Vidyasagar University Journal of Commerce
Vol. 30, 2025/ISSN 0973-5917
DOI : http://dx.doi.org/10.62424/VUJC.2025.30.00.01

HOW ENVIRONMENTAL PROTECTION INVESTMENT CONTRIBUTES THE SUSTAINABLE DEVELOPMENT ACROSS THE SELECT ASIAN EMERGING ECONOMIES? A COMPARATIVE VIEW

Biswajit Paul*

Priyajit Kumar Ghosh**

Abstract

Climate change significantly impacts global sustainable development, especially in emerging and developing economies, where industrialization and urbanization contribute to environmental degradation. Recently, Environmental Protection Investment (EPI) has gained attention as a crucial tool to tackle these issues. Its role is vital in these regions, where economic growth often conflicts with environmental sustainability. This study investigates the contribution of EPI to sustainable development in Asian emerging economies, focusing on both long-term and short-term dynamics. To achieve this, the present study considers yearly data of seven Asian emerging economies, namely China, India, Indonesia, Malaysia, Philippines, Thailand, and Vietnam, from 1995 to 2022 and adopts a Vector Error Correction Model (VECM). Results of the study reveals existence of a cointegrating relationship between EPI and sustainable development in Asian emerging economies. This study highlights that EPI favourably contributes to sustainable development both in the long-run and the short-run across all countries. But in short-run it has less impact over the sustainable development as compared to the long-run. Further, country-wise disparity in terms of the influence of EPI on sustainable development is also found. Results of this study recommends policy makers of Asian emerging economies to put more focus on EPI at the time of framing different policies so that countries can minimize the pressure on mother nature arise due to economic activities and can move faster towards achieving different Sustainable Development Goals (SDGs) by 2030.

Keywords: EPI, Sustainable Development, Asian Emerging Economies, VECM

JEL Classification: C32, O53, Q50, Q56

* Assistant Professor, Department of Commerce, University of Gour Banga, India
Email: *ugb.biswajitpaul@gmail.com;* ORCID: *https://orcid.org/0000-0001-5935-5373*

**Assistant Professor, Department of Commerce (Morning),
St. Xavier's College (Autonomous), Kolkata, India
Email: priyajitkumarghosh97@gmail.com
(Corresponding Author)
ORCID: https://orcid.org/0009-0001-0661-6995

Vidyasagar University Journal of Commerce
Vol. 30, 2025/ISSN 0973-5917
DOI : http://dx.doi.org/10.62424/VUJC.2025.30.00.01

Introduction

Nowadays, the concept of Sustainable Development (SD) is emerged as a most prominent global concern, in light of the growing level of human and industrial activities, population boom and its resultant multiple social and environmental issues. During the past few years, it is observed that several countries have chosen the path of economic growth for their countries while compromising with multiple social and environmental avenues. Asian Emerging economies are not exception here, they have also demonstrated a significant mark on their journey of worldwide economic growth. These economies, mainly comprise of China, India, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam often rank top in terms of economic growth and expanded economic activities, resource consumption, etc.

All of these elements, however, also put a great deal of strain on their natural ecosystems, thus these countries must strike a balance between environmental protection and economic development. In this regard, Environmental Protection Investment (EPI) is thought to be one of the main ways to achieve this equilibrium. There is broad agreement from earlier studies regarding the advantages of environmental investments for fostering sustainable development. Researches indicate that spending on resource-efficient practices, renewable energy, and cleaner technology can maintain or even accelerate economic growth in addition to improving environmental results. Nonetheless, there is still much to learn about the unique effects of national investments in environmental protection on sustainable development in Asian rising countries, especially from a comparative aspect. Due to this gap in the literature, a thorough examination of the various ways that EPI supports sustainable development in various nations—each with its own distinct socioeconomic and environmental circumstances—is required. Therefore, the goal of this research is to demonstrate a comparative view of how investments in environmental protection affect sustainable development in a select Asian rising nations. By applying the VECM, this research seeks to look into the short-run and long-run dynamics of EPI and sustainable development. The VECM is especially well-suited for this analysis because it enables for the evaluation of both short-run and long-run relationships among variables that are non-stationary at the level but cointegrated, providing a strong foundation for getting better knowledge about the vital and complex interactions between EPI and sustainability outcomes.

The remainder portion of the present investigation is laid out as follows: In Section 2, a brief summary of the environmental finance and sustainable development literature that has been consulted is provided. Section 3 presents the research methods for the study. The findings and discussion are presented in Section 4. The conclusion is included in Section 5.

Vidyasagar University Journal of Commerce
Vol. 30, 2025/ISSN 0973-5917
DOI : http://dx.doi.org/10.62424/VUJC.2025.30.00.01

Review of Literature

This section presents the key findings from past studies on environmental protection spending and its impact on SD and economic growth.

Pearce and Palmer (2005) did not find much evidence to suggest that spending on the environment had a detrimental influence over economic growth. A portion of overall government spending, which often boosts the economy temporarily, goes toward environmental protection **(Blanchard & Leigh, 2013)**. According to **Krajewski (2016)**, public spending on areas of environmental protection rises and boosts economic growth. The findings revealed that public spending on environmental protection had a greater impact on GDP during times of crisis, and that its benefits are greatest felt by economies that have been impacted by the global financial crisis. **Yurynets and Kruglyakova (2016)** considered government income and spending on research and development, particularly in the field of environmental protection, to investigate the connection between economic growth (GDP) and government policy. Significant evidence of an association between public efficiency and population density and development status, particularly in environmental protection, was presented by **Moreno-Enguix and Bayona (2017).** Whereas the study of **Meyer (2019)** provided the empirical evidence of the positive influence of effective government outlay and management on the economy. The empirical research of **Lich and Cam Tu's (2019)** reported that public spending increases in accordance with a nation's level of development, and there is an apparent linkage between investment and economic growth. Romania's spending on environmental protection, which covered the years 2010 to 2018, was considered by **Soare et al. (2020),** with an emphasis on public administration, environmental taxes, expenditures on environmental protection etc. Their study's conclusions implied an unfavourable relationship between economic growth and spending on environmental preservation. **Levytska and Romanova's (2020)** study suggested amending Ukraine's environmental laws to improve project execution and the regulatory structure. In order to support such efforts, it also underscored the importance of expanding funds for environmental protection. The study of **Moshiri and Daneshmand (2020)** considered one of the major developing economies in the Middle East region, i.e., Iran, and found linkages between economic growth and its environmental effect. They evaluated the effects of wealth and government spending on environmental improvement using ecological footprint data and an ARDL model. The findings did not indicate an important shift or a noteworthy effect of government spending. **Caglar and Yavuz (2023)** assessed the influence of renewable energy consumption and environmental protection spending on the European Union-22 countries' multiple global goal i.e., SDG 7 (cheap and clean energy), SDG 6 (clean water and sanitation), and SDG 15 (life on land) goals. Research revealed that spending on environmental protection is inadequate and that using renewable energy improves the condition of the

Vidyasagar University Journal of Commerce
Vol. 30, 2025/ISSN 0973-5917
DOI : http://dx.doi.org/10.62424/VUJC.2025.30.00.01

environment. The empirical investigation by **Georgieva (2024)** found that economic growth exaggerates emissions in European Union countries. In contrast, environmental protection expenditure lowers emissions in European Union countries.

After reviewing a wide range of literature, it turns out clear that the majority of the earlier research endeavours sought to investigate the link between environmental protection spending and economic growth. Comprehensive research on the impact of environmental protection investment on sustainable development in emerging Asian nations is lacking. At present, these emerging countries are standing at a juncture. They have to ensure economic development to become a developed country. On the other hand, this economic growth often deteriorates their environment. Putting this as a significant research gap, this research attempts to investigate how EPI helps to sustainable development in a few selected Asian emerging nations.

Research Methodology

Data Source and Variable Selection

To achieve the study's stated aims, annual data from 1990 to 2022 on several macroeconomic variables in chosen Asian emerging economies are used. China, India, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam constitute Asia's rising economies. The picking of these countries was based on the list supplied by the International Monetary Fund in its Regional Economic Outlook report. Table 1 presents a succinct description of select variables.

Table 1. Succinct Description of Select Variables.

Code of Variables	Name of Variables	Unit of Measurement of Select Variables	Sources of Database
SDI	Sustainable Development Index	The SDI represents sustainable development index. It comes from the empirical research that Hickel, J. (2020) conducted. This statistic considers a variety of sustainable developmental factors, such as social, economic, and environmental issues. Life expectancy, income level, education level, and ecological efficiency are all taken into account by this index.	Sustainable Development Index Project
EPI	Environmental Protection Investment	The proxy variable for EPI is the amount spent on environmental protection as a percentage of GDP. The country's efforts toward various	Organization for Economic Co-operation

Vol. 30, 2025/ISSN 0973-5917
DOI : http://dx.doi.org/10.62424/VUJC.2025.30.00.01

		ecological preservation-related initiatives, which include handling of different waste, conserving of biodiversity, reducing pollution, etc. Here, this spending on environmental protection is considered as a proxy variable for EPI in earlier research by Chen et al. (2018), Liu and Lin (2019), Qu et al. (2022), and Fang et al. (2022) also considered this as a proxy of EPI and green finance.	and Development (OECD)
GDPPC	Gross Domestic Product Per Capita	One measure of economic growth that is used as a stand-in is GDP per capita (constant 2015 US$).	World Bank (World Development Indicator)

Source: Researchers' own estimation

Estimation Procedure

In order figure out whether the data series are stationary or non-stationary, researchers first employed the Augmented Dickey-Fuller (ADF) unit root test. The researchers then chose the lag length using the AIC criteria. Next, in order to ascertain whether a long-term co-integrating relationship persisted between EPI and SD, researchers performed the Johansen Co-integration test. The VECM test was then run by the researchers. Furthermore, several diagnostic tests are carried out to validate the accuracy and consistency of the model's output. Granger causality tests are implemented at the end to establish to shed light on the dynamic causal interrelationships between selected variables.

Model Specification:

The following equation is considered in this study:

$$SDI_t = \beta_0 + \beta_1 \, EPI_t + \beta_2 \, GDPPC_t + \varepsilon_t$$

Where:

- SDI_t: Sustainable Development Index at time t
- EPI_t: Environmental Protection Investment at time t
- $GDPPC_t$: GDP per capita at time t
- ε_t: Error term
- β_0, β_1, β_2: Coefficients to be determined

Vidyasagar University Journal of Commerce
Vol. 30, 2025/ISSN 0973-5917
DOI : http://dx.doi.org/10.62424/VUJC.2025.30.00.01

In the model, SDI is the dependent variable, EPI is the independent variable, and GDPPC is the control variable.

Econometric Tools Used

Unit Root Test: Time series modelling is not feasible if the nature of select data series are non-stationary (Farooq & Islam, 2021; Temiz Dinç & Akdoğan, 2019). Here, at first in order to figure out whether the select data streams are stationary or not, the researchers have employed the ADF unit root test (Dickey & Fuller, 1979).

Cointegration Test: Johansen cointegration test is used to ascertain the actual presence of a cointegrating relationship between select time series variables.

Vector Error Correction Model (VECM): The VECM model is used to determine the long-run as well as short-run dynamics between the select series **(Asari et al., 2011; Temiz Dinç & Akdoğan, 2019; Ghosh & Paul, 2023)**.

Diagnostic Tests:

Serial correlation LM Test is used to detect the presence of serial correlation in the model. Whereas, **Breusch-Pagan Test** is used to detect the presence of heteroscedasticity in the model's residuals. Because heteroscedasticity can lead to discarded estimations and erroneous statistical conclusions.

Granger Causality Test:

The Granger causality test is utilised to figure out whether one time series can predict another time series. In this study, the Granger causality test is performed to determine the causal linkages between select variables in this study.

Results and Discussion

In the study, the Augmented Dickey-Fuller (ADF) unit root test is used for the stationarity analysis and the results are given in Table 2.

Table 2: Results of Country-wise ADF Unit Root Test

Variables	**Level**	**First Difference**	**Order of Integration**
	Statistic	Statistic	
China			
L_SDI	-1.0591	-3.0264**	I (1)
L_EPI	-1.9540	-4.8611*	I (1)
L_GDPPC	-2.6736	-3.0100	I (1)
India			
L_SDI	-1.7038	-3.5010**	I (1)

Vidyasagar University Journal of Commerce
Vol. 30, 2025/ISSN 0973-5917
DOI : http://dx.doi.org/10.62424/VUJC.2025.30.00.01

L_EPI	-2.1721	-7.7893*	I (1)
L_GDPPC	-0.1696	-5.1032*	I (1)
Indonesia			
L_SDI	-0.7949	-4.9628*	I (1)
L_EPI	-1.8246	-5.6390*	I (1)
L_GDPPC	0.5929	-4.0855*	I (1)
Malaysia			
L_SDI	-1.5552	-6.6653*	I (1)
L_EPI	-2.9061	-5.4575*	I (1)
L_GDPPC	-0.1866	-5.5928*	I (1)
Philippines			
L_SDI	-0.4998	-4.6726*	I (1)
L_EPI	-1.6841	-6.7077*	I (1)
L_GDPPC	0.1771	-4.8905*	I (1)
Thailand			
L_SDI	-0.9002	-4.7545*	I (1)
L_EPI	-1.0171	-5.2007*	I (1)
L_GDPPC	-0.3869	-4.1455*	I (1)
Vietnam			
L_SDI	-1.5895	-4.1717*	I (1)
L_EPI	0.4362	-4.5978*	I (1)
L_GDPPC	-0.4777	-6.2355*	I (1)

Source: Researchers' own estimation

*, ** *denote significance at 1% and 5% level, respectively.*

Table 2 contains the unit root test results. As previously indicated, ADF unit root tests were run to examine the variables' time series characteristics. The findings show that, in every instance at first difference, the null hypothesis of a unit root is rejected at the 1% level of significance. It turns out that L_SDI, L_EPI, and L_GDPPC for the Asian rising economies are integrated at order one, or I (1), based on the findings of the unit root test. Thus, additional analysis can be conducted using the VECM model.

Vidyasagar University Journal of Commerce
Vol. 30, 2025/ISSN 0973-5917
DOI : http://dx.doi.org/10.62424/VUJC.2025.30.00.01

Table 3: Results of Country-wise Johansen Test of Co-integration

L_SDI = f (L_EPI, L_GDPPC)							
No. of Cointegration Equations	**Eigen Value**	**Trace Stat.**	**0.05 Critical Value**	**prob-Value****	**Max-Eigen Value**	**0.05 Critical Value**	**prob-Value****
China							
None * (R = 0)	0.5054	33.5830	29.7970	0.0175	18.3050	21.1316	0.0188
At most 1 (R ≤ 1)	0.3415	15.2780	15.4947	0.0539	10.8661	14.2646	0.1610
At most (R ≤ 2)	0.1560	4.4118	3.8414	0.0357	4.4118	3.8414	0.0357
India							
None * (R = 0)	0.7819	50.1899	29.7970	0.0001	35.0318	21.1316	0.0003
At most 1 (R ≤ 1)	0.4764	15.1581	15.4947	0.0561	14.8820	14.2646	0.0399
At most (R ≤ 2)	0.0119	0.2760	3.8414	0.5993	0.2760	3.8414	0.5993
Indonesia							
None * (R = 0)	0.6828	46.8081	29.7970	0.0002	29.8598	21.1316	0.0023
At most 1 (R ≤ 1)	0.4588	16.9483	15.4947	0.0300	15.9637	14.2646	0.0267
At most (R ≤ 2)	0.0371	0.9845	3.8414	0.3211	0.9845	3.8414	0.3211
Malaysia							
None * (R = 0)	0.6260	39.1773	29.7970	0.0031	24.5912	21.1316	0.0156
At most 1 (R ≤ 1)	0.3537	14.5860	15.4947	0.0682	10.9136	14.2646	0.1586
At most (R ≤ 2)	0.1366	3.67246	3.8414	0.0553	3.6724	3.8414	0.0553
Philippines							
None * (R = 0)	0.5779	32.0909	29.7970	0.0268	22.4312	21.1316	0.0327
At most 1 (R ≤ 1)	0.2216	9.6596	15.4947	0.3078	6.5143	14.2646	0.5481
At most (R ≤ 2)	0.1139	3.1453	3.8414	0.0761	3.1453	3.8414	0.0761
Thailand							
None * (R = 0)	0.6526	39.7493	29.7970	0.0026	25.3807	21.1316	0.0119
At most 1 (R ≤ 1)	0.3180	14.3686	15.4947	0.0734	9.1863	14.2646	0.2710
At most (R ≤ 2)	0.1942	5.1822	3.8414	0.0228	5.1822	3.8414	0.0228
Vietnam							
None * (R = 0)	0.6811	39.1551	29.7970	0.0032	29.7180	21.1316	0.0024
At most 1 (R ≤ 1)	0.2994	9.4371	15.4947	0.3265	9.2545	14.2646	0.2656
At most (R ≤ 2)	0.0069	0.1825	0.6692	0.6692	0.1825	3.8414	0.6692

Source: Researchers' own estimation

** Indicates rejection of the hypothesis **Trace test and Max-eigen value test show 1 co-integrating equation(s) at the 1% or 5% level*

The maximal eigenvalue test and the trace test are the two common approaches among

Vidyasagar University Journal of Commerce
Vol. 30, 2025/ISSN 0973-5917
DOI : http://dx.doi.org/10.62424/VUJC.2025.30.00.01

different test statistics for the Johansen cointegration test. The findings of the two approaches are summarized in Table 3, and when the P value under the maximum eigenvalue technique and the trace statistic is less than 0.05 at the 5% significance level, the null hypothesis—which asserts there is no co-integration—is rejected. The null hypothesis ($R \leq 1$), arguing that there is only one cointegration at the 0.05 significance level, is not rejected by either test, indicating that there is a cointegration relationship between the GDPPC, SDI, and EPI in every economy.

Table 4: Results of Country-wise Long-run Estimation of VECM

Variable	China	India	Indonesia	Malaysia	Philippines	Thailand	Vietnam
L_EPI	1.5108*	1.1664*	0.2518*	0.2234*	0.1794*	0.1669*	0.3957*
L_GDPPC	0.1683*	0.1548*	0.0846*	0.0180*	0.0156*	0.0391*	0.0697*
C	7.20041*	5.9066*	3.75021*	7.1601*	1.1238*	2.2473*	4.1296*

Source: Researchers' own estimation

**, ** denote significance at 1% and 5% level respectively.*

Table 4 presents the long-run estimate results. Table 4 demonstrates that for each economy, the co-efficient value of L_EPI and L_GDPPC is positive and statistically significant. The findings show that a one unit rise in L_EPI over the long term causes a 1.51 unit increase in L_SDI. Because a growth in EPI makes it easier to ensure sustainable development in China, this suggests that EPI has a positive, statistically significant, long-term impact on sustainable development in China. Similarly, for India, a long-term increase of 1 unit in L_EPI results in a 1.16 unit increase in L_SDI. Over time, a unit rise in L_EPI in Indonesia, Malaysia, the Philippines, Thailand, and Vietnam causes an equivalent increase in L_SDI of 0.25, 0.22, 0.17, 0.16, and 0.39 units in each of those countries. On the other hand, the control variables result shows that in China, India, Indonesia, Malaysia, Philippines, Thailand, and Vietnam, respectively, a unit rise in L_GDPPC causes an increase in L_SDI of 0.16, 0.15, 0.08, 0.01, 0.01, 0.03, 0.06 units.

Table 5: Results of Country-wise Short-run Estimation of VECM

Variable	China	India	Indonesia	Malaysia	Philippines	Thailand	Vietnam
ECT	-0.4594*	-0.1792*	- 0.8850*	-0.1881*	-0.3797*	-0.1554*	-0.1336*
D (L_SDI (-1)	0.2916*	0.0442*	0.1235*	0.1259*	0.0042*	0.5388*	0.3070*
D (L_EPI (-1)	0.3375*	0.2997**	0.0517*	0.0718*	0.0537*	0.0689*	0.0611**
D (L_GDPPC (-1)	0.1410*	0.1306**	0.1694*	0.1445	0.1127*	-0.0178*	0.3429*
C	0.1403*	0.1376*	0.0386*	0.0114*	0.1225*	0.0060*	0.0031*
R-squared	0.4900	0.3453	0.5177	0.3519	0.5437	0.8559	0.7989
Adjusted R-squared	0.2800	0.2205	0.1467	0.2285	0.4568	0.7451	0.7161

Source: Researchers' own estimation

**, ** denote significance at 1% and 5% level respectively.*

Vidyasagar University Journal of Commerce
Vol. 30, 2025/ISSN 0973-5917
DOI : http://dx.doi.org/10.62424/VUJC.2025.30.00.01

Table 5 presents the short-run estimation results. The series are cointegrated and advance together toward long-term equilibrium, as indicated by the substantial and negative sign of the error correction term (ECT). In essence, it's the negative reaction needed to keep the series balanced throughout time. A fixed amount of annual deviation from the long-term balance is compensated for, according to the negative sign. With a value of -0.45, the error correction term for China in this instance indicates that the long-term balance deviation is rectified by 45% in less than a year. Similarly, negative and substantial error correction term values are seen for India, Indonesia, Malaysia, Philippines, Thailand, and Vietnam, corresponding to 17%, 88%, 18%, 37%, 15%, and 13%, respectively. Table 5 additionally demonstrates that, for all seven economies but Thailand, the co-efficient value of L_EPI is positive and statistically significant, as is the co-efficient value of L_GDPPC. This suggests that although the short-term impact of EPI is less than the long-term impact, it is still statistically significant and has a positive short-term influence on sustainable development.

Table 6: Results of Country-wise Breusch-Pagan Test and Serial Correlation LM (Lagrange Multiplier) Test

	Breusch-Pagan Test		**Serial Correlation LM test**	
Test Statistic	Chi-sq	Probability	Rao F-stat	Probability
China	80.74461	0.5804	0.660887	0.7365
India	65.3210	0.0487	0.386293	0.9346
Indonesia	82.43859	0.5278	0.482675	0.8744
Malaysia	36.80366	0.8803	0.687947	0.7152
Philippines	64.5766	0.0553	0.7815	0.6343
Thailand	119.2227	0.5029	0.499045	0.8576
Vietnam	84.1387	0.4752	2.183983	0.0534

Source: Researchers' own estimation

The summarised outcomes of the serial correlation LM test and the Breusch-Pagan test for homoscedasticity are displayed in Table 6. The null hypothesis in this case of the Breusch-Pagan Test for Homoscedasticity is that there is homoscedasticity or no heteroscedasticity, since the variance of the residuals is constant. Since the probability value is greater than 0.05 in every country, the null hypothesis is accepted. This outcome indicates that the residuals lack heteroscedasticity. On the other hand, the absence of autocorrelation or serial uncorrelation of residuals is the null hypothesis for the serial correlation LM test. Here, the null hypothesis is accepted because the probability value is higher than 0.05 in each country. This indicates that there are no indications of autocorrelation in the residuals.

Vidyasagar University Journal of Commerce
Vol. 30, 2025/ISSN 0973-5917
DOI : http://dx.doi.org/10.62424/VUJC.2025.30.00.01

Table 7: Results of Country-wise Granger Causality Test

Null Hypotheses (NHs) are:	**F-Stat.**						
	China	**India**	**Indonesia**	**Malaysia**	**Philippines**	**Thailand**	**Vietnam**
L_EPI does not Granger Cause L_SDI	2.9098**	6.4749**	0.0133**	2.2575**	2.5822**	0.3270**	2.5285***
L_SDI does not Granger Cause L_EPI	2.2645	0.0833	2.6726***	2.6818***	3.8550**	1.8631	7.4728*
L_GDPPC does not Granger Cause L_SDI	0.4566*	0.6287*	0.2687*	0.4321*	10.1885*	0.4797*	4.2931**
L_SDI does not Granger Cause L_GDPPC	1.4389	2.9899	4.8514	3.2196	3.7362	7.1313	0.6481
L_GDPPC does not Granger Cause L_EPI	0.7073	0.0258	2.6464***	2.0207	2.3856	1.2428	2.8835***
L_EPI does not Granger Cause L_GDPPC	2.0715	2.0611	0.5129	0.0345	2.8253***	0.0117	1.5750

Source: Researchers' own estimation

Table 7 outlines the country-wise Granger Causality Test results. It shows that in the cases of China, India, and Thailand, there is unidirectional causality running from L_EPI to L_SDI. However, in the contexts of Indonesia, Malaysia, the Philippines, and Vietnam, there are two-way causal links between L_EPI and L_SDI. Moreover, all the select economies report unidirectional causality running from L_GDPPC to L_SDI. Whereas, for Vietnam and Indonesia, unidirectional causality is listed from L_EPI to GDPPC and for the Philippines, from L_GDPPC to L_EPI.

Conclusion

Present study examined the impact of Environmental Protection Investment (EPI) on Sustainable Development (SD) in the context of Asian emerging economies by employing VECM. The results of this study revealed the critical role that environmental protection investment may play in fostering sustainable growth and development by demonstrating the favourable long-term effects of EPI on SD across these economies. Strategic investment in environmental protection promotes economic growth that is consistent with sustainability goals, mitigating environmental issues, and aid in the preservation of natural ecosystems. But the short-term less significant effects of EPI on sustainable development indicates that investments in the environmental protection might lead to rapid improvements in sustainability, the biggest gains can come over longer time horizons not short time span. Therefore, it is urged that policymakers be cautious and committed to maintaining and expanding environmental investments in order to achieve major and long-lasting achievements in terms of sustainable development. Furthermore, in order to enhance the funding for EPI and develop more effective solutions to ensure SD, governments must to encourage public-private collaborations. To ensure that investments complement sustainability goals, Government should regularly monitor and evaluate EPI's impact on sustainable development. To make the required adjustments and advancements throughout time, Governments should set up reliable review processes for environmental investments and initiatives. Adopting recommended policies can boost investment returns and create a future that is more resilient.

Limitations of the Study

This study focuses on seven prominent Asian emerging economies. Therefore, the empirical results derived from this research may not be applicable to all other emerging economies that possess varying institutional, environmental, and economic frameworks. The research utilises secondary annual data spanning from 1995 to 2022. While the duration of the study is quite extensive, it does not account for certain recent developments that have taken place after 2022. Climate policies, green finance, and sustainability frameworks are in a state of continuous evolution. Consequently, the changes that occur in the post-2022 timeframe are not incorporated into the analysis. The model did not incorporate various macro-economic factors that might impact the link between sustainable development and investments in environmental protection, such as Foreign Direct Investment (FDI), technological innovation, institutional quality, interest rates, and geopolitical tensions, among others. The research employs the Vector Error Correction Model (VECM). This model presumes and illustrates linear relationships between variables. It is unable to account for non-linear relationships and structural breaks that may occur as a result of economic crises, policy changes, or significant global events.

References

1. Asari, F. F. A. H., Baharuddin, N. S., Jusoh, N., Mohamad, Z., Shamsudin, N., & Jusoff, K. (2011). A vector error correction model (VECM) approach in explaining the relationship between interest rate and inflation towards exchange rate volatility in Malaysia. *World applied sciences journal, 12*(3), 49-56. https://iranarze.ir/wp-content/uploads/2017/08/7449-English-IranArze.pdf

2. Blanchard, O. J., & Leigh, D. (2013). Growth forecast errors and fiscal multipliers. *American Economic Review, 103*(3), 117-120. https://doi.org/10.1257/aer.103.3.117

3. Caglar, A. E., & Yavuz, E. (2023). The role of environmental protection expenditures and renewable energy consumption in the context of ecological challenges: Insights from the European Union with the novel panel econometric approach. *Journal of*

Vol. 30, 2025/ISSN 0973-5917
DOI : http://dx.doi.org/10.62424/VUJC.2025.30.00.01

Environmental Management, 331, 117317. https://doi.org/10.1016/j.jenvman.2023.117317

4. Chen, Z., Kahn, M. E., Liu, Y., & Wang, Z. (2018). The consequences of spatially differentiated water pollution regulation in China. *Journal of Environmental Economics and Management, 88,* 468–485. https://doi.org/10.1016/j.jeem.2018.01.010

5. Fang, Z., Yang, C., & Song, X. (2022). How do green finance and energy efficiency mitigate carbon emissions without reducing economic growth in G7 countries? *Frontiers in Psychology, 13,* 879741. https://doi.org/10.3389/fpsyg.2022.879741

6. Farooq, F. B., & Islam, A. H. (2021). The short run and long run dynamics of GDP and trade in a seemingly unrelated regression framework. *Revista Brasileira de Economia de Empresas, 21*(1). http://hdl.handle.net/11159/13143

7. Georgieva, V. (2024). Environmental Investments and Climate Change: How Environmental Protection Expenditure and Gross Domestic Product Affect Emissions in the European Union. *Journal of Sustainable Development of Energy, Water and Environment Systems*, *12*(4), 1-17. https://doi.org/10.13044/j.sdewes.d12.0528

8. Ghosh, P. K., & Paul, B. (2023). The Effects of Education on Poverty Reduction in India: Striving Towards Sustainable Development. *Sustainable Roadmap Development Strategies in India: Paving the Way for a Better Future*, 162-174. https://doi.org/10.31674/book.2023srdsi013

9. Hickel, J. (2020). The sustainable development index: Measuring the ecological efficiency of human development in the anthropocene. *Ecological economics, 167,* 106331. https://doi.org/10.1016/j.ecolecon.2019.05.011

10. Krajewski, P. (2016). The impact of public environmental protection expenditure on economic growth. *Problemy ekorozwoju–problems of sustainable development, 11*(2), 99-104. https://ssrn.com/abstract=2884612.

11. Levytska, O., & Romanova, A. (2020). Assessment of the impact of government expenditure on environmental protection on the GDP in the context of environmental legislation. *Journal of Eastern European and Central Asian Research (JEECAR), 7*(3), 375-384. https://doi.org/10.15549/jeecar.v7i3.342

12. Li, L., Shen, Z., Song, M., & Vardanyan, M. (2023). Public expenditure, green finance, and environmental governance: Evidence from China. *Environmental Modeling & Assessment, 28*(5), 859-873. https://doi.org/10.1007/s10666-023-09899-w

13. Meyer, D. F. (2019). A quantitative assessment of the impact of government activities on the economy of Poland. *Journal of Eastern European and Central Asian Research (JEECAR), 6*(2), 220-233. https://doi.org/10.15549/jeecar.v6i2.338

14. Moreno-Enguix, M. D. R., & Lorente Bayona, L. V. (2017). Factors affecting public expenditure efficiency in developed countries. *Politics & Policy, 45*(1), 105-143. https://doi.org/10.1111/polp.12194

15. Moshiri, S., & Daneshmand, A. (2020). How effective is government spending on

Vol. 30, 2025/ISSN 0973-5917
DOI : http://dx.doi.org/10.62424/VUJC.2025.30.00.01

environmental protection in a developing country? An empirical evidence from Iran. *Journal of Economic Studies, 47*(4), 789-803. https://doi.org/10.1108/JES-12-2018-0458

16. Pearce, D., & Palmer, C. (2001). Public and private spending for environmental protection: a cross-country policy analysis. *Fiscal studies*, *22*(4), 403-456. https://doi.org/10.1111/j.1475-5890.2001.tb00048.x

17. Qu, Y., Li, J., & Wang, S. (2022). Green total factor productivity measurement of industrial enterprises in Zhejiang Province, China: A DEA model with undesirable output approach. *Energy Reports, 8,* 307–317. https://doi.org/10.1016/j.egyr.2022.05.094

18. Soare, B. E., Potârniche, M., & Petre, I. L. (2020). The effect of GDP growth on environmental protection expenditure in Romania. *International Multidisciplinary Scientific GeoConference: SGEM, 20*(5.2), 547-554. https://doi.org/10.5593/sgem2020/5.2/s21.067

19. Temiz Dinç, D., & Akdoğan, E. C. (2019). Renewable energy production, energy consumption and sustainable economic growth in Turkey: A VECM approach. *Sustainability, 11*(5), 1273. https://doi.org/10.3390/su11051273

20. Yurynets, Z. V., & Kruglyakova, V. V. (2016). Neural Network Modelling as A Forecasting Tool for Innovative Development of Ukraine's Economy. *Aktual'ni Problemy Ekonomiky Actual Problems in Economics*, (180), 425. https://www.proquest.com/openview/a5a19ac96691c8949e20b4058e301282/1?pq-origsite=gscholar&cbl=2035679