OPEN ACCESS

Kashf Journal of Multidisciplinary Research
Vol: 02 - Issue 1 (2025)
P-ISSN: 3007-1992 E-ISSN: 3007-200X
https://kjmr.com.pk

PANEL DATA STUDY OF ASEAN COUNTRIES ABOUT TOURISM, TRADE AND ENVIRONMENTAL SUSTAINABILITY

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DOI: https://doi.org/10.71146/kjmr221

Article Info

Abstract

This research explores the determinants of environmental sustainability in the form of tourism and trade for eight ASEAN economies over the time 2001 to 2020. In the presence of cross-sectional dependency in the cross section, we apply the 2nd generation unit root test to check the stationary of the variables. On the basis of mixed order of integration, we utilize the panel ARDL (PMG) method for short and long run analysis. The empirical findings reveal that the tourism, trade, GDP, and industrialization are significant contributors in increasing environmental degradation in long run scenario. But the effects of tourism and trade are positive and significant on environment degradation in short run. In the light of these results, trade and tourism are effective and useful tools for environmental sustainability in ASEAN countries. Further research can be conducted by including economic and regulatory indicators along with trade and tourism to design as effective policy to maintain environmental sustainability.

Keywords:

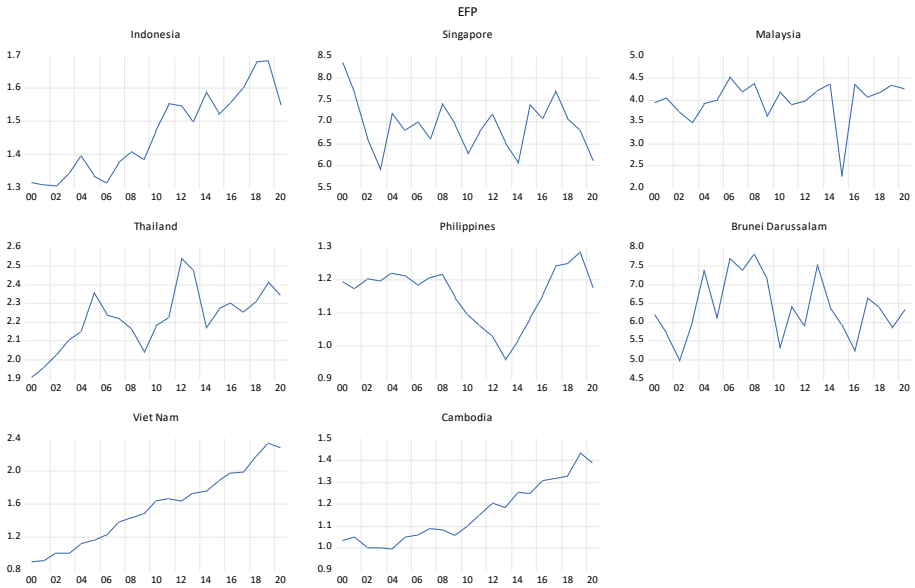
Environment, Sustainability, Trade, Tourism, Panel Data, Industrialization.

Introduction

The ever-multiplying income inequality, unbridled resource consumption, and environmental sustainability have become core issues world-over (Guan, C., et al., 2022). One of the chief concerns is to maintain environmental sustainability (Khan, et al., 2024), this would have an irreversible impact on ecosystems. The unfavorable consequences of environmental degradation give boost to terrible disaster as of drought, food shortages, low agricultural productivity and the rapid melting of glaciers (Mongo et al., 2021). Most of the researchers believe that the polluted environment is a main driver of increasing global temperatures having lethal impact on natural and human ecosystems (Wei & Lihua, 2023), almost two-thirds of dangerous gases emissions are produced by the energy sector including 81% share of CO_2 emission (IEA, 2017).

The Association of Southeast Asian Nations are in grip of environmental degradation having an abundance of natural resources and good economic performance (Umar et al., 2022). In this economic performance, the consumption of fossil fuels is regarded as a main key driver to upgrade the environmental vulnerability in these countries in account of increase in CO_2 emissions (Sandu et al., 2019). In earlier studies, most of the researchers have used CO_2 emission for environmental degradation (Ansari, et al., 2022) that covers only single aspect of environmental quality. In this study, we have used the ecological footprint (EF) as a yard-stick to measure environmental quality, comprising the utilization of natural resources and waste generation by using productive land including cropland, grazing-land, fishing grounds, built-up land, forest area, and carbon absorption land (Global Footprint Network, 2021). Being an effective indicator of environmental degradation as compared to CO_2 emissions, it incorporates a broader range of environmental impacts, including land use, water consumption, and resource extraction (Ansari, et al., 2022). From the figure 01, EF of eight ASEAN countries has an increasing and fluctuating trend from 2000-2020. Among these countries, Indonesia, Thailand, Viet Nam and Cambodia are major pollution producers' economies, whereas, the environmental condition of Singapore, Malaysia and Brunei Darussalam is not satisfactory owing to the ever-fluctuating environmental quality of these nations. In the nut shell, the environment of ASEAN economies is an uphill challenge for researchers and policy-makers to sort-out the factors that create such critical environment situation.

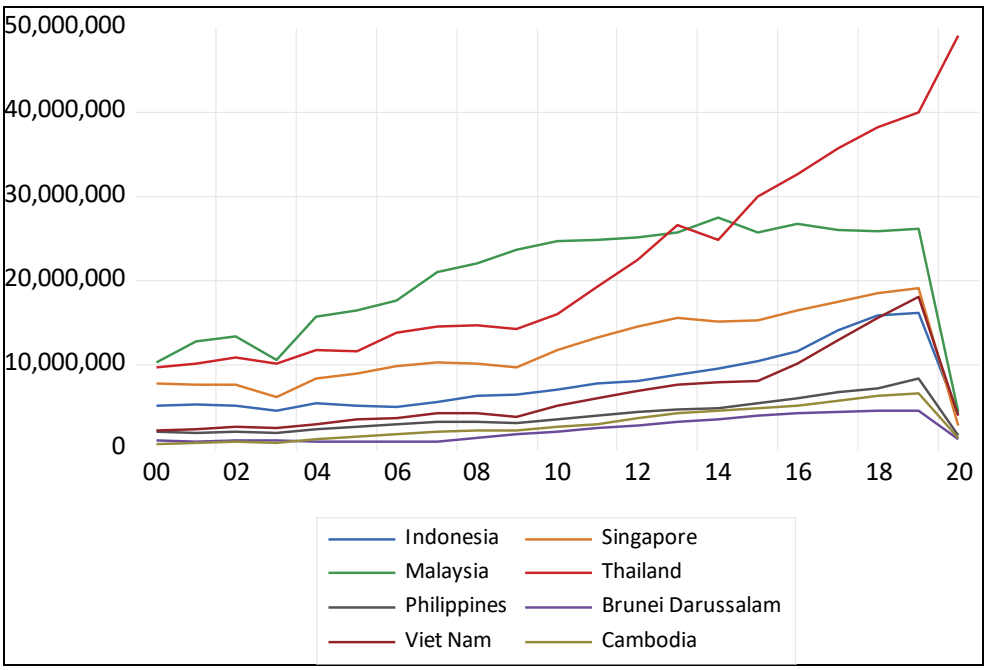
Figure 1: Trends of EFP of ASEAN



Source: Designing by author through EViews 12

The World Economic Forum (2022) has recommended ASEAN economies as tourism-friendly nations. Therefore, this sector acts as a game change agent for the economic growth due to its cultural diversity, and several beautiful sights (Aini, Y. N., 2024). The attraction of international tourists in this region is merely because of its affordable travelling cost, multiple historical places, and adventurous tourism activities. Keeping these glamorous attributes in view, government authorities focus on tourism sector by stepping up infrastructure and promising safety measures. From 2001 to 2020, the trend of this sector is optimistic in the economic growth of this region due to government opt initiatives for the promotion of this sector, this trend is highlighted in figure 2. In this diagram, we can observe that Malaysia, Thailand and Singapore welcome more tourists from all over the world than other ASEAN countries.

Figure 2: Trends of Tourist of ASEAN



Moreover, the growth of tourism industry is based on transportation, infrastructure, energy, residential accommodation and food availability etc. (Bento & Moutinho, 2016) and these tourism connecting activities are the prime sources of the climatic change and water pollution (Sun and Liu, 2020). In this environmental degradation, transportation and accommodation sectors contribute 75% and 20% greenhouse gas emissions respectively (IPCC, 2014). In this context, Lee and Chen (2021) conducted a study on environmental sustainability measured in ecological footprint, tourism and country risk in 123 European economies from 1992 to 2016. The findings of this research indicate that the positive growth in tourism sector gives forth to increase environmental degradation. On the contrary, the study of Kongbuamai, et al., (2020) highlighted the negative relationship among tourism, natural resources and environmental degradation from 1995 to 2016 in the ASEAN countries. Therefore, the effect of tourism on environment sustainability is surprisingly different in various studies as per identified determinants of ecological footprint.

Similar to tourism, another crucial ingredient of environmental quality is foreign trade which is a life-line for growth and regional economic integration (Pham & Nguyen, 2024). Trade drives resource exploitation, such as deforestation for timber and palm oil production in Indonesia and Malaysia, leads to habitat loss,

biodiversity decline, and increased carbon emissions. Industrial activities linked to trade also result in significant pollution, as factories produce harmful emissions and waste that degrade air, water, and soil quality. Also, the logistics of trade, particularly shipping, contribute to a large carbon footprint, exacerbating climate change.

Objectives:

The objectives of this study are highlighted below:

1. To evaluate the impact of tourism on the ecological footprint in ASEAN countries.
2. To investigate how trade openness influences the ecological footprint in the region.
3. To compare country-specific variations in the ecological footprint due to tourism and trade.
4. To propose sustainable strategies to mitigate the environmental impacts of tourism and trade in ASEAN.

Pata et al. (2023) conducted a study on environmental deterioration in ASEAN nations, they gave the direction to initiate future study by including more ASEAN countries, using ecological footprint as environmental degradation indicator instead of CO_2 emission, and analyzing country-specific results also. Based on these future recommendations, we conduct this study on environmental degradation of eight ASEAN economies and the environmental degradation is measured in ecological footprint instead of CO_2 emission for attaining robust results. Additionally, we include panel data results for acquiring more accurate analysis to design environment friendly policy.

This paper is further divided into four section: the "Literature Review" section summarizes earlier studies on the subject and assesses the literature review that is relevant to this study. The "Data and Methodology" section contains an introduction to the data and methodology. The results are shown in the "Results and Discussion" and "Conclusion" section offers a summary of the findings and future recommendation.

2. Literature Review

In this section, the earlier studies of this topic have been reviewed to identify the important determinants of environmental degradation. On the basis of previous researches, the current can be more meaningful for policy formation to cope up climatic adversity.

Tourism is considered as an important component of environmental sustainability. But the debate in this context is a controversial according to earlier research. Now, the literature is reviewed for the relationship of tourism and environmental sustainability to analysis this controversial discussions. The previous studies indicate that tourism is a main source of environment degradation. The environmental degradation increased due to the rise in tourism activities in the light of the working of Selvanathan (2021), but some researchers claimed that tourism can be beneficial for environmental sustainability (Wei and Lihua 2022). The study of Ansari et al. (2021) conducted a research on the relationship between tourism and ecological footprint. In this study, they included five nations that attract tourists and they concluded that the ecological footprint increases due more inflow of tourists in these countries. For the association of tourism and EFP, a research was initiated in 10 tourist centers in the period of 1995-2016 by Alola et al. (2021). They employed the Pooled Mean Group approach and they observed a positive relationship between the number of tourists and the ecological footprint. Moreover, Guan et al. (2022) confirmed the positive relationship between tourism and the ecological footprint from 1995 to 2019 of G-10 nations.

On the other hand, the role of tourism is crucial to reduce environmental degradation. In this context, Kongbuamai et al. (2020) conducted a study on tourism and ecological footprint in ASEAN countries from 1995 to 2016, they analyzed that tourism is negatively related to the ecological footprint. Moreover,

Nathaniel et al. (2021) observed that the tourist's inflow and tourism revenue impacted negatively on environment in 10 selected countries used in this study.
At the end, the studies that argue that there is no relationship between the tourism activities and environmental deterioration. Ozturk et al. (2016) completed their research on environmental degradation and tourism activities for 144 countries in 1988-2008. They analyzed that tourism inflow did not significantly affect environment. The research of Han et al. (2022) indicated that the relationship between tourism and the ecological footprint did not exist. From this literature, we analyze the given hypothesis in this study.

H_1: Tourism significantly increases the ecological footprint in ASEAN countries.

This hypothesis posits that higher levels of tourism activity correlate with a larger ecological footprint due to increased resource consumption and waste generation.

In environment sustainability, the trade is more powerful contributor to achieve this goal. The study of Mrabet and Alsamara (2017) highlighted the trade and environment nexus in Qatar from 1980 to 2011. They utilized the ARDL approach and explored the positive association between trade openness and environment. In the light of this study, more trade creates more environmental degradation in Qatar with stated time frame. Conversely, Destek et al. (2018) examined the connection between trade, GDP and ecological footprint in EU countries. They identified the negative relationship between Trade openness and the ecological footprint. This study focuses on trade activity which leads to reduce environmental deterioration in EU nations. Nathaniel et al. (2020) conducted a study to analyze the impact of trade, economic growth and urbanization on environment in 6 countries like Colombia, Indonesia, Vietnam, Egypt, Turkey, and South Africa. They examined that trade activities and economic growth do not cause harmful effect on environment. On the basis of earlier studies, we examine the H_2 hypothesis in current study.

H_2: Trade openness leads to a higher ecological footprint in ASEAN countries.

This hypothesis suggests that greater trade openness results in more industrial activity, resource exploitation, and environmental degradation, thus increasing the ecological footprint.

The literature of the relationship between economic growth and the environmental degradation provides the basic roots to determine environmental sustainability. In this scenario, Addai et al. (2022) conducted a study on the relationship between economic growth and the EFP in Eastern Europe from 1998 to 2017. They found that a unidirectional causal relationship exists between economic growth and the EFP in long run, but it is a bi-directional causal relationship between economic growth and the EFP in Japan in both the short run and long run with reference to the study of Ikram et al. (2021). In the period of 1999-2017, Çakmak and Acar (2022) explored the positive and significant link between economic growth and EFP in eight oil-producer like Saudi Arabia, Kuwait, Nigeria, China, the United States, Russia, Canada, and Brazil. Moreover, Ritu and Kaur (2024) confirmed the positive association between economic growth and EFP in the long run for the period 1997–2020 in India. In the light of previous studies, we examine the H_3 hypothesis in current study.

H_3: Economic growth leads to a higher ecological footprint in ASEAN countries.

This hypothesis suggests that greater economic growth results in more production activities, and environmental degradation, thus increasing the ecological footprint.

Urbanization plays a pivotal role in rising the demand of natural resources that leads to environmental sustainability issues. Studies of Ahmed et al. (2020), and Nathaniel et al. (2020) indicate that the EFP increases with the increase in urbanization. While, Ullah et al. (2023), and Arnaut and Dada (2023) determine that urbanization leads to reduce in the EFP. They argue that urbanization correlates with increased purchasing power among urban residents, potentially driving demand for clean technologies and more optimal utilization of natural resources. The literature shows that urbanization can have either a positive or negative impact on the EFP. On the ground of past studies, we find the H_4 hypothesis in current study.

H_4: Urbanization leads to a higher ecological footprint in ASEAN countries.

This hypothesis suggests that more urbanization results in more land occupation, more infrastructure, high energy consumption, and environmental degradation, thus increasing the ecological footprint.

As per the study of Yang et al. (2021), industrialization is linked with economic growth and it is one of the most leading contributors to an increased EFT. Moreover, industries require substantial energy and resources to sustain themselves within a specific timeframe. Wang et al. (2022) indicated that industrialization is accompanied by increased energy demand, which is predominantly sourced from fossil fuels. Additionally, fossil fuels and other energy sources, including coal and renewable energy, are required to sustain the industrial networks in major cities and urban centers globally. Munir and Ameer (2020) attained a similar results to employ the nonlinear ARDL technique and they found that industrialization is important for the environment. On the basis of earlier studies, we examine the H_5 hypothesis in current study.

H_5: Industrialization leads to a higher ecological footprint in ASEAN countries.

This hypothesis suggests that higher industry leads to more land requirement, vast infrastructure, high energy consumption, and environmental degradation, thus increasing the ecological footprint.

On the basis of earlier studies, GDP, industrialization, urbanization, trade openness, and tourism are pivotal components for environmental sustainability. For the sake of environmental sustainability, we conduct a research in eight ASEAN countries despite of data limitation and take a comprehensive environmental sustainability indicator such as ecological footprint which is more powerful indicator of it.

3. Data Collection and Methodology

3.1 Data Collection

In this study, the eight ASEAN countries such as Indonesia, Malaysia, Thailand, Singapore, Vietnam, Philippines, Brunei Darussalam and Cambodia etc. have been selected on the basis of their fast economic growth and massive environmental degradation due to fossil fuels consumption (Kostakis, I., 2024), whereas, two countries like Laos and Burma were not included in this study owing to data limitation. This panel data study analyzes the effect of tourism and trade on environmental degradation in the ASEAN Countries for 2001-2020. The data of all the variables used in this study have taken from World Development Indicators (WDI) databases but the data of Ecological Footprint were obtained from Global Footprint Network (GFN) database.

3.2 Econometric Model

The aim of this study is to investigate the effect of tourism and trade on environment degradation of eight ASEAN countries. The econometric form of this study is as follows:

$lnED_{it} = \alpha_0 + \alpha_1 lnTO_{it} + \alpha_2 lnGDP_{it} + \alpha_3 lnTU_{it} + \alpha_4 UR_{it} + \alpha_5 IND_{it} + U_{it}$---------- *(1)*

In above econometric model, symbol 'i' indicates the cross sections and't' represents the time period. The parameters α_0 show intercept and $\alpha_1, \alpha_2, \alpha_3, \alpha_4$ and α_5 are the slope co-efficients. From equation 1, the variables used in this study are given below:

ED = Environmental Degradation, TO = Trade Openness, GDP = Gross Domestic Product

TU = Tourism, UR = Urbanization, IND = Industrialization

In above model, all variables are in logarithmic form except Urbanization and Industrialization due to its negative values and U_{it} is error term.

3.3 Variable Description

The description of six variables used in current study are highlighted in table 01. The proxy of environmental degradation is ecological footprint taken as a dependent variable. The trade openness and tourism were two main independent variables and other were control variables.

TABLE 1: Variables Description

Variable	Proxy	Symbol	Measurement Unit
Environmental Degradation	Ecological Footprint	EF	Global Hector, per capita
Trade	Trade	TO	% of GDP
Economic Growth	Gross Domestic Income	GDI	Constant LUC
Tourism	International Tourism	IT	Number of Arrivals
Industrialization	Manufacturing, value added	IND	annual % growth
Urbanization	Urban population growth	UR	annual %

3.4 Methodology

3.4.1 Checking Multicollinearity

To check the multicollinearity, correlation matrix is developed form the given data. After the calculation of correlation, Variance Inflation factor (VIF) can be utilized to determine multicollinearity among the regressors.

3.4.2 Hsiao'S Heterogeneity Test

Hsiao (2014) introduced tests to determine the homogeneity or heterogeneity in panel data. Suppose, we have the following function:

$y_{it} = \alpha_i + \beta_i x_{it} + e_{it}$

Test-1: Null Hypotheses: The panel is homogeneous.

Test-2: Null Hypotheses: The panel is partially homogeneous.

Test-3: Null Hypotheses: The panel is partially heterogeneous.

If the p values of these hypothesis are less than 5%, the null hypothesis have been rejected and the overall conclusion is that the panel data is heterogeneous.

3.4.3 Cross-Section Dependence Test

In panel data study, we, initially, check cross sectional dependence in individual cross sections and residual terms. For this, we use Breusch-Pagan LM test to check the presence of CSD due to small cross section units and a large time periods. The equation of Breusch-Pagan LM test is given below:

$LM = N \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^{\,2}$ ---------- (2)

Where,

$\hat{\rho}_{ij}$ = Correlation coefficient of error terms between cross-sectional units i and j

3.4.4 Panel Unit Root

The Panel unit root tests can be classified into two categories such as 1st generation and 2nd generation tests. If CSD is present in the panel data, we apply 2nd generation unit root test for further proceeding, otherwise we employ the 1st generation unit tests to take unbiased results (Guan et al., 2022).

3.4.5 Panel ARDL Approach

To check the stationary in the variables through unit root tests, if the variables are stationary at level and 1st difference order of integration. In this case, Pesaran et al., (2001) suggested the panel autoregressive distributed lag model (ARDL) to analyze co-integration and they devised the pooled mean group (PMG) estimator, incorporating both pooling and averaging of coefficients. Furthermore, Narayan and Narayan (2004) recommend that panel ARDL method provides better and reliable results for small samples.

The panel ARDL equation is represented as follows:

$$\Delta ED_{it} = \beta_i + \delta_1 ED_{i,t-1} + \delta_2 TO_{i,t-1} + \delta_3 GDP_{i,t-1} + \delta_4 TU_{i,t-1} + \delta_5 UR_{i,t-1} + \delta_6 IND_{i,t-1} + \sum_{i=1}^{p} \alpha_{1i} \Delta ED_{i,t-1} + \sum_{i=0}^{q1} \alpha_{2i} \Delta TO_{i,t-1} + \sum_{i=0}^{q2} \alpha_{3i} \Delta GDP_{i,t-1} + \sum_{i=0}^{q3} \alpha_{4i} \Delta TU_{i,t-1} + \sum_{i=0}^{q4} \alpha_{5i} \Delta UR_{i,t-1} + \sum_{i=0}^{q5} \alpha_{6i} \Delta IND_{i,t-1} + \varepsilon_{it}$$ ---------- (3)

Where,

i = Cross Section, t = Time, β_i = Fixed effects, $\delta_1, \delta_2, \delta_3, \delta_4, \delta_5, \delta_6$ = long-run coefficients

$\alpha_{1i}, \alpha_{2i}, \alpha_{3i}, \alpha_{4i}, \alpha_{5i}, \alpha_{6i}$ = Short-run coefficients, ε_{it} = Error Term across countries and time.

Model (3) can be expressed as a VECM system as follows:

$$\Delta ED_{it} = \beta_i + \sum_{i=1}^{p} \alpha_{1i} \Delta ED_{i,t-1} + \sum_{i=0}^{q1} \alpha_{2i} \Delta TO_{i,t-1} + \sum_{i=0}^{q2} \alpha_{3i} \Delta GDP_{i,t-1} + \sum_{i=0}^{q3} \alpha_{4i} \Delta TU_{i,t-1} + \sum_{i=0}^{q4} \alpha_{5i} \Delta UR_{i,t-1} + \sum_{i=0}^{q5} \alpha_{6i} \Delta IND_{i,t-1} + \vartheta_i ECM_{i,t-1} + \varepsilon_{it}$$ ---------- (4)

In equation 4, $ECM_{i,t-1}$ represents error correction term, and symbol ϑ_i indicates the speed of adjustment from the short run to the long-run equilibrium position. The value of ϑ_i should be negative and significant for the transformation into long-run equilibrium (Dritsaki, M., & Dritsaki, C., 2024).

3.4.6 Panel ARDL Causality Test

The method was developed by Dumitrescu and Hurlin (2012) to check the existence of a causal relation between the variables. In this test, the causality relationship between *Y* and *X* is analyzed using a linear model as follows:

$$Y_{i,t} = \alpha_i + \sum_{k=1}^{K} \beta_i^k Y_{i,t-k} \sum_{k=1}^{K} Y_i^k X_{i,t-k} + \varepsilon_{i,t}$$ ---------- (5)

From equation 5, *k* indicates the optimal lag length. The null and alternative hypotheses of the DH causality test can be defined as follows:

H_0: Causality between X and Y does not exist for all cross-sections

H_1: Causality between X and Y exists for all cross-sections

If the p-value is less than 5% then we reject null hypothesis and causality between variables exists.

4. Results and Discussion

In this section, we present the results of the data of ASEAN countries of the selected study variables.

4.1 Results

4.1.1 Descriptive Analysis

In descriptive analysis, the mean values of logEFT, log GDP, logTU, logTO, UR and IND were 0.380776, 13.04793, 6.784332, 2.079627, 2.552916 and 5.239212 respectively. To check the variables 'normality, Jarque Bera test was applied. From this test, we observed that the variables whose p-value were less than 5% were not normal. In the table, log GDP, logTU and logTO were considered as normal as per the Jarque Bera test.

Table 2: Descriptive Analysis

	LogEFT	Log GDP	LogTU	LogTO	UR	IND
Mean	0.380776	13.04793	6.784332	2.079627	2.552916	5.239212
Median	0.308407	12.97178	6.793614	2.083124	2.444823	5.068526
Maximum	0.921526	16.02825	7.691135	2.640806	5.321517	30.28660
Minimum	0.049486	9.884174	5.668386	1.518148	-1.474533	-21.83876
Std. Dev.	0.309066	0.261239	0.445230	0.247429	0.934084	6.963717
Skewness	0.382934	0.291882	-0.284322	0.308936	-0.337343	0.183708
Kurtosis	1.606922	3.082394	2.419991	3.037254	4.929802	6.273926
Jarque Bera	17.69055	2.757657	4.618358	2.682076	29.25536	75.97512
Probability	0.000144	0.279604	0.099343	0.261574	0.000000	0.000000
Observation	168	168	168	168	168	168

Note: Authors calculation from EViews 10

4.1.2 Multicollinearity Test

For multicollinearity, the correlation matrix is created by using EViews 10 software. The given table 3 shows the low correlation between the variables except logEFT and log GDP. According to rule of thumb, the variance inflation factor (VIF) should be less than 10 and the results of all the variables represented that the VIF is less than 10. Therefore, the multicollinearity among regressors does not present.

Table 3: Multicollinearity Results

Variable	**Correlation**						**VIF**
	LogEFT	IND	UR	LogTO	LogTU	Log GDP	
LogEFT	1.0000						-
IND	-0.2121	1.0000					1.15
UR	-0.2861	0.0868	1.0000				1.15
LogTO	0.5940	0.1211	-0.0267	1.0000			1.60
LogTU	0.2251	-0.1305	0.0968	0.2646	1.0000		1.23
Log GDP	-0.7601	0.1645	0.3278	-0.4571	0.0969	1.0000	1.67

Note: Authors calculation from EViews 10

4.1.3 Cross-Section Dependence Test

In panel data analysis, cross-section dependence test is applied before moving to unit root tests. From table 4, we apply three CSD tests like Breusch-Pagan LM, Pesaran Scaled LM and Pesaran CD in this study (Pata et al., 2023). If the p-value is less than 5%, the CSD is present in the panel data, otherwise, it is not present. The below-mentioned table shows that there is CSD present in panel as per prescribed tests

because the p-values of Breusch-Pagan LM and Pesaran Scaled LM except Pesaran CD test are less than 5% which indicates the overall presence of CSD in panel data.

Table 4: CSD Test Results

Test	Chi-bar Statistic	p-value
Breusch-Pagan LM	65.94783	0.0001*
Pesaran Scaled LM	5.070992	0.0000*
Pesaran CD	1.467537	0.1422

Source: Author's Calculation by EViews 10

4.1.4 Hsiao Test for Homogeneity

For the exhibition of heterogeneity in cross-sectional units, we apply Hsiao test. In this context, three tests are used to specify homogeneity in panel data. From the table 5, we can discuss these tests results as follows:

- In test I, the very low p value from 5% level of significance indicates the rejection the null hypothesis. Therefore, we conclude that the panel is either heterogeneous or partially homogeneous.
- In test II, we reject the null hypotheses due to very low-p value. Therefore, we conclude that the panel is heterogeneous.

- From test III, the very low p-value indicates that we reject the null hypothesis that the panel is homogeneous. Therefore, the panel is partially homogeneous.

Table 5: Homogeneity Specification Tests Results

Hypotheses	Chi-bar Statistic	p-value
H_1	84.77925	1.15E-71
H_2	4.934089	2.75E-11
H_3	256.3121	8.40E-82

Source: Author's Calculation by EViews 10

In the light of above discussion, we have rejected the null hypotheses for both H1 (homogeneity) and H2 (partial homogeneity), the overall conclusion is that the panel data is heterogeneous.

4.1.5 Panel Unit Root Test

In case of the presence of CSD in panel data, we apply 2nd generation unit root test for getting reliable results. For assessing the second-generation unit root, we employ Pesaran's (2007) single-factor CIPS test in the presence of cross-sectional dependence and heterogeneity in the panel data.

Table 6: Panel Unit Root Test (2nd Generation)

At Level with Intercept			At 1st Difference with Intercept	
Variable	**t-stat**	**Decision**	**t-stat**	**Decision**
LogGDP	-2.020	Non-stationary	-3.654	Stationary*
LogTU	-2.221	Non-stationary	-3.284	Stationary*
LogTO	-1.569	Non-stationary	-3.097	Stationary*

LogEFT	-2.283	Non-stationary	-4.815	Stationary*
IND	-3.463	Stationary*	-	-
UR	-1.925	Non-stationary	-4.342	Stationary*

Source: Author's Calculation by STATA 14, Critical Values: -2.57 (1%), -2.34 (5%) & -2.21 (10%)

From the above table 6, we can observe that all variables except industrialization were non-stationary at level but non-stationary variables were stationary at 1st difference. Therefore, we can assess that majority of the variables were stationary at 1st difference and only one variable was stationary at level.

4.1.6 PMG ARDL COINTEGRATION TEST

Panel unit root test indicates that the variable are integrated at level and 1st difference. So, we use the panel ARDL-PMG approach to determine environmental sustainability. The tourism industry, trade openness, GDP and industrialization play a positive and significant role in increasing environmental degradation in these countries in long run scenario. But the participation of GDP in this environmental deterioration is more as compared to tourism, trade and industrialization in long run, while, the effect of urbanization is a positive and insignificant on EFP.

In short run, the effects tourism and trade openness were positive and significant on environment degradation in these nations. But the effect of GDP, industrialization and urbanization on environmental sustainability was insignificant.

Table 7: ARDL- PMG Results

Long-run Results of the Panel ARDL (PMG) **ARDL** (1, 1, 1, 1, 1, 1, 1)				
Dependent Variable: LogEFT				
Variable	**Coefficient**	**Std. Error**	**t-statistic**	**Prob.***
LogGDP	0.309264	0.050703	6.099468	0.0000*
LogTU	0.060801	0.028140	2.160666	0.0330*
LogTO	0.119180	0.045893	2.596901	0.0107*
IND	0.001507	0.000661	2.279648	0.0246*
UR	0.002335	0.004337	0.538330	0.5915

Short-run Results of the Panel ARDL (PMG)

Variable	**Coefficient**	**Std. Error**	**t-statistic**	**Prob.***
ECM (-1)	-0.544006	0.125168	-4.346211	0.0000*
D(LogGDP)	-0.192461	0.308136	-0.624598	0.5336
D(LogTU)	0.070868	0.027620	2.565805	0.0117*
D(LogTO)	0.178681	0.063357	2.820203	0.0057*
D(IND)	0.000526	0.000840	0.626636	0.5322
D(UR)	0.033712	0.026833	1.256350	0.2117
C	-1.465890	0.351679	-4.168259	0.0001

From the table 7, if 1% increase in GDP, tourism activities, trade and industrialization lead to 0.31%, .061%, 0.12% 0.002% rising environment degradation respectively. But the effects of urbanization are positive insignificant on environmental sustainability. In short run, if 1% increase in tourism activities, and trade lead to 0.071% and 0. 18% rising environment degradation respectively. But the impacts of

industrialization and urbanization are positive and insignificant on environmental sustainability, whereas GDP affects negatively and insignificantly on environment.

Lastly, the coefficient of error correction term (ECT) is negative and statistically significant and this coefficient suggests that short-term deviations will be converged towards long-term equilibrium with speed of 54%.

4.1.7 Panel Causality Test

Finally, we determine the causality between variables through Dumitrescu Hurlin (DH) test (2012). According to this we identify the unidirectional or bidirectional relationship between variables. Form the table 8, we can see that there is unidirectional relation in environmental degradation to trade openness. The more trade can strengthen environment. Moreover, the GDP has unidirectional relation with trade, urbanization and industrialization. Consequently, trade, urbanization and industrialization can increase GDP in this context. In case of tourism, it has unidirectional relation with trade, urbanization, and industrialization. So, trade, urbanization, and industrialization play meaningful role to boost up trade in these countries in this tenure. Only urbanization has bidirectional association with trade, these two variable can affect to each other. At last, unidirectional relation exists in industrialization to urbanization and urbanization increases industrialization in these countries.

Table 8: Dumitrescu Hurlin Panel Causality Test

No.	H_0	W-stat	Z bar Stat	Prob.	Decision
1	LogGDP ≠ LogEFT	3.75505	1.45652	0.1452	None
2	LogEFT ≠ LogGDP	1.58229	-0.76943	0.4416	None
3	LogTU ≠ LogEFT	2.62562	0.29944	0.7646	None
4	LogEFT ≠ LogTU	1.74982	-0.59780	0.5500	None
5	LogTO ≠ LogEFT	2.89515	0.57558	0.5649	None
6	LogEFT ≠ LogTO	4.54827	2.26916	0.0233	LogEFT LogTO
7	UR ≠ LogEFT	3.38134	1.07367	0.2830	None
8	LogEFT ≠ UR	3.04718	0.73132	0.4646	None
9	IND ≠ LogEFT	2.06170	-0.27828	0.7808	None
10	LogEFT ≠ IND	4.04918	1.75785	0.0788	None
11	LogTU ≠ LogGDP	1.99263	-0.34905	0.7271	None
12	LogGDP ≠ TU	3.04259	0.72662	0.4675	None
13	LogTO ≠ LogGDP	2.89776	0.57825	0.5631	None
14	LogGDP ≠ LogTO	12.0537	9.95831	0.0000	LogGDP LogTO
15	UR ≠ LogGDP	2.36995	0.03752	0.9701	None
16	LogGDP ≠ UR	6.17407	3.93477	8.E-05	LogGDP UR
17	IND ≠ LogGDP	3.93618	1.64209	0.1006	None
18	LogGDP ≠ IND	9.28258	7.11938	1.E-12	Longping
19	LogTO ≠ LogTU	2.61089	0.28436	0.7761	None
20	LogTU ≠ LogTO	7.95731	5.76166	8.E-09	LogTU LogTO
21	UR ≠ LogTU	2.07208	-0.26765	0.7890	None
22	LogTU ≠ UR	5.73361	3.48352	0.0005	LogTU UR
23	IND ≠ LogTU	0.75374	-1.61827	0.1056	None
24	LogTU ≠ IND	5.50418	3.24847	0.0012	LogTU→IND
25	UR ≠ LogTO	5.06045	2.79388	0.0052	UR→LogTO
26	LogTO ≠ UR	7.39622	5.18684	2.E-07	LogTO→UR
27	IND ≠ LogTO	2.89187	0.57222	0.5672	None
28	LogTO ≠ IND	3.49170	1.18672	0.2353	None
29	IND ≠ UR	7.30023	5.08850	4.E-07	IND→UR
30	UR ≠ IND	3.89020	1.59498	0.1107	None

4.2 Discussion

In this study, we analyzed that these countries focused on trade such as export-led growth, whereas trade accelerated GDP that put high pressure on natural resources. On the basis of globe demand, the repaid plantations of palm oil in Malaysia and Indonesia created more deforestation and biodiversity loss in this region. Moreover, the repaid trade flow due to trade agreements like AFTA and ACFTA boosted economic integration on the cost of increasing environmental degradation. The analysis of current study about the positive relationship between trade and environmental degradation was also confirmed by Mrabet and Alsamara (2017) study. On the basis of this research, more trade hubs created more environmental degradation in Qatar.

Tourism in Thailand, Vietnam, and Malaysia is considered as an economic driver. But higher tourist arrivals inflow created significant environmental challenges such as more waste generation, increase coastal areas population, and destruction of marine ecosystems. This study also highlights this positive and significant relationship between them and the research of Alola et al. (2021) also verified this current research findings.

The expansion in GDP brings more energy consumption, high waste production, and an increase in urbanization. Therefore, high-income economies such as Singapore saw developments in energy efficiency and sustainability initiatives, but middle- and low-income nations continued to maintain balance economic growth with environmental protection. In this regard, energy consumption in form of fossil fuels, mostly coal, played significant role in environmental degradation. In the light of Çakmak and Acar (2022) study, the positive association between GDP and environmental degradation confirmed in long run.

In Thailand, Vietnam, and the Philippines are the hubs of manufacturing sector for producing exports. This process of industrialization boosted economic growth but created major environmental issues. These Industrial centers lacked robust environmental regulations, allowing pollution to exceed sustainable levels. The study of Wang et al. (2022) proved this positive relationship between industrialization and environmental degradation,

ASEAN nations faced the challenge of balanced economic growth and environmental sustainability from 2001 to 2020. Whereas trade openness, tourism, Economic growth, and industrialization are the main ingredients of ASEAN development, they increased ecological degradation.

5. Conclusion

In the UN Sustainable Development Goals (SDGs), the Goal 13 ‘Climatic Action’ is very hot issue in current debates and discussions. Therefore, the current study also plays meaningful role to access the environmental sustainability indicators. In this study, we analyze the impact of trade and tourism on environmental sustainability in 08 ASEAN economies. For this, we applied the panel ARDL (PMG) technique and DH panel causality tests. The findings of this study indicates that the tourism, trade, GDP and industrialization are significant contributors in increasing environmental degradation in long run scenario. But the effects of tourism and trade are positive and significant on environment degradation in short run. In the light of these results, trade and tourism are effective and useful tools for environmental sustainability in ASEAN countries. Moreover, if 1% increase in GDP, tourism activities, trade and industrialization led to 0.31%, .061%, 0.12% 0.002% rising environment degradation respectively. But the effects of urbanization were positive insignificant on environmental sustainability. In short run, if 1% increase in tourism activities, and trade led to 0.071% and 0. 18% rising environment degradation respectively. In the light of these results, trade and tourism are effective and useful tools for environmental sustainability in ASEAN countries.

Future studies should be conducted to develop the specific mechanisms to promote industrialization for environmental sustainability in ASEAN countries. In the presence of targeted policies, further research should be initiated to investigate the effects of various kinds of tourism activities on environmental

degradation. Furthermore, comparative studies on the differential effects of tourism and trade in ASEAN economies with various economic and regulatory perspectives are needed for further study.

References:

Addai, K., Serener, B., & Kirikkaleli, D. (2022). Empirical analysis of the relationship among urbanization, economic growth and ecological footprint: evidence from Eastern Europe. *Environmental Science and Pollution Research*, 29, 27749–27760. https://doi.org/10.1007/s11356-021-17311-x

Ahmad, M., Jiang, P., Majeed, A., Umar, M., Khan, Z., & Muhammad, S. (2020). The dynamic impact of natural resources, technological innovations and economic growth on ecological footprint: An advanced panel data estimation. *Resource Policy*, 69, 101817. https://doi.org/10.1016/j.resourpol.2020.101817

Aini, Y. N. (2024). Sustainable Tourism in Southeast Asia: Balancing Economic Growth, Employment, and Carbon Emissions through Evidence-Based Strategies. *Jurnal Kepariwisataan Indonesia: Jurnal Penelitian Dan Pengembangan Kepariwisataan Indonesia*, 18(1), 157–174. https://doi.org/10.47608/jki.v18i12024.157-174

Alola, A. A., Eluwole, K. K., Lasisi, T. T., & Alola, U. V. (2021). Perspectives of Globalization and Tourism as Drivers of Ecological Footprint in Top 10 Destination Economies. *Environmental Science and Pollution Research*, 28, 31607-31617. https://doi.org/10.1007/s11356-021-12871-4

Ansari, M. A., Haider, S., Kumar, P., Kumar, S., & Akram, V. (2022). Main determinants for ecological footprint: an econometric perspective from G20 countries. *Energy, Ecology and Environment*, *7*(3), 250-267. https://doi.org/10.1007/s40974-022-00240-x

Ansari, M. A., & Villanthenkodath, M. A. (2022). Does tourism development promote ecological footprint? A nonlinear ARDL approach. *Anatolia*, *33*(4), 614-626. https://doi.org/10.1080/13032917.2021.1985542

Arnaut, M., & Dada, J. T. (2022). Exploring the nexus between economic complexity, energy consumption and ecological footprint: new insights from the United Arab Emirates. *International Journal of Energy Sector Management*, *17*(6), 1137-1160. https://doi.org/10.1108/IJESM-06-2022-0015

ASEAN. (2020). *ASEAN key figures 2020*. Association of Southeast Asian Nations. https://www.asean.org

ASEAN. (2021). *ASEAN key figures 2021*. Association of Southeast Asian Nations. https://www.asean.org

ASEAN Secretariat. (2017). *ASEAN Socio-Cultural Community Blueprint 2025*. Association of Southeast Asian Nations. https://www.asean.org

ASEAN Secretariat. (2020). *ASEAN Integration Report 2020*. Association of Southeast Asian Nations. https://www.asean.org

Caballero-Anthony, M. (2018). Understanding ASEAN's role in Asia-Pacific security. *Contemporary Southeast Asia*, 40(3), 336-361.

Çakmak, E. E., & Acar, S. (2022). The nexus between economic growth, renewable energy and ecological footprint: An empirical evidence from most oil-producing countries. *Journal of Cleaner Production*, *352*, 131548. https://doi.org/10.1016/j.jclepro.2022.131548

Chia, S. Y. (2020). The Regional Comprehensive Economic Partnership: Still a work in progress. *Asian Economic Policy Review*, 15(1), 77-93.

Destek, M. A., Ulucak, R., & Dogan, E. (2018). Analyzing the environmental Kuznets curve for the EU countries: the role of ecological footprint. *Environmental Science and Pollution Research*, *25*(29), 29387-29396. https://doi.org/10.1007/s11356-018-2911-4

Dritsaki, M., & Dritsaki, C. (2024). Immigration, Growth and Unemployment: Panel VAR Evidence from EU Countries. *Journal of the Knowledge Economy*, 1-36. https://doi.org/10.1007/s13132-024-01909-w

Dumitrescu, E. I., & Hurlin, C. (2012). Testing for Granger non-causality in heterogeneous panels. *Economic modelling*, *29*(4), 1450-1460. https://doi.org/10.1016/j.econmod.2012.02.014

Global Footprint Network. (2021). Global Footprint Network 2021 Annual Report. https://overshoot.footprintnetwork.org/annual-report-2021/

Guan, C., Rani, T., Yueqiang, Z., Ajaz, T., & Haseki, M. I. (2022). Impact of tourism industry, globalization, and technology innovation on ecological footprints in G-10 countries. *Economic Research-Ekonomska Istraživanja*, *35*(1), 6688-6704. https://doi.org/10.1080/1331677X.2022.2052337

Han, V., Polat, G., & Coşkun, S. (2022). Türkiye'de Turizm Gelişiminin Çevresel Bozulma Üzerine Etkisinin Değerlendirilmesi. *Fiscaoeconomia*, *6*(2), 345-361. https://doi.org/10.25295/fsecon.1049390

Ikram, M., Xia, W., Fareed, Z., Shahzad, U., & Rafique, M. Z. (2021). Exploring the nexus between economic complexity, economic growth and ecological footprint: contextual evidences from Japan. *Sustainable Energy Technologies and Assessments*, *47*, 101460. https://doi.org/10.1016/j.seta.2021.101460

International Energy Agency. (2017). World Energy Outlook 2017a world in transformation. https://www.iea.org/reports/world-energy-outlook-2017

IPCC. (2014). AR5 Synthesis Report: Climate Change 2014. https://www.ipcc.ch/report/ar5/syr/

Khan, A., Awais, M., Majeed, K. B., Beenish, H., & Rashad, M. (2024). Assessing the Impact of Technological Innovations and Trade Openness on Environmental Sustainability: An Empirical Study of South Asian Economies Using Panel ARDL Approach. *Bulletin of Business and Economics (BBE)*, *13*(2), 243-250. https://doi.org/10.61506/01.00322

Kongbuamai, N., Bui, Q., Yousaf, H. M. A. U., & Liu, Y. (2020). The impact of tourism and natural resources on the ecological footprint: a case study of ASEAN countries. *Environmental Science and Pollution Research*, *27*, 19251-19264. https://doi.org/10.1007/s11356-020-08582-x

Kostakis, I. (2024). An empirical investigation of the nexus among renewable energy, financial openness, economic growth, and environmental degradation in selected ASEAN economies. *Journal of Environmental Management*, *354*, 120398. https://doi.org/10.1016/j.jenvman.2024.120398

Lee, C. C., & Chen, M. P. (2021). Ecological footprint, tourism development, and country risk: International evidence. *Journal of Cleaner Production*, 279, 123671. https://doi.org/10.1016/j.jclepro.2020.123671

Majeed, M. T., & Mazhar, M. (2019). Environmental degradation and output volatility: A global perspective. *Pakistan Journal of Commerce and Social Sciences*, 13(1), 180-208. https://hdl.handle.net/10419/196193

Mongo, M., Belaïd, F., & Ramdani, B. (2021). The effects of environmental innovations on CO2 emissions: Empirical evidence from Europe. *Environmental Science & Policy*, *118*, 1-9. https://doi.org/10.1016/j.envsci.2020.12.004

Mrabet, Z., & Alsamara, M. (2017). Testing the Kuznets Curve hypothesis for Qatar: A comparison between carbon dioxide and ecological footprint. *Renewable and sustainable energy reviews*, *70*, 1366-1375. https://doi.org/10.1016/j.rser.2016.12.039

Munir, K., & Ameer, A. (2020). Nonlinear effect of FDI, economic growth, and industrialization on environmental quality: evidence from Pakistan. *Management of Environmental Quality: An International Journal*, *31*(1), 223-234. https://doi.org/10.1108/MEQ-10-2018-0186

Musah, A., & Yakubu, I. N. (2022). Exploring industrialization and environmental sustainability dynamics in Ghana: a fully modified least squares approach. *Technological Sustainability*, *2*(2), 142-155. https://doi.org/10.1108/TECHS-06-2022-0028

Ng, K. H., & Vaghefi, N. (2020). The Strait of Malacca: A Strategic Maritime Chokepoint. *Institute of Southeast Asian Studies*.

Narayan, S., & Narayan, P. K. (2004). Determinants of demand for Fiji's exports: an empirical investigation. *The Developing Economies*, *42*(1), 95-112. https://doi.org/10.1111/j.1746-1049.2004.tb01017.x

Nathaniel, S., & Khan, S. A. R. (2020). The nexus between urbanization, renewable energy, trade, and ecological footprint in ASEAN countries. *Journal of cleaner production*, *272*, 122709. https://doi.org/10.1016/j.jclepro.2020.122709

Nathaniel, S., Nwodo, O., Sharma, G., & Shah, M. (2020). Renewable energy, urbanization, and ecological footprint linkage in CIVETS. *Environmental Science and Pollution Research*, *27*, 19616-19629. https://doi.org/10.1007/s11356-020-08466-0

Nathaniel, S. P., Barua, S., & Ahmed, Z. (2021). What drives ecological footprint in top ten tourist destinations? Evidence from advanced panel techniques. *Environmental Science and Pollution Research*, *28*(28), 38322-38331. https://doi.org/10.1007/s11356-021-13389-5

Ozturk, I., Al-Mulali, U., & Saboori, B. (2016). Investigating the environmental Kuznets curve hypothesis: the role of tourism and ecological footprint. *Environmental Science and Pollution Research*, *23*, 1916-1928. https://doi.org/10.1007/s11356-015-5447-x

Pata, U. K., Dam, D.D., Kaya, F. (2023). How effective are renewable energy, tourism, trade openness, and foreign direct investment on CO2emissions? An EKC analysis for ASEAN countries. *Environmental Science and Pollution Research*, 30, 4821–14837 https://doi.org/10.1007/s11356-022-23160-z

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, *16*(3), 289-326. https://doi.org/10.1002/jae.616

Pham, D. T. T., & Nguyen, H. T. (2024). Effects of trade openness on environmental quality: evidence from developing countries. *Journal of Applied Economics, 27(1).* https://doi.org/10.1080/15140326.2024.2339610

Ritu, R. K., & Kaur, A. (2024). Towards environmental sustainability: nexus of ecological footprint, human capital, economic growth and energy consumption in India. *Management of Environmental Quality: An International Journal*, *35*(1), 179-200. https://doi.org/10.1108/MEQ-06-2023-0172

Sandu, I., van Niekerk, A., Shepherd, T. G., Vosper, S. B., Zadra, A., Bacmeister, J., ... & Svensson, G. (2019). Impacts of orography on large-scale atmospheric circulation. *npj Climate and Atmospheric Science*, *2*(1), 10. https://doi.org/10.1038/s41612-019-0065-9

Selvanathan, E. A., Jayasinghe, M., & Selvanathan, S. (2021). Dynamic modelling of inter-relationship between tourism, energy consumption, CO2 emissions and economic growth in South Asia. *International Journal of Tourism Research*, *23*(4), 597-610. https://doi.org/10.1002/jtr.2429

Solarin, S. A., & Al-Mulali, U. (2018). Influence of foreign direct investment on indicators of environmental degradation. *Environmental Science and Pollution Research*, *25*, 24845-24859. https://doi.org/10.1007/s11356-018-2562-5

Ullah, A., Tekbaş, M., & Doğan, M. (2023). The impact of economic growth, natural resources, urbanization and biocapacity on the ecological footprint: The case of Turkey. *Sustainability*, *15*(17), 12855. https://doi.org/10.3390/su151712855

Umar, M., Riaz, Y., & Yousaf, I. (2022). Impact of Russian-Ukraine war on clean energy, conventional energy, and metal markets: Evidence from event study approach. *Resources Policy*, *79*, 102966. https://doi.org/10.1016/j.resourpol.2022.102966

UNESCO. (2019). Cultural Heritage in ASEAN. United Nations Educational, Scientific and Cultural Organization.

Wei, Z., & Lihua, H. (2023). Effects of tourism and eco-innovation on environmental quality in selected ASEAN countries. *Environmental Science and Pollution Research*, *30*(15), 42889-42903. https://doi.org/10.1007/s11356-021-17541-z

World Economic Forum. (2022). Travel & Tourism Development Index 2021: Rebuilding for a Sustainable and Resilient Future.

Wang, W., Rehman, M. A., & Fahad, S. (2022). The dynamic influence of renewable energy, trade openness, and industrialization on the sustainable environment in G-7 economies. *Renewable Energy*, *198*, 484-491. https://doi.org/10.1016/j.renene.2022.08.067

Yang, B., & Usman, M. (2021). Do industrialization, economic growth and globalization processes influence the ecological footprint and healthcare expenditures? Fresh insights based on the STIRPAT model for countries with the highest healthcare expenditures. *Sustainable Production and Consumption*, *28*, 893-910. https://doi.org/10.1016/j.spc.2021.07.020