022) examine how environmental policy stringency (EPS), solar energy, and climate technologies affected environmental sustainability in OECD nations between 2001 and 2018. Although economic development is the principal driver of environmental deterioration, its outcomes may have a long-term beneficial effect on environmental challenges and ensure environmental sustainability. Azam (2024) has not yet explored the influence of environmental policy stringency, technical innovation, FDI, and environmental innovation on the process of the energy transition. Quantile regression techniques are applied to analyze the newly industrialized nations (NICs) from 2000 to 2021. Our research results reveal that FDI has a positive and significant influence on the process of the energy transition. According to Chen et al., the ongoing rise in environmental degradation, which is primarily brought on by the use of nature for both non-economic and commercial purposes, is an issue facing the world economy. The years 1990 to 2022 are covered in this paper. The results reveal that digitization, renewable energy, and environmental technology have a positive influence on the environment.

Alalmaee (2025) proposes using Ordinary Least Squares (OLS) and Fixed Effects (FE) models to analyze the dynamic interaction between financial systems and environmental policy. This research analyzes the correlation between the financial development of 40 nations from 1990 to 2021 and their environmental policies. According to our results, strict environmental policies significantly and positively affect financial development, with their main channels being the deepening and efficiency of financial markets. Alatrash, Bein, and Samour (2025) investigate the moderating effect of environmental sustainability (ES) on the relationship between green growth and green investments (GI). The data was collected between 1990 and 2019. By analyzing the consolidated data set, we found that investments and innovations in the green economy have a significant positive impact on green growth. The data indicates that the impact is significant.

According to Rehman et al. (2024), "efficacy of environmental policies (EPS)" is the level of success that the government has achieved in implementing policies that limit the emissions of carbon and other harmful activities while promoting the use of alternative energy. According to Dale et al. (2016), energy that comes from natural resources such as the sun, wind, water, tides, the oceans, and geothermal can be replenished within a significant timeframe in relation to human activity. Khan et al. propose that societies transition from one primary energy source to another due to advancements in science, economic development, and environmental changes. Individuals globally are undergoing this transformation. Regulations that promote

environmental sustainability can be positive in that they can raise the cost of unfavorable sources of energy and make alternative sources of clean energy more attractive, hence encouraging a move towards clean energy sources to reduce a nation's carbon footprint, an aspect that can contribute to a reduction in climate change.

In order to investigate how Green Innovation (GI) and Environmental Policy Stringency (EPS) affected Energy Transition Investments (ETIs) in sixteen nations between 2004 and 2019, Maghyereh, Boulanouar, and Essid (2025) did this study. We found a robust and affirmative correlation between earnings per share (EPS) and environmental tax indices (ETIs). Further, we discovered that the indices of tax on the environment have risen significantly since 2012. This means that the environmental regulations have worked. Alalmaee (2025) recommends the use of Ordinary Least Squares (OLS) and Fixed Effects (FE) models to determine the relationship between financial systems and the environmental policies. This research will focus on analyzing the association between the environmental policies of 40 countries and the corresponding economic growth rates between 1990 and 2021. Our research results show that strict environmental laws positively and significantly affect the development of the financial industry. The main effects of these policies are the improvement and the heightened efficiency of financial markets.

All of them investigate the impact of the traditional energy, the market of minerals, energy conversion, and the growth of the economy (Tiwari, Mentel, et al., 2024). The information is yearly and spans the years 1993 through 2020. Based on empirical evidence, environmental sustainability is positively affected by energy transformation and the mineral market. Research by Wang et al. (2022) looked at how the BRICS countries' environmental quality was affected by more stringent environmental regulations and the transition to renewable energy sources. A cross-sectional augmented autoregressive distributed lag (ARDL) model covering the years 1990–2019 is used in this study. One of the study's conclusions is that both economic growth and the rise in industrial value-added have a positive effect on CE and are important growth drivers.

Corrocher and Mancusi (2021) The study is based on an original data set, with climate change and mitigation technology data on patents and co-patents between the years 1995–2014. The conclusion has positively impacted the intensity of global collaborations. Godawska and Wyrobek (2021) The study incorporates environmental policy tools favoring the promotion of renewable energy. It also considers the stringent environmental laws that governed renewable energy generation in Slovakia, Hungary, Poland, and the Czech Republic between 1993 and 2012. According to our main findings, the stringency of the tools positively contributes to the promotion of renewable energy, but this is not the only attribute. Li et al. (2022) This study examines the ways in which environmental regulation strictness and financial market development impact innovation in the renewable energy sector. It makes use of data from 1990 to 2019. It also discovers that international oil prices and the intensity of expenditure on research and development have positive impacts on the innovation of renewables.

Godawska and Wyrobek (2021) According to the research, environmental policy measures that support the growth of renewable energy are being used increasingly frequently as part of policies to mitigate climate change and other initiatives. It includes yearly data from 1993 to 2012.The study's main conclusions are that there is a beneficial impact on the production of renewable energy. Zhang et al. (2022) looked at how the tightening of environmental regulations has affected green innovation in the renewable energy technology industry. In addition, the authors investigated whether or not the impact of environmentally friendly innovation is proportional to the degree to which environmental restrictions are tightened. The article examines the data of thirty-three countries (all in the range of 1990-2015). The results demonstrate that environmental constraints have a positive effect on the advancement of technology that uses renewable energy sources.

Corrocher and Mancusi (2021) provided the significance of energy technologies international cooperation between the OECD and BRICS countries. The paper used a novel database of climate change-related patents and co-patents and the manner of addressing it 1995 to 2014. International collaboration can

be enhanced by experienced people in their particular field as they can offer valuable insights, which could result in effective solutions of energy technologies to suit the needs of different countries and global environmental challenges such as minimizing carbon emissions and increasing energy efficiency through alternate ways. Li et al. (2022) consider solar energy, effectiveness of environmental policies (EPS), and climate change technology tackling technologies as factors that impacted the growth of environmental sustainability in OECD countries in 2001-2018. The study's findings indicate that environmental degradation is mostly caused by economic expansion. Nevertheless, the biggest role in tackling the issue of the environment and keeping it healthy through decreasing greenhouse gas emissions and facilitating sustainable development in other areas belongs to solar energy, the effectiveness of environmental policies, and climate change technology.

Xia et al. (2025) examined the effects of economic development, foreign direct investment (FDI), and earnings per share (EPS) on energy production from both renewable and non-renewable sources in China from 1989 to 2022 using the recently developed wavelet quantile correlation (WQC) methodology. Through time, there is a negative relationship between economic growth and EPNR (energy production of non-renewable sources) and in all quantiles there is a positive relationship between economic growth and EPR (energy production of renewable sources). Afshan et al. (2022) studied the ecological footprint change of OECD countries over the period of 1990 and 2017. This has been made possible by the adoption of stringent laws, innovative environmental protection measures and use of renewable energy sources which have greatly minimized carbon emissions and established a more sustainable energy system. As a result, this era experienced what can be termed as reduced ecological footprint of the OECD countries. The findings of the study demonstrate that the ecological footprint has a negative correlation with the various green factors, which include using more of renewable energy, improved waste management and more energy-saving actions which means that higher the value of green factors, the smaller the ecology footprint. Albulescu et al. (2022) utilized OECD to examine the effects of pollution reduction on the CO_2 emission in 32 countries between 1990 and 2015. This research came up with the fact that reducing pollution does make a difference in the emission of CO 2, particularly in areas where there is a lack of carbon emission. The reason is that it will reduce overall emission levels by a significant amount and will stimulate even more related to carbon emissions reduction measures, such as switching to renewable sources of energy, which will also go a long way on the overreliance on fossil fuels and will contribute to a sustainable development. Through these practices, there could be an improved environment and health outcomes in the population.

Yıldırım et al. (2024) present an analysis that examines the effects of foreign capital investment on environmental quality in BRICS nations. The analysis of the issue is based on a second-generation approach to panel data, covering the period from 1992 to 2020. The analysis of the issue has already demonstrated its negative impact, as well as underlined the importance of acknowledging the moderating role of these investments in the efficiency of climate policies in mitigating their negative impact on the environment, particularly in relation to how foreign capital can either exacerbate or alleviate environmental degradation in BRICS countries. The research by Tiwari, Mohammed, et al. (2024) analyzes how the circular economy contributes to reducing CO_2 emissions from 1997 to 2020.

Degirmenci et al. (2024) highlight that energy intensity is a key issue that captures much of the research attention in environmental studies as well as in energy studies. It is imperative to reduce energy intensity to attain sustainable development, but it is not enough to ensure that the environment remains healthy. This reduction must be supplemented by other variables, including the use of renewable sources of energy, as well as effective management of resources, which involves implementing energy efficiency measures as well as imposing stringent regulations. As can be seen, the loss of energy resources, and the severity of energy consumption, can cause various adverse effects on nature, and the depletion of natural resources. This research based on some statistical techniques will examine the impact of energy intensity, depletion of natural resources, sources of renewable energy, and stringent environmental regulations on the load capacity factor

of G7 countries in 1990-2020. The findings of this study reveal that it is imperative to enforce environmental regulations, as well as impose pollution fines, in economically important countries.

Alatrash et al. (2025) analyse the relationship between World Uncertainty (WU), Environmental Policy Stringency (EPS) and Technological Innovation (TI) and environmental sustainability to formulate equitable policies that would stimulate growth. The results are founded on the panel data of developed countries 1990-2021 showing that WU can contribute to a significant decline in CO2 emissions in all quantiles in contrast to no impact of EPS. As they explore the use of environmental technology in mitigating climate change and its effects on the environment and economy, Baz and Zhu will have studied the causal influence of environmental technology in 19 OECD member countries by 2025. The value of it depends on its ability to protect the environment, and to promote economic development.

The study of Sohag et al. (2024) shows how ecological footprint can be reduced with the help of environmental regulations. The research discovered that the environmental laws can only help to reduce the environmental footprint where they are applied alongside other issues that induce variations of practices to reduce environmental degradation such as the use of renewable energy sources and the use of new strategies that can promote sustainable practices. This study collected data on OECD countries between 1990-2018 using panel data. The results of the study illustrate that the environment policy can significantly reduce the environmental footprints with the use of renewable energy and new strategies, especially with its combination with technological innovations and the introduction of one-way awareness campaigns whereby environmental sustainability can be perceived as holistic. The article by Zhang et al. (2022) discusses the effects of strict environmental regulations on the renewable energy source. The results of Zhang et al. (2022) are based on the panel data collected in 33 countries between 1990 and 2015. The influence of the developed countries and OECD countries is larger, which is reflected in the data, but not statistically significant.

Hypothesis 1: A positive correlation exists between renewable energy sources and rigorous environmental legislation.

The purpose of this paper is to examine how energy and environmental policies affect economic performance, measured through innovation, productivity, and competitiveness (Mahalik et al., 2024). Following the calculations, this paper will evaluate the merits of various indicators of policy stringency. The results highlight the importance of selecting the appropriate indicator for testing, as they reflect the degree of consistency among the different indicators.

Research Methodology

Research designs can employ quantitative research methodologies, for instance, panel data regression analysis, to investigate the effect of strong environmental legislation on the consumption of renewable energy resources in OECD countries.

Feng et al. (2021) used a semi-parametric variable coefficient system model to analyze the effect of robust environmental legislation on the dynamics of industrial productivity in OECD countries. The findings elucidate the adoption of renewable energy. Other methods include econometric analysis of panel and cross-sectional data, as well as inference with clustered errors using the bootstrap method. These methods help researchers sharpen their understanding of the relationship between the adoption of renewable energy and robust environmental legislation.

The operational variables are explained in this way:

Renewable Energy: According to Dale et al. (2016), renewable energy is energy generated from natural resources that can easily be accessed within a human timeframe. Renewable energy sources include solar energy, wind, rain, tides, waves, and geothermal energy.

Stringency of environmental policies: Rehman et al. (2024) define "stringency of environmental policies" (EPS) as the capacity of governments to enforce laws that control carbon emissions and other practices that affect the environment, as well as laws that promote the use of renewable energy sources.

Trade: Dowrick and Golley (2004) explain that trade is a way in which technology can be transferred from one country to another, thereby facilitating the sharing of new ideas and improvements between countries.
Industrialization: Gollin et al. (2016) increased the share of the manufacturing sector, along with tradable services, in the overall GDP significantly.

Energy Intensity: Li et al. (2025) claim that energy intensity is a tool for measuring the efficiency of a country's energy consumption in economic activities. To calculate energy intensity, divide the total Gross Domestic Product by the total energy units.

Urbanization: Kasana (2020) states that urbanization is a revolutionary concept that shows how cities are expanding all over the world. It highlights how industrialization, technology, and cultural movements are changing urban landscapes, influencing economic activities, and affecting social dynamics in cities.

$$RE = \beta_0 + \beta_1(EPS) + \beta_2(FDI) + \beta_3(EI) + \beta_4(IND) + \beta_5(TRD) + \beta_6(URB) + \varepsilon$$

The present study, based on the positivist paradigm, relies on statistical analysis and observation to identify correlations between the use of renewable energy resources and the stringency of environmental policies. The present study employs a logical research methodology that first formulates a hypothesis based on literature, followed by its corroboration. This research approach is relevant because it aims to validate the hypothesis that a positive correlation exists between the utilization of renewable energy and the stringency of environmental policies. This research utilizes a quantitative research methodology based on panel data regression analysis to identify the correlation with respect to the utilization of renewable energy and the stringency of environmental regulations in OECD member countries. To measure the stringency of the regulations, the study will rely on a sample of the countries that are members of the OECD during a given period with reference to data on renewable energy collected by authoritative organizations including International Energy Agency (IEA) and Environment Policy Stringency Index (EPSI).

The factors considered by the regression analysis include aspects such as industrialization, GDP, and energy intensity. The result may vary due to these factors. The regression analysis will determine the impact of stringent environmental regulations on renewable energy. This research should seek to establish how environmental regulations that are strict affect renewable energy in 12 Asian countries.

Table 1

Variables	Dimensions	Acronym	Operationalization	Source
Environmental policy stringency	Regulatory strictness, Incentives/subsidies, Carbon pricing, Policy coverage	EPS	Environmental policy stringency index.	WDI
Renewable energy	Energy source mix, Installed capacity, Energy production, Consumption share	RE	The proportion of total final energy consumption that is obtained from renewable sources.	WDI
Foreign Direct investment	Net inflows, Sector distribution	FDI	FDI net inflows as a proportion of GDP	WDI
Energy intensity	Energy use per unit of GDP	EI	The energy consumption per GDP unit is measured in kilograms of oil equivalent for $1,000 of GDP, using 2018 PPP constant.	WDI
Industry	Industry Contribution	IND	Construction and other industries % of GDP that is value contributed	WDI
Trade	Trade openness	TRD	Goods and services that are brought into and taken out of the country (as a proportion of GDP)	WDI
Urbanization	Population in urban areas	URBPOP	Percentage of population living in urban areas	WDI

This research will be aimed at finding out whether the increase in renewable energy is encouraged through the stricter environmental regulations. This paper will review how renewable energy is related to stringent environmental laws in 12 Asian countries.

By examining the connection between the usage of renewable energy and the strictness of environmental regulations, an explanatory research study can aid in explaining the effectiveness of environmental policies. The target population for the study includes Asian member countries, with a sample of 12 countries selected from 2012 to 2021. The WDI's cross-sectional and time-series data are combined in this study's panel data. The research study uses econometric analysis, including descriptive statistics, correlation matrices, Driscoll-Karry (DK), and feasible generalized least squares (FGLS) methods, done using Stata software.

Data Analysis

After taking into account all of the relevant factors, the major purpose of this investigation is to ascertain whether or not the stringency index of environmental laws and the components that make up such regulations have an effect on the amount of renewable energy that is used in Asian countries. The yearly data for twelve Asian countries were used for both static and dynamic studies, which we carried out between the years 2012 and 2021.

Table 1

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
RE	120	15.4	14.5	0.5	48.1
EPS	120	25.8	49.3	0	213.8
IND	120	24.4	2.30	19.3	28.1
TRADE	120	4.26	0.51	3.20	5.08
EI	120	3.27	1.73	0	7.25
FDI	120	22.8	2.18	17.6	26.1

Renewable Energy (RE), Environmental policy stringency (EPS), Industry (IND), Trade, Energy intensity (EI), Foreign Direct investment (FDI).

Results

This study utilizes 120 data points for the majority of variables. The average for renewable energy is 15.458, which means it is performing at a low level, with a standard deviation of 14.559. The data points go from 0.5 to 48.1, which shows that the returns are very different from each other. The EPS is very different from one company to the next, with a mean of 25.895 and a standard deviation of 49.346. Some companies have an EPS of 0, while others have a large EPS value, ranging from 0 to 213.89. There are 117 observations, and the average level of industrial development (lind) is 24.486, with a standard deviation of only 2.303. The observations show that the industries are moving ahead steadily, ranging from 19.397 to 28.142. There are 116 observations, and the average level of trade openness (LTRD) is 4.264, with a standard deviation of 0.519. Trade levels between entities don't change much, as shown by the lowest and highest data values of 3.207 and 5.089, respectively. The EI has a mean of 3.275 and a standard deviation of 1.734 based on 120 observations. The data, which varies from 0 to 7.25, shows that some places are more economically connected while others have little to no intensity. Finally, just 34 observations have access to foreign direct investment (lfdi). Its standard deviation is 2.186 and its mean is 22.862. The range of FDI inflows among the included entities is moderate, with the lowest figure being 17.663 and the highest being 26.109.

Table 2

Matrix of Correlations

Variable	(1)	(2)	(3)	(4)	(5)	(6)
(1) RE	1.000					
(2) EPS	0.363	1.000				
(3) IND	0.026	0.600	1.000			
(4) TRD	-0.266	-0.304	-0.376	1.000		
(5) EI	0.079	0.165	0.035	0.100	1.000	
(6) FDI	-0.239	0.002	0.685	-0.223	-0.034	1.000

Renewable Energy (RE), Environmental Policy Stringency (EPS), Industrialization (IND), Trade (TRD), Energy Intensity (EI), Foreign Direct Investment (FDI)

Results

Table 3 displays the correlation matrix. Although the correlation between RE and EPS is 0.363, indicating a positive association, Devid (1971) considers this correlation to be moderate. A very weak positive association is indicated by the correlation of 0.026 between RE and industry. The weakly negative association between RE and Trade is indicated by the correlation coefficient of -0.266. With a correlation of 0.079, RE and EI have a very weakly positive association. With a correlation of -0.239, RE and FDI appear to have a weakly negative association. With a correlation of 0.600, there is a moderately to strongly positive association between EPS and industry. With a correlation of -0.304, EPS and trade appear to have a moderately negative association. With a correlation of 0.165, EPS and EI show a marginally favorable association. With a correlation of 0.002, there is hardly any association between FDI and EPS. With a correlation of -0.376, Industry and Trade appear to have a moderately unfavorable association. With a correlation of 0.035, industry and EI have a very weakly positive relationship. The correlation coefficient's value of 0.685 indicates a strong positive relationship between industry and external direct investment. Trade and EI have a correlation of 0.100, which indicates that there is a very little positive association between the two. There is a minor inverse association between trade and foreign direct investment, as shown by the correlation coefficient of -0.223 between the two variables. There is no relationship between the two sets of data, as indicated by the correlation coefficient of -0.034 between EI and FDI.

Table 3

Impact of Environmental Policy Stringency on Renewable Energy

	(1)	(2)
VARIABLES	**DK**	**FGLS**
EPS	0.46	0.46
	(0.06)	(0.13)
IND	-5.88	-5.88
	(1.20)	(1.88)
TRADE	13.9	13.9
	(7.76)	(3.63)
EI	-1.65	-1.65
	(0.64)	(1.03)
FDI	0.10	0.10
	(2.67)	(1.52)
Constant	95.5	95.5
	(68.9)	(46.2)
Observations	120	120
R-squared	0.472	
Number of groups	12.00	
Number of id		12.00

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Results

Table 4 examines the impact of strict environmental regulations on renewable energy sources. In the regression analysis of the two models, DK and FGLS, the positive and substantial link between the variable EPS (Environmental Policy Stringency) and RE (Renewable Energy) is revealed. These two approaches are centered upon renewable energy. Each of the two models has a coefficient value of 0.468, which indicates that the amount of renewable energy will grow by 0.468 units for every one unit increase in the stringency of environmental rules. The fact that this link is highly significant ($p < 0.01$) indicates that there is a strong positive relationship between the two variables has been established.

The variable "lind" (industrialization) and renewable energy have a negative association, as seen by the coefficient of -5.880 in both models. This indicates that there is a 5.880 unit drop in renewable energy for every unit rise in industrialization. At the 1% level, this difference is quite substantial. The variable ltrd (trade openness) is positively related to renewable energy, as shown by the coefficient of 13.97. In the FGLS model, this relationship is statistically significant ($p < 0.01$), which means that trade openness has a substantial impact on the growth of renewable energy. The coefficient of -1.658 shows that EI (Energy Intensity) is negatively related to renewable energy.

In contrast, the DK model shows a statistically significant relationship with $p < 0.05$, which means that there is a weak but substantial negative relationship.This result shows that there is a statistically significant relationship. The coefficient of the LFDI variable that is the variable of Foreign Direct Investment is 0.107. This shows that it has an extremely small and statistically insignificant influence on renewable energy. This demonstrates that foreign direct investment is not a significant influence in this specific scenario. The fact that the independent variables in the model have an R-squared value of 0.472 shows that they are responsible for explaining 47.2% of the variance in renewable energy. The overall number of observations is 120, and that number is broken down into 12 different categories.

The findings from this research indicate that while industrialization and high energy consumption can be a problem, environmental regulations and trade openness can help people consume more renewable energy.

Prior studies have demonstrated that environmental policy stringency (EPS) has a significant and positive impact on renewable energy, whereas foreign direct investment (FDI) has a minor effect. According to the results of the OECD, the strength of environmental legislation has a minor but considerable influence on the amount of foreign direct investment that is directed toward a country. Because restrictive laws are preferred, the relationship is nonlinear. Therefore, although our results suggest that Environmental Policy Standards (EPS) make it easier to use renewable energy, the data from the OECD shows that EPS have a little effect on the amount of foreign direct investment.

Although the studies were carried out in diverse environments, the findings of the previous studies, together with the research carried out by Herman and Xiang in the literature of 2019, have reflected the favorable effects of stringent environmental laws on the emergence of clean and renewable energy resources including amplified investments in solar and wind energy, and diminished emissions of greenhouse gases. In our study, we have shown that the Porter Hypothesis is right in its application in the national context. In particular, we are able to show that stringent environmental policy (EPS) influences favourably and substantially renewable energy projects.

The article by Herman & Xiang (2019) develops this argument by indicating that strong foreign environmental regulations can also stimulate global innovation in clean energy technology. The two studies also emphasize the relevance of excellent policies in creating innovation and renewable energy development, though the article by Herman and Xiang adds a global front by suggesting that they result in cross-border policy spills, whereas in our study, the results concern the immediate effects at the local level.

Conclusion

Regarding the importance of GHRM strategies in enhancing sustainable employee performance, this study significantly adds to the body of knowledge already available on sustainable human resource management. Although the research has limitations, it offers some significant theories and practices on the importance of the humane approach to environmental sustainability. This area of research is a significant and relevant concept in the development of sustainable institutions despite the challenges that come with resource depletion and climate change.

There were a number of motivations for drafting this paper. First, it looked at the direct link between GHRM practices and long-term employee performance. Second, it looked at how essential green living is for workers in breaking this connection. This showed a crucial behavioral mechanism via which HR policies impact performance results. This article looked at how being aware of the surroundings might change the effectiveness of green activities, either making the relationship stronger or weaker. The purpose of each of these aims was to provide a full picture of GHRM practices as a strategic way to build human capital in order to reach long-term goals.

Furthermore, the mediating effect of a green lifestyle was also significant, which implies that individuals who support the value of green and use it in their lifestyle as well as in their working environment are more likely to show sustainable performance in the workplace. This study also supports the idea that GHRM practices can have a direct effect on the outcome in the organization, as well as on individual cognition and behavior. Another finding of the study was that there is a possibility of environmental awareness promoting sustainable practices among employees that can be applied to improve the overall performance of the organization. People who are more aware of their surroundings showed a stronger link between a green lifestyle and sustainable performance. This suggests that being aware can make the impact of a green lifestyle on sustainable performance stronger.

Despite the fact that the study identifies some advantages, there are some critical points that should be taken into consideration. First, the cross-sectional nature of the data makes it difficult to identify causality. Longitudinal data is extremely valuable in identifying the accuracy of the direction and timing of relationships, particularly when there are high correlations between the variables. Secondly, self-administered questionnaires are prone to response bias, particularly when it comes to the measurement of the socially desirable variables such as environmental awareness and sustainable practices. The study was only carried out in the academic sector of Punjab, Pakistan, and therefore it is difficult to generalize the findings to other sectors and geographical locations. The findings may not be generalizable, as there are cultural, organizational, and sectoral differences that influence the adoption and perception of GHRM practices. Furthermore, despite the fact that there are conflicting views and experiences of management and non-management employees regarding GHRM, the study did not make any distinction between the two.

Our results have several implications for policy. In order to reach the goal of net zero CO_2 emissions by 2050, the governments of the OECD must play a significant role. To accomplish this goal, they must depend more and more on technological assistance regulations and market and non-market environmental policy tools to encourage the use of green energy.

Our results have several directions for further research. One direction is to conduct longitudinal research to investigate the evolution of green behavior and sustainable performance, to allow for more causal inferences. Another research focus is to investigate the generalizability of the model by collecting data from other industries, such as manufacturing, healthcare, and technology. Another research focus is to investigate other potential mediators and moderators. Psychological ownership, organizational commitment, and green corporate culture may be mechanisms or contexts that help to explain the GHRM-performance relationship.

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