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Impact of Energy Consumption and Agriculture Growth on the Environmental Degradation: Evidence from ASEAN Countries

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Globally, renewable and nonrenewable energy usage have been identified as key indicators of environmental degradation, necessitating additional investigation. This essay aims to examine the impact of energy use and agricultural expansion on environmental degradation. The paper selected several energy consumptions factors, including renewable energy, fossil fuel, electric power, energy consumption, energy import, and GDP. The study gathered secondary data from World Bank indicators from 1991 to 2020 from ASEAN countries. Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) approaches were utilized to analyze unit roots between constructions. The study also considered the QARDL approach to assess the correlation between selected constructs. In the sample of ASEAN economies, renewable energy consumption and CO2 emissions were inversely linked; however, other variables demonstrated a positive relationship with CO2 emissions. After the paper, several ramifications were outlined that could aid regulators in taking corrective action regarding CO2 reduction through REC.

Key words: Renewable energy consumption, Gross domestic product, Electric power consumption, Agriculture growth, Energy import, Energy use, carbon dioxide (CO2) emissions.

1. INTRODUCTION

In recent decades, the global environment has undergone dramatic changes. Regardless of the cause of these changes, there is little doubt that they have disastrous repercussions for humanity. Few of these factors' results are comparable to global warming. Global warming is now a global problem that has compelled the globe to take substantial measures to combat it (Ainou, Ali, & Sadiq, 2022). The international community expresses its interest in this matter through various means, such as the Paris Agreement, etc., as environmental degradation has become a major concern for the entire human population. This issue is mostly caused by manmade factors as opposed to natural occurrences. Compared to wealthy nations, CO2 emissions have a bigger negative impact on the environment and a greater negative impact on developing countries.

Additionally, it has been discovered that using nonrenewable energy increases carbon emissions. In contrast, the use of renewable energy results in a decrease in CO2 emissions (Chien et al., 2021; Sadiq et al., 2022).Climate change is currently the most popular topic. Fossil fuels are responsible for 90 percent of carbon-dioxide emissions. In order to mitigate the negative effects of climate change, renewable energy resources are a rapidly expanding energy source that will account for 14% of total energy consumption by 2035. Due to trade-friendly policies, industrialized nations should have the willpower to transition to renewable energy sources.

Additionally, the EU has agreed to contribute at least 20% of its renewable energy resources. When the economy begins to expand, deforestation, water consumption, and carbon dioxide emissions begin to occur (Chien, Hsu, Ozturk, Sharif, & Sadiq, 2022). However, the steady economy increases artificial environmental factors mostly cause this issue is the fundamental factor in the development of environmental quality, as numerous ASEAN nations, such as Indonesia, face significant environmental issues due to carbon emissions and are ranked third in air pollution. From 1990 to 2017, 166 countries gave evidence that countries that supported their energy resources with solar, wind, geothermal, and hydroelectricity resolved their environmental problem (Chien et al., 2022; Nasir, Duc Huynh, & Xuan Tram, 2019). As a result of shifting fuel prices and the environTofits of renewable energy sources, renewable energy sources are gaining importance in the industrial sector. More than 22 percent of the whole population is without power due to cable and grid station issues. Between 2003 and 2014, biomass burning was responsible for 40 to 60 emergences in major Southeast Asian cities. As a result of the fire, the area encompasses the entire continent.

Southeast Asia and the Maexpands have been affected by an increase in carbonaceous chemicals, specifically black carbon. As a result, the absorption and dispersion of sunlight in the atmosphere may be reduced, resulting in reduced visibility. Such incidents have disrupted regular activities such as commercial activity, transportation, and even schoolchildren's commutes. As environmental degradation is "the disintegration or deterioration of the environment caused by the use of assets such as air, water, and soil," it is clear that environmental degradation is a serious problem (Huang, Sadiq, & Chien, 2021a). Ecosystem destruction and the extinction of species. There are concerns with air pollution, water pollution, waste, and

environmental contamination in emerging nations. As hazardous gases and industrial waste also contribute substantially to environmental degradation. Most businesses in undeveloped nations do not take the steps necessary to reduce air pollution; instead, they release toxic gases into the atmosphere and dispose of hazardous materials dire emergencies bodies of water (Liu, Yin, Putra, & Sadiq, 2022).

According to Khan et al. (2020), the Climate Risk Index identifies the Association of Sincreasedn Nations (ASEAN) as one of the regions that has been severely impacted. According to this ranking, among the top 25 countries, Myanmar, Cambodia, Thailand, Vietnam, and the Philippines represent the ASEAN area. Diverse researchers have expressed their position on this matter by recommending that countries establish proactive methods to address the harmful impact of agriculture growth and climate change, as these challenges are grave and require policies to make the economy of these nations sustainable (Hussain, Shahzad, & Shafiq, 2020; Nishimura, Ambashi, Iwasaki, & Maeda, 2019). Table 1 displays the agricultural GDP contribution of ASEAN nations. As previously said, addressing climate change has become a major priority for ASEAN states. Population growth, which increases the use of vehicles, etc., poverty-related use of nonrenewable energy sources due to low cost, urbanization, economic factors such as industrialization, institutional factors, land degradation, air and water pollution, etc., are the few causes of environmental degradation. This environmental degradation has a fundamental impact on human health, biodiversity loss, ozone depletion, etc (Huang, Sadiq, & Chien, 2021). Consequently, it is crucial to address this issue, particularly in emerging nations. As a result, they decided to switch from relying on renewable energy production to relying on renewable energy production. As part of phase two of the ASEAN Plan of Action for Energy Cooperation 2021-2025, ASEAN states have developed an ambitious five-year sustainability strategy. As part of this agreement, ASEAN energy ministers agreed to set a target of 23% of total renewable energy supply for the region and 35% capacity for ASEAN by 2025. (Kamarudin, Anwar, Chien, & Sadiq, 2021; Nasir et al., 2019; Nathaniel, 2021; Nawaz, Azam, & Bhatti, 2019). By 2025, this will require the addition of 35 to 40 GW of renewable energy capacity. All ASEAN member states are now drafting legislation to facilitate the transition from nonrenewable to renewable energy sources

Table 1.2 Agriculture share to GDP of ASEA region in 2018 (Country wise)

Country	GDP Share (%)
Indonesia	12.5
Malaysia	7.3
Singapore	0.5
Thailand	6.2
Vietnam	14.3
Laos	14.5
Cambodia	16.3
Myanmar	24.6
Philippines	8.1
Brunei	0.8

Environment degradation can be reduced by planting more trees, reducing the use of machines that emit chlorofluorocarbons, reducing the use of fuels, using more efficient and less environmentally hazardous methods to generate electricity, treating toxic gases and waste from industries before releasing them so that they are less harmful to the natural environment, and controlling population growth by increasing public awareness. Figure 1 depicts the consumption of renewable energy in ASEAN.

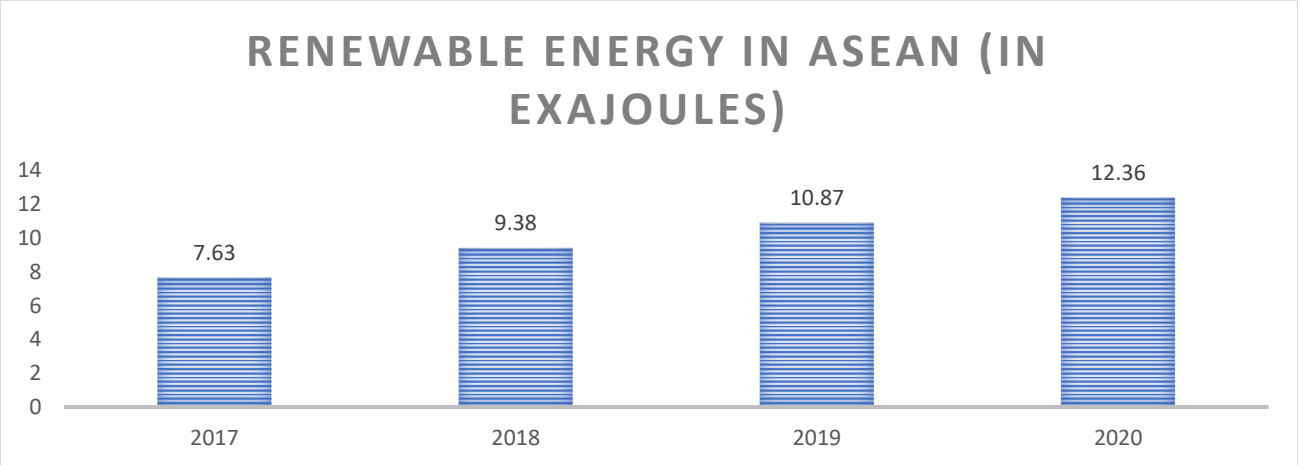

Figure 1. Renewable energy consumption in ASEAN countries

The current study fills a number of glaring gaps in the literature;1) highlights the crucial and delicate relationship between energy consumption and agricultural growth and environmental degradation, which has been discussed in the past but whose significance in the context of ASEAN countries remains obscure. 2) Nathaniel (2021) examined whether environmental deterioration has an impact on natural resources, economic development, etc. in ASEAN, whereas the current study will focus on environmental degradation and REW energy and non-REW energy in the ASEAN economy. 3) Duc Nha (2019) examined the relationship between environmental degradation and economic growth. This study will attempt to evaluate the multiple factors of energy consumption, including fossil fuel, electric power, energy input, energy use, and GDP, and their impact on CO2 emissions in a sample of ASEAN economies. 4) Nasir et al. (2019) investigated the foreign development index and climate change, whereas the current study focuses on environmental degradation and its relationship with agriculture expansion and other forms of energy using the most recent data on the ASEAN economy. 5) The framework of the current study consists of several energy, non-renewable energy, and environmental degradation factors, such as carbon dioxide emission, renewable energy consumption, fossil fuel energy consumption, electricity power consumption, energy input, energy use, and gross domestic product, which have not been studied simultaneously in the ASEAN economy with the most recent data; the impact study fills the gap in a contextual manner. Similarly, 6. In contrast, the. (2019) focused on resource depletion and its relationship to economic growth, whereas the current work evaluates the effectiveness of energy sources and agricultural growth in preventing environmental deterioration. 7) Finally, Belad and Zrelli (2019) examined the identical constructs used in the study, but in the context of Mediterranean nations.

Since the deficiencies are sufficient to necessitate research, the study helps in numerous ways. First, it may emphasize the significance of various energy. In contrast, the environmental damage. Additionally, the study presents actual information addressing the relationship between agricultural expansion and environmental damage. Thirdly, the study's findings motivate practitioners to rebuild their policies for environmental sustainability. The study may also aid scientists in identifying the benefits and downsides of renewable and nonrenewable energy in relation to environmental degradation and national economies, particularly in ASEAN economies.

This investigation consists of five stages. The introduction describes the topic in-depth and identifies any discovered gaps contextually. In the second phase of the study, the selected constructs are discussed in depth in light of prior research. The third phase covers the methodology portion, while the subsequent phase discusses in depth the study's findings. In the last phase, the debate is established by comparing the current findings to previous fragments of evidence. In addition, the study concludes with some conclusions and suggestions.

2. LITERATURE REVIEW

The globe relies extensively on renewable and nonrenewable energy sources, which causes serious challenges and worries. In reality, the global community is also focusing on the potential reduction of environmental problems, energy security, and nonrenewable energy sources. In this situation: Lee (2019) studied the dynamics of renewable energy use and its impact on economic growth and carbon emissions in specific nations. Carbon dioxide is regarded as a global concern and issue that is causing environmental deterioration. Due to the possible impact of diseases on humans in ASEAN nations, environmental degradation concerns have been brought to the forefront.

Similarly, Koengkan, Fuinhas, and Santiago (2020) demonstrated the connection between urbanization, economic growth, non-renewable energy, renewable energy, and carbon emissions in the common markets. It depends on the consumption of renewable energy how it could be consumed and how it affects the environment. Therefore, consideration must be given to the practical ways to renewable energy consumption in ASEAN nations (Sadiq et al., 2022; Zhao, Zhang, Sadiq, Hieu, & Ngo, 2021). These methods not only aid in the control of environmental degradation, but also in the improvement of the energy sector. As environmental degradation is the disintegration or deterioration of the environment caused using also focuses, water, and soil, it is a consequence of human activity. Ecosystem destruction and the extinction of species. Air pollution, water pollution, trash, and environmental degradation are problems in India (Lisha & Abdullah, 2021; Sadiq et al., 2022). Ge, Wang, Zhu, and Ding (2017) described the projections and analyses of carbon dioxide emissions from companies as a result of energy consumption. To govern the consumption of renewable energy in a manner that has a minimal impact on environmental degradation, it is necessary to adopt sophisticated procedures. Typically, governments are attentive to the investments generated by renewable energy technologies (Tan et al., 2022; Zhao et al., 2021). Therefore, this technological advancement in the consumption and production of renewable energy sources must be managed appropriately. Therefore, Koengkan and Fuinhas (2020) investigated the impacts and effects of transitioning to renewable energy, controlling idea emissions in industrialized nations. and improving the management of energy resources that emit carbon dioxide, which is hazardous to the environment, are crucial to the management of the organization as a whole. Despite this, the constant and rising consumption of renewable energy has a detrimental effect on the surroundings of many nations. This continuance of renewable energy vastly increases timely attention to carbon dioxide's damaging effects on the environment (Lan, Khan, Sadiq, Chien, &

Baloch, 2022; Oanh et al., 2021).

The consistent use of renewable and nonrenewable energy sources has a lasting impact on environmental degradation. This is due to the burning of various material energy sources, which alters environmental levels and causes harm to both humans and animals. The global community has expressed concern on the usage of fossil fuels in creating energy sources (Thuy, Phuong Dio, Hoan, Ninh, & Thuy Nga, 2021). In this context, Pereira and Pereira (2017) enumerated the methods for reducing carbon emissions that are most effective: carbon pricing, energy efficiency, and fossil fuel price restrictions. Due to the abundant availability of energy resources, the use of energy sources in ASEAN nations has expanded dramatically. Different materials, such as fossil fuels, are emphasized more in energy resources because their consumption has had a significant impact on environmental degradation. Similar to Pintuma and renewable energy consumption2), Pintuma and Aunyawong (2021) and Sebos (2022) evaluated the fractions of fossil fuel energy use that increasingly result in the production of carbon dioxide that negatively impacts the environment. This is a result of the emission of carbon dioxide gas from the combustion of fossil fuels. When fossil fuels are burned, several gases, such as carbon, are produced. Therefore, Henderson and Sommer (2022) and Ojogiwa (2021) elaborated on the impact of fossil fuel energy use on carbon emission in the energy sector. Most ASEAN nations are about using fossil fuels to create usage, which is detrimental to the environment. The planet's temperature has risen due to the intensive burning of fossil fuels, which produces the most effective carbon emissions Sadeghieh (2019) highlighted the connection between economic expansion, fossil fuel usage, carbon emissions, and financial growth. Due to the ever-present presence of carbon dioxide and the constant emergences of carbon dioxide, the ecosystems are disturbed. Globally, companies are concerned about potentially impacting fossil fuel usage and their energy production. Due to the combustion of fossil fuels, global environmental and socioeconomic factors have also contributed to the trend of growing carbon dioxide levels.

The birth and development of technology have benefited the world thus far but have left the earth with hazardous radiation waves. Animals and humans alike have several radio waves emissions caused when fossil fuels are burned using power. As a result, Abokyi, Appiah-Konadu, Tangato, and Abokyi (2021) investigated the relationship between power use and production in relation to carbon emissions. In many nations, the power sector is the primary impediment to economic development and environmental stability. Electricity consumption improves the financial status of every industry, but it also affects the state of the environment.

Similarly, Turk, Reay, and Haszeldine (2018) evaluated the intensity of power systems that contribute significantly to carbon dioxide emissions and environmental deterioration. Typically, energy generation relies on water, coal, fuel, oil, and numerous other substances that emit carbon dioxide. In ASEAN nations, the generation and emission of carbon dioxide are deemed damaging to both human life and the environment. In this regard, Khan (2019) examined the temporal carbon intensity in relation to renewable fossil fuel and power systems. The shift between renewable and nonrenewable energy usage is regarded as a crucial environmental factor. This is due to the high amount of carbon dioxide produced by the usage of electrical energy by several companies. In ASEAN nations, electricity output has expanded significantly during the past several decades. Abokyi et al. (2021) also examined the causal effects of industrialization, economic growth, power consumption, and carbon dioxide emissions. This manufacture utilizes energy resources and also produces carbon dioxide. On one hand, the consumption of nonrenewable energy promotes the verdict of electricity power, but on the other, it has an impact on the environment. In general, the electric power consumption supports the production and operations of different industries. The encouragement of electricity power consumption accelerates the expansion of industries but has a lasting impact by emitting carbon dioxide.

Nature has endowed the globe with several energy resources and has ordered them according to the environment. In the end, the energy consumption in the parent countries where these are generated or founded is environmentally sustainable. Bigerna, Bollino, and Galkin (2021) emphasized the essential optimization of the balance between energy security and its import for environmental sustainability. This results from efficient technology that generates these energy resources in ways that do not affect the environment. However, certain restrictions are also imposed on energy consumption to ensure environmental sustainability. In addition, Kryukov (2017) noted the environmentally hazardous substitution of equipment and technology imports in the energy sector. In ASEAN nations, the import of energy is manifest in the generation of vast quantities of carbon dioxide, which contributes to environmental damage (MoslehpElectric power consumption generally imports energy from mineral-rich nations and has a significant impact on their environment. Therefore, Deng, Ma, Zhang, and Liu (2018) evaluated the energy trade's structural decomposition and extraction techniques that impact environmental sustainability. This is due to the advent of obsolete technologies used to produce energy that is imported from other nations and whose quality makes them unfeasible. Imports of energy generate a substantial amount of carbon dioxide, which has a significant impact on the environment's viability and preservation. In addition, Fal'tsman (2017) evaluated the military and energy industries owing to import substitution and its impact on carbon dioxide emissions. Crude oil is the greatest illustration of a product that is imported from mineral-rich nations and utilized in cars and machinery that do not

conform to oil quality standards (Liu, Lan, Chien, Sadiq, & Nawaz, 2022). Typically, the import of energy must be adjusted and constructed in ways that promote environmental sustainability. Imported power plants for the purpose of energy consumption have a detrimental effect on the natural environment. Despite the fact that petroleum products are the primary imports and extractions, the ecosystem faces destabilizing effects (Liu, Lan, et al., 2022).

In several ASEAN nations, persistent energy use has led to increased environmental challenges during the past few decades. There are numerous allocation measures for the efficient use of energy, which aid in mitigating environmental problems. Godoy-Shimizu et al. (2018) investigated. Energy consumption generates office buildings, and the resulting carbon significantly impacts deterioration. Developing and developed nations aid their industries by efficiently using carbon dioxide-emitting energy. This carbon dioxide emission is unquestionably managed at the end of the inadequate approach that developed countries use to sustain the environment (Li et al., 2022). In addition, Borén (2020) noted the environmental impact of the electricity busses' consistent noise, expense, and consequences on the sustainability of energy usage. Energy is utilized in a variety of ways to support industry and humanity. The manufacture of many medicines and foods depends on energy utilisation.

The total production is processed through the application and deployment of carbon dioxide-heavy technologies. Moreover, in this context, He et al. (2019) examined energy consumption from multiple perspectives, including its use in water supply and its developing effect on environmental deterioration. This substantial creation of carbon dioxide is detrimental to the environment, and the energy demand constantly exacerbates this damage. Due to the rise of carbon dioxide, the primary component of the environment that fluctuates regularly is the climate. Similarly, Juárez-Hernández and Sheinbaum Pardo (2019) studied the irrigation industry's greenhouse gas emissions and energy consumption, as well as their environmental impact. This development depends on the world's high energy consumption, which generates greenhouse gases and smog. In addition to harming habitats and animals, excessive energy consumption contributes to carbon dioxide emissions. Due to the development of minerals and the need for industry, energy consumption in ASEAN nations has unquestionably risen (Liu, Lan, et al., 2022).

As a result of the generation of carbon dioxide, environmental degradation has become a globally famous phenomenon. As a result of its dependence on renewable and nonrenewable energy use, carbon dioxide generation has a number of repercussions. It has effects on both the environment and the gross domestic product. Before this, Habimana, Mnsson, and Sjolander (2021) established the impact of emerging countries' real GDP and carbon dioxide emissions in attracting investments. The gross domestic product is a vital component of economic growth in ASEAN countries. The economic prosperity of many nations depends on environmental stability, and environmental instability could be caused by the emergence of carbon dioxide emissions (Lisha & Abdullah, 2021). In addition, Cialani (2017) identified the very influential relationships between international trade, gross domestic product, and carbon emissions on international commerce and growth. A substantial amount of investment is halted and reduced due to the deteriorating climate caused by greenhouse gases and carbon dioxide release. The globe examines the gross domestic product when deciding where to invest. The increasing problems associated with global warming have significantly influenced worldwide investment and business. Ben Jebli and Hadhri (2018) investigated the dynamic relationship between international tourism, energy consumption, domestic products, and transport-related carbon emissions.

This demonstrates that high levels of pollution caused by the rising usage of renewable and nonrenewable energy have environmental consequences. For investors, the sustainability and maintainability of the environment also affects the gross domestic product. (Moslehpour, Al-Fadly, et al., 2022) Not only does a lower gross domestic product signal slower economic growth, but it is also related with a number of problems. Abokyi et al. (2021) evaluated the relationship between population, energy consumption, carbon dioxide emissions, and gross domestic product in relation to environmental degradation. Not only can variations in the gross domestic product have an effect on the environment, but they also affect carbon dioxide emissions. It is vital to foster economic expansion while prioritizing environmental stability. With environmental stability, the gross domestic product and economic growth should be dynamically expanded (Moslehpour, Chang, Pham, & Dadvari, 2022).

The agriculture sector is expected to be the backbone of any nation's economy because it contributes significantly to GDP. The sector also provides for the nation's fundamental needs but could also contribute to its industrialization (Bartoli, Hamelin, Rozakis, Borzęcka, & Brandão, 2019). It is suggested that this sector can play a critical role in the economy's growth, particularly in nations with a lower ratio of real income per capita, since it may prove useful in boosting the economy. Ansari & Khan (2018) claimed that there are several ways in which the expansion of agriculture might contribute to the economy. First, facilitates non-agricultural sector people and raw materials through food. Second is the capacity to generate demand for quality output through the rural population.

Additionally, agriculture expansion might position the nation for export success and provide employment possibilities for the less educated and skilled, easing poverty (Ding et al., 2016). However, in addition to its significance, the sector faces environmental concerns. Ben Jebli et al. (2017) reported that the agriculture sector is accountable for global CO2 emissions due to its substantial

consumption of fossil fuels. Agriculture and forestry contribute 24 percent of global greenhouse gas emissions, according to Pachauri et al. (2014). In addition, methane and CO2 are responsible for 30% and 49%, respectively. The agriculture sector emits these three gases, methane, nitrous oxide, and carbon dioxide. The emissions are caused by chemical fertilizer, rice agriculture, and municipal trash. In contrast, one study found little support for the environmental Kuznets curve between agriculture growth and Co2 consumption in Indonesia, Malaysia, Thailand, and the Philippines (Liu et al., 2021)

3. RESEARCH METHODS

This article investigates the impact of REC, EPC, FFEC, energy import, energy consumption, and GDP on carbon dioxide emissions in ASEAN economies. However, the Loa nation was excluded from the analysis due to inaccessible data. The secondary data from 1991 to 2020 have been collected from the WDI. The following expression for the study variable has been constructed and presented:

$$CO2_{it} = \alpha_0 + \beta_1 REC_{it} + \beta_2 FFEC_{it} + \beta_3 EPC_{it} + \beta_4 EU_{it} + \beta_5 EI_{it} + \beta_6 GDP_{it} + \beta_7 AG_{it} + e_{it} \quad (1)$$

Where;

CO2	=	Carbon Dioxide Emission
t	=	Time Period
i	=	Country
REC	=	Renewable Energy Consumption
FFEC	=	Fossil Fuel Energy Consumption
EPC	=	Electricity Power Consumption
EI	=	Energy Import
EU	=	Energy Use
GDP	=	Gross Domestic Product
AG	=	Agricultural growth

The present study has taken the CO2 emission as the primary variable of the study and measured the carbon dioxide damage (% of GNI). Additionally, the research has also taken the REC measured as the REC (% of total energy consumption), EPC measured as the EPC (kWh per capita), FFEC measured as the FFEC (% of total), and energy import measured as the energy import net (% of energy use) and energy use measured as the energy use (kg of oil equivalent per capita) as the independent variables. Finally, the GDP has been taken as the control variable and measured as the GDP growth (annual percentage). Table 1 shows the measurements

Table 1: Variables with measurements

Variables	Measurement	Sources
Carbon Dioxide Emission	Carbon dioxide damage (% of GNI)	(Behera & Dash, 2017)
Renewable Energy Consumption	REC (% of total energy consumption)	(Ozcan & Ozturk, 2019)
Fossil Fuel Energy Consumption	FFEC (% of total)	(Mensah et al., 2019)
Electricity Power Consumption	Electric power consumption (kWh per capita)	(Abdullahi et al., 2021)
Energy Import	Energy import net (% of energy use)	(Murshed, Mahmood, Alkhateeb, & Bassim, 2020)
Energy Use	Energy use (kg of oil equivalent per capita)	(Verbič, Satrovic, & Muslija, 2021)
Gross Domestic Product	GDP growth (annual percentage)	(Boukhatem & Moussa, 2018)
Agriculture Growth	Agriculture output per unit area	Uddin (2020)

The page presents descriptive statistics by year that reveal the specifics of the structures concerning the years. In addition, the research runs descriptive statistics per nation that reveal the specifics of the constructs about countries. In addition, descriptive statistics were utilized to disclose the total number of observations, minimum values, mean values, standard deviations, and maximum values for each construct. In addition, the paper presents the correlation matrix that reveals the relationship between the constructs. The study concludes by applying the PP and ADF tests to determine the unit root among the variables. The equation is as follows:

$$d(Y_t) = \alpha_0 + \beta t + \Upsilon Y_{t-1} + d(Y_t(-1)) + \varepsilon_t \quad (2)$$

The stationarity has been examined using PP and ADF individually, and the individual equation for each variable is given as under:

$$d(CO2_t) = \alpha_0 + \beta t + \Upsilon CO2_{t-1} + d(CO2_t(-1)) + \varepsilon_t \quad (3)$$

$$d(REC_t) = \alpha_0 + \beta t + \Upsilon REC_{t-1} + d(REC_t(-1)) + \varepsilon_t \quad (4)$$

$$d(FFEC_t) = \alpha_0 + \beta t + \Upsilon FFEC_{t-1} + d(FFEC_t(-1)) + \varepsilon_t \quad (5)$$

$$d(EPC_t) = \alpha_0 + \beta t + \Upsilon EPC_{t-1} + d(EPC_t(-1)) + \varepsilon_t \quad (6)$$

$$d(EI_t) = \alpha_0 + \beta t + \Upsilon EI_{t-1} + d(EI_t(-1)) + \varepsilon_t \quad (7)$$

$$d(EU_t) = \alpha_0 + \beta t + \Upsilon EU_{t-1} + d(EU_t(-1)) + \varepsilon_t \quad (8)$$

$$d(GDP_t) = \alpha_0 + \beta t + \Upsilon GDP_{t-1} + d(GDP_t(-1)) + \varepsilon_t \quad (9)$$

$$d(AG_t) = \alpha_0 + \beta t + \Upsilon AG_{t-1} + d(AG_t(-1)) + \varepsilon_t \quad (10)$$

Finally, the ARDL model has been used that exposed the short and long-run nexus among the variables. The ARDL model has the characteristic that it is suitable when some constructs have no unit root at the level and others have no unit root at first difference. The equation for the ARDL model is given below:

$$\Delta CO2_{it} = \alpha_0 + \sum \delta_1 \Delta CO2_{it-1} + \sum \delta_2 \Delta REC_{it-1} + \sum \delta_3 \Delta FFEC_{it-1} + \sum \delta_4 \Delta EPC_{it-1} + \sum \delta_5 \Delta EI_{it-1} +$$

$$\sum\delta_6\Delta EU_{it-1} + \sum\delta_7\Delta GDP_{it-1} + \sum\delta_8\Delta AG_{it-1} + \varphi_1 CO2_{it-1} + \varphi_2 REC_{it-1} + \varphi_3 FFEC_{it-1} + \varphi_4 EPC_{it-1} + \varphi_5 EI_{it-1} + \varphi_6 EU_{it-1} + \varphi_7 GDP_{it-1} + \varphi_7 AG_{it-1} + \varepsilon_{it} \quad (11)$$

In the above equation, δ_1, δ_2, δ_3, δ_4, & δ_5 show the "short term coefficients" for the short-run association; in contrast, φ_1, φ_2, φ_3, φ_4, φ_5, & ε_1 are shows the "long term coefficients" for the long run association. The article also applied the QARDL model to analyze the association between the constructs. Moreover, the QARDL model provided consistent findings when a small sample was utilized. The QARDL equation is mentioned below:

$$Q_{CO2it} = \alpha(\tau)_0 + \sum_{i=1}^{n1} b_i(\tau)CO2_{it-i} + \sum_{i=0}^{n2} c_i(\tau)REC_{it-i} + \sum_{i=0}^{n3} d_i(\tau)FFEC_{it-i} + \sum_{i=0}^{n4} e_i(\tau)EPC_{it-i} + \sum_{i=0}^{n5} f_i(\tau)EI_{it-i} + \sum_{i=0}^{n6} g_i(\tau)EU_{it-i} + \sum_{i=0}^{n7} g_i(\tau)GDP_{it-i} + \sum_{i=0}^{n8} g_i(\tau)AG_{it-i} + \varphi_1(\tau)CO2_{it-1} + \varphi_2(\tau)REC_{it-1} + \varphi_3(\tau)FFEC_{it-1} + \varphi_4(\tau)EPC_{it-1} + \varphi_5(\tau)EI_{it-1} + \varphi_6(\tau)EU_{it-1} + \varphi_7(\tau)GDP_{it-1+} + \varphi_7(\tau)AG_{it-1} + \varepsilon_{it} \quad (11)$$

4. FINDINGS OF THE STUDY

The research employs descriptives that reveal the construct's country-by-country specifics. The findings suggested that the Philippines had the lowest concentration of carbon dioxide at 0.755%, while Vietnam had the highest concentration. In addition, the lowest value of REC was 0.025 per cent in Brunei, while the greatest value of REC was 73.913 per cent in Cambodia. Moreover, the data indicate that the lowest FFEC value was 24.339 percent in Cambodia, and the highest was 100.041 percent in Brunei. In addition, the lowest EPC value was recorded in Cambodia at 131.427 percent, while the highest was recorded in Brunei. In addition, the data revealed that the minimum EI value in Brunei was -569.662 percent, while the maximum EI value in the Philippines was 98.226 percent. In addition, Myanmar had the lowest EU value at 314.775 percent, while Brunei had the highest EU value at 7881.521 percent. Finally, the minimum GDP value was 1.333 percent in Brunei and 6.935 percent in Cambodia.

Table 3: Descriptive statistics (Country)

	CO2	REC	FFEC	EPC	EI	EU	GDP	AG
Brunei	1.725	0.025	100.041	8411.457	-569.662	7881.521	1.333	2.7
Cambodia	1.205	73.913	24.339	131.427	25.651	340.703	6.935	31.53
Indonesia	2.379	39.204	63.062	569.619	-83.872	773.099	4.633	33.18
Malaysia	2.613	5.185	95.482	3369.940	-38.253	2474.719	5.308	26.09
Myanmar	2.214	78.750	31.992	128.863	-21.732	314.775	8.481	20
Philippines	0.755	0.543	94.875	7816.946	98.226	5167.799	5.347	30
Singapore	1.280	32.382	57.701	569.862	47.893	475.792	4.164	0.5
Thailand	2.306	22.862	78.744	1940.206	42.187	1543.854	3.812	43.18
Vietnam	3.336	47.193	56.771	775.166	-18.879	523.359	6.719	13.96

The research also used descriptives to reveal the properties of each construct. The results indicated that the mean value of CO2 was 1.979 per cent, while the average value of REC was 33.340 per cent. In addition, the outcomes also exposed that the average value of FFEC was 67.001 per cent, while the mean value of EPC was 2634.607 per cent. Furthermore, the results indicated that the mean value of EI was -57.605 per cent, while the average value of EU was 2166.180 per cent and the average value of GDP was 5.192 per cent. Table 4 shows the findings.

Furthermore, the article shows the correlation matrix that exposed the association between the constructs. The results revealed that the REC has a negative while EPC, FFEC, energy import, energy use, and GDP positively impact the CO2 emissions in ASEAN countries. Table 5 shows these results.

Table 4: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
CO2	270	1.979	0.959	0.291	4.508
REC	270	33.340	29.163	0.001	91.119
FFEC	270	67.001	27.323	13.813	100.318
EPC	270	2634.832	3229.607	0.597	11953.152
EI	270	-57.605	200.646	-849.555	99.085
EU	270	2166.180	2555.094	248.693	9837.472
GDP	270	5.192	3.932	-13.127	14.526
AG	270	22.34	15.456	2.75	45.67

Table 5: Matrix of correlations

Variables	CO2	REC	FFEC	EPC	EI	EU	GDP	
CO2	1.000							
REC	-0.097	1.000						
FFEC	0.010	-0.971	1.000					
EPC	0.271	-0.763	0.758	1.000				
EI	0.012	0.297	-0.339	-0.408	1.000			
EU	0.241	0.726	0.738	0.949	-0.595	1.000		
GDP	0.075	0.389	-0.353	-0.349	0.258	-0.352	1.000	
AG	0.736	0.345	0.521	0.321	0.612	0.544	0.756	1.000

The research has applied the PP and ADF tests to investigate the unit root among the variables. The finding exposed that the FFEC, EI, and GDP have no unit root at the level, and CO2, REC, EPC, and EU have no unit root at first. Table 6 presents the detail of the outcomes.

Table 6: Unit Root Test

	ADF		PP	
Series	Level	First difference	Level	First difference
CO2	-1.429	-5.721***	-0.910	-5.276***
REC	-1.192	-4.923***	-1.422	-4.729***
FFEC	-3.232**	-7.101***	-4.192***	-7.493**
EPC	-1.197	-5.007***	-1.320	-3.092**
EI	-2.763*	-7.109***	-2.519**	-5.028**
EU	-1.295	-6.199***	-1.201	-3.369***
GDP	-3.268***	-7.104***	-4.299***	-7.371***
AG	-1.446	-5.342***	-0.823	-5.324***

The panel QARDL results indicate the negative relationship between renewable energy consumption with carbon dioxide emissions. However, other factors such as agriculture growth, fossil fuel, GDP, electric power, energy import and energy usage are positively correlated with CO2 emissions in the context of ASEAN economies. The findings reveal that the negative association of REC and CO2 emission is observed in 1 to 8 quantiles and 1 to 7 quantiles in the short run and long run, respectively. The outcome also revealed that fossil fuel energy form is positively correlated with CO2 emissions in 1 to 6 and 8 quantiles in case of the short and long run. In the case of electric power consumption, a positive relationship was observed in 1 to 7 quantiles in the short run case and 1 to 6 and 8 quantiles in the long run case. Energy import and CO2 are positive in 1 to 6 and 9 quantiles in short run context and 1 to 6 in long run case. Finally, in the case of agriculture growth, the positive association with CO2 is observed in 1 to 4 and 6 to 7 quantiles in the short run case and in the long run case, 1 to 5 and 8 to 9 quantiles.

Table 7: Panel QARDL Model

	REC	FFEC	EPC	EI	EU	GDP	AG
Panel A: Short-run Coefficients							
Q0.1	-0.40*	0.43*	0.23*	0.24*	0.43**	0.42*	0.34**
Q0.2	-0.39**	0.20**	0.42**	0.31*	0.20*	0.61**	0.62*
Q0.3	-0.29*	0.81*	0.51*	0.39*	0.27*	0.31*	0.32*
Q0.4	-0.10*	0.69***	0.29*	0.71**	0.59*	0.76**	0.67*
Q0.5	-0.72***	0.61*	0.51**	0.81**	0.73*	0.21	0.41*
Q0.6	-0.71**	0.72**	0.47*	0.43*	0.85**	0.35*	0.54**
Q0.7	-0.90***	0.12	0.53**	0.20	0.09	0.48*	0.12
Q0.8	-0.56**	0.27*	0.31	0.10	0.17	0.04	0.15
Q0.9	-0.21	0.02	0.03	0.52*	0.19	0.17	0.18
Panel B: Long-run Coefficients							
Q0.1	-0.52*	0.63*	0.91**	0.43**	0.66**	0.47*	0.64**
Q0.2	-0.83**	0.49**	0.43*	0.20*	0.32*	0.63**	0.23*
Q0.3	-0.29*	0.72**	0.62*	0.28*	0.19*	0.41*	0.18*
Q0.4	-0.74**	0.17*	0.34*	0.38**	0.24*	0.33*	0.27*
Q0.5	-0.61**	0.50*	0.71*	0.26**	0.71**	0.61*	0.65**
Q0.6	-0.34*	0.20*	0.42**	0.39*	0.23*	0.12	0.24*
Q0.7	-0.29*	0.13	0.13	0.12	0.21	0.06	0.29
Q0.8	-0.12	0.53*	0.22*	0.11	0.11	0.53*	0.14
Q0.9	-0.04	0.13	0.07	0.02	0.23*	0.33*	0.34*
Panel C: Diagnostics							
Ad. R square	0.45						
Reset	1.43*						
LM	0.99						

5. DISCUSSIONS

The results suggested that renewable energy consumption is negatively associated with environmental damage. These results are consistent with Sharif et al. (2020).'s findings, which indicate that as the use of renewable energy for supporting infrastructure of commercial or residential buildings and other machines increases, CO2 emissions decrease, as this reduces the use of fossil fuels such as coal, oil, and gas, or electricity generated from fossil fuel combustion, which increases CO2 emission. Consequently, the usage of renewable energy helps combat environmental damage. These findings are supported by Adebayo and Kirikkaleli (2021). They demonstrate that when renewable energy sources are favored over nonrenewable energy in an economy for heating and lighting or to generate motion in technologies and tools, there is a significant decrease in CO2 emissions, and the problem of environmental degradation can be addressed.

The results suggested that using fossil fuels for energy is positively associated with environmental degradation. These results are consistent with Asongu, Agboola, Alola, and Bekun's (2020) findings that in countries where commercial units rely heavily on fossil fuels to run heavy machines or plants to achieve competitive goals and make

progress, CO2 emissions are found in high quantities, and there are negative changes in environmental conditions. These findings are corroborated by Gokmenoglu and Sadeghieh (2019), who assert that fossil fuels are carbon-containing compounds that emit carbon particles when burned. After being released, they combine with oxygen-containing air to generate CO2 emissions. Consequently, the utilization of fossil fuels for energy promotes environmental damage.

The results demonstrated a correlation between agricultural expansion and environmental damage. These findings are consistent with Uddin's (2020) assertion that, as agricultural output rises, numerous agricultural techniques are employed to expedite the process. Consequently, it is ultimately responsible for CO2 emissions that cause environmental deterioration. When agriculture expands, it contributes a larger share to a nation's GDP, boosting economic growth. However, as a result, environmental difficulties arise since the ecosystem eventually undergoes negative changes.

The findings demonstrated a correlation between electrical energy usage and environmental damage. These results are consistent with Rahman's (2020) finding that when the use of electricity increases in a country, there is a proportional increase in pollution emissions, such as CO2 emissions because most electricity is generated through the consumption of fossil fuels or nuclear power, which are the largest sources of CO2 emissions. Therefore, the environment is negatively affected when electrical energy consumption rises due to an increase in residential or commercial activity. These results are also supported by Bello, Solarin, and Yen (2018), who found that even though the use of electricity is considered to be the safest approach compared to the consumption of fossil fuels as the traditional source of energy, it still emits CO2 during the transfer process when converting to heat energy. Increased CO2 and heat emissions into the atmosphere alter the climate and degrade the environment and quality of natural resources. The findings revealed a correlation between energy consumption and environmental damage. These findings are corroborated by Muhammad, Khan, Khan, and Khan (2021). They theorize that nearly all forms of energy affect environmental quality, albeit in some places more so than in others. The kind of energy consumed dictates its environmental effects. When nonrenewable energy sources are exploited in an economy, CO2 emissions rise, and negative environmental consequences arise. Due to the reduction in CO2 emissions, the use of renewable energy sources has the least negative impact on the environment. These outcomes are likewise corroborated by H. According to Wang (2022), locations where the usage of energy sources is increasing rather than relying on nature or manual power for heating, lighting, and cooling, as well as carrying out other procedures that require force or power, have large CO2 emissions.

The results demonstrated a negative relationship between energy imports and environmental damage. These results concur with Gyamfi, Ozturk, Bein, and Bekun's (2021) finding that energy sources grow as a country's energy imports increase. These resources can be employed whenever necessary for economic or domestic purposes, increasing the country's CO2 emissions and degrading its environment. These findings are corroborated by Kahouli, Miled, and Aloui's (2022) examination of the effects of energy imports on environmental quality. This study hypothesizes that nations that purchase fossil fuels from other nations to meet their energy demands boost their utilization of technologies and industrial practices. In this circumstance, national CO2 emissions are more than in the past. According to the findings, SDG is positively associated with environmental damage. These outcomes are consistent with J. Wang and Dong (2019) demonstrate that when a nation's GDP rises, its industrial methods and processes improve while its energy consumption rises. Where technology and energy sources are heavily utilized, CO2 emissions are high and environmental conditions deteriorate. Consequently, rising GDP adds to environmental damage.

6. IMPLICATIONS

The consequences of this work are both theoretical and empirical. It has theoretical significance due to its contributions to the environmental quality literature. It investigates the effects of diverse energy sources and agricultural expansion on environmental degradation. The role of renewable energy consumption, nonrenewable energy consumption, and the Gross Domestic Product in environmental degradation has been addressed in a prior study, but at various times. This work contributes to the existing body of knowledge by initiating the simultaneous description of the effects of renewable energy consumption, nonrenewable energy consumption, and GDP on environmental degradation. In addition, this is the first time that ASEAN economies have been picked as the focal point for researching the effects of various energy types and agricultural expansion on environmental degradation. Different types of energy are consumed in great quantities for residential and business uses in developing nations. This research aids authorities in setting policies addressing the use of REC to reduce CO2 emissions. This report is the best resource for environmental regulators and economists since it details the elements that raise CO2 emissions and lead to environmental damage. In addition, it emphasizes that they are capable of overcoming CO2 emissions and environmental destruction.

7. CONCLUSIONS AND LIMITATIONS

The study aimed to examine the effects of renewable and nonrenewable energy on environmental deterioration; hence, the implications of various energy forms and agricultural expansion on environmental degradation were

analyzed. It is believed that the ASEAN sample will collect data on renewable energy consumption, fossil fuel energy consumption, electric power consumption, energy import, energy use, GDP, and CO2 emissions, which are indicative of environmental degradation. The empirical research demonstrated a positive relationship between FFEC, EPC, EI, GDP, and EU, but a negative relationship between renewable energy use and environmental deterioration. The results demonstrated that the tendency of common people and commercial entities to consume renewable energy for fuel purposes minimizes the usage of dirty energy and its negative effects on the environment. Reduced CO2 emissions and consumption of nonrenewable energy protect the environment from degradation. According to the findings, fossil fuels increase the amount of carbon in the atmosphere. Due to oxygen in the air, this carbon is converted into CO2, and the environment becomes contaminated. High electricity consumption also increases the emission of hazardous gases such as CO2 and degrades environmental conditions. In addition, the data demonstrated that an increase in energy use, whether renewable or nonrenewable, generates toxic substances, smoke, fumes, chemicals, and wastes. As a result, the increase in energy imports increases domestic energy consumption, and there may be CO2 emissions. The primary sources of CO2 emissions are technology and energy consumption, and the increase in GDP growth increases the use of technologies and energy. Therefore, when GDP growth increases, carbon dioxide emissions harm the environment.

Although this essay has theoretical and empirical consequences, it is subject to certain restrictions. These restrictions can be eliminated by modifying the current study. This study illuminates the effects of renewable energy consumption, fossil fuel energy consumption, electric power consumption, energy import, energy consumption, and GDP on environmental degradation. It does not consider the geographical peculiarities, technical advances, and eco-friendly campaigns that significantly impact environmental degradation. This study must be replaced with one that includes these elements for the examination of environmental degradation. In addition, evidence from ASEAN economies was used to investigate the relationship between renewable energy consumption, fossil fuel energy consumption, electric power consumption, energy import, energy use, and GDP and environmental deterioration. Consequently, the present investigation has limited implications. To increase the study's credibility, future writers must consider regional elements from around the globe.

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REFERENCES

Abokyi, E., Appiah-Konadu, P., Tangato, K. F., & Abokyi, F. (2021). Electricity consumption and carbon dioxide emissions: The role of trade openness and manufacturing sub-sector output in Ghana. *Energy and Climate Change*, *2*, 100026. doi:https://doi.org/10.1016/j.egycc.2021.100026

Adebayo, T. S., & Kirikkaleli, D. (2021). Impact of renewable energy consumption, globalization, and technological innovation on environmental degradation in Japan: application of wavelet tools. *Environment, Development and Sustainability, 23*(11), 16057-16082. doi:https://doi.org/10.1007/s10668-021-01322-2

Ainou, F. Z., Ali, M., & Sadiq, M. (2022). Green energy security assessment in Morocco: green finance as a step toward sustainable energy transition. *Environmental Science and Pollution Research*. doi:https://doi.org/10.1007/s11356-022-19153-7

Asongu, S. A., Agboola, M. O., Alola, A. A., & Bekun, F. V. (2020). The criticality of growth, urbanization, electricity and fossil fuel consumption to environment sustainability in Africa. *Science of The Total Environment, 712*, 136376. doi:https://doi.org/10.1016/j.scitotenv.2019.136376

Bartoli, A., Hamelin, L., Rozakis, S., Borzęcka, M., & Brandão, M. (2019). Coupling economic and GHG emission accounting models to evaluate the sustainability of biogas policies. *Renewable and Sustainable Energy Reviews, 106*, 133-148. doi:https://doi.org/10.1016/j.rser.2019.02.031

Behera, S. R., & Dash, D. P. (2017). The effect of urbanization, energy consumption, and foreign direct investment on the carbon dioxide emission in the SSEA (South and Southeast Asian) region. *Renewable and Sustainable Energy Reviews, 70*, 96-106. doi:https://doi.org/10.1016/j.rser.2016.11.201

Belaïd, F., & Zrelli, M. H. (2019). Renewable and non-renewable electricity consumption, environmental degradation and economic development: Evidence from Mediterranean countries. *Energy Policy, 133*, 110929. doi:https://doi.org/10.1016/j.enpol.2019.110929

Bello, M. O., Solarin, S. A., & Yen, Y. Y. (2018). The impact of electricity consumption on CO2 emission, carbon footprint, water footprint and ecological footprint: The role of hydropower in an emerging economy. *Journal of Environmental Management, 219*, 218-230. doi:https://doi.org/10.1016/j.jenvman.2018.04.101

Ben Jebli, M., & Ben Youssef, S. (2017). Renewable energy consumption and agriculture: evidence for cointegration and Granger causality for Tunisian economy. *International Journal of Sustainable Development & World Ecology, 24*(2), 149-158. doi:https://doi.org/10.1080/13504509.2016.1196467

Ben Jebli, M., & Hadhri, W. (2018). The dynamic causal links between CO2 emissions from transport, real GDP, energy use and international tourism. *International Journal of Sustainable Development & World Ecology, 25*(6), 568-577.

doi:https://doi.org/10.1080/13504509.2018.1434572

Bigerna, S., Bollino, C. A., & Galkin, P. (2021). Balancing energy security priorities: portfolio optimization approach to oil imports. *Applied Economics*, *53*(5), 555-574. doi:https://doi.org/10.1080/00036846.2020.1808573

Borén, S. (2020). Electric buses' sustainability effects, noise, energy use, and costs. *International Journal of Sustainable Transportation*, *14*(12), 956-971. doi:https://doi.org/10.1080/15568318.2019.1666324

Boukhatem, J., & Ben Moussa, F. (2018). The effect of Islamic banks on GDP growth: Some evidence from selected MENA countries. *Borsa Istanbul Review*, *18*(3), 231-247. doi:https://doi.org/10.1016/j.bir.2017.11.004

Chien, F., Hsu, C.-C., Ozturk, I., Sharif, A., & Sadiq, M. (2022). The role of renewable energy and urbanization towards greenhouse gas emission in top Asian countries: Evidence from advance panel estimations. *Renewable Energy*, *186*, 207-216. doi:https://doi.org/10.1016/j.renene.2021.12.118

Chien, F., Sadiq, M., Nawaz, M. A., Hussain, M. S., Tran, T. D., & Le Thanh, T. (2021). A step toward reducing air pollution in top Asian economies: The role of green energy, eco-innovation, and environmental taxes. *Journal of Environmental Management*, *297*, 113420. doi:https://doi.org/10.1016/j.jenvman.2021.113420

Chien, F., Zhang, Y., Sadiq, M., & Hsu, C.-C. (2022). Financing for energy efficiency solutions to mitigate opportunity cost of coal consumption: An empirical analysis of Chinese industries. *Environmental Science and Pollution Research*, *29*(2), 2448-2465. doi:https://doi.org/10.1007/s11356-021-15701-9

Cialani, C. (2017). CO2 emissions, GDP and trade: a panel cointegration approach. *International Journal of Sustainable Development & World Ecology*, *24*(3), 193-204. doi:https://doi.org/10.1080/13504509.2016.1196253

Deng, G., Ma, Y., Zhang, L., & Liu, G. (2018). China's embodied energy trade: based on hypothetical extraction method and structural decomposition analysis. *Energy Sources, Part B: Economics, Planning, and Policy*, *13*(11-12), 448-462. doi:https://doi.org/10.1080/15567249.2019.1572836

Ding, Y., Mu, M., Zhang, J., Jiang, T., Zhang, T., Wang, C., . . . Zhang, S. (2016). Impacts of Climate Change on the Environment, Economy, and Society of China. In D. Qin, Y. Ding, & M. Mu (Eds.), *Climate and Environmental Change in China: 1951–2012* (pp. 69-92). Berlin, Heidelberg: Springer Berlin Heidelberg.

Fal'tsman, V. K. (2017). Import Substitution in the Energy and Defense Industries. *Problems of Economic Transition*, *59*(1-3), 16-26. doi:https://doi.org/10.1080/10611991.2017.1319183

Ge, X.-l., Wang, Y., Zhu, H.-q., & Ding, Z. (2017). Analysis and forecast of the Tianjin industrial carbon dioxide emissions resulted from energy consumption. *International Journal of Sustainable Energy*, *36*(7), 637-653. doi:https://doi.org/10.1080/14786451.2015.1077841

Godoy-Shimizu, D., Steadman, P., Hamilton, I., Donn, M., Evans, S., Moreno, G., & Shayesteh, H. (2018). Energy use and height in office buildings. *Building Research & Information*, *46*(8), 845-863. doi:https://doi.org/10.1080/09613218.2018.1479927

Gokmenoglu, K. K., & Sadeghieh, M. (2019). Financial Development, CO2 Emissions, Fossil Fuel Consumption and Economic Growth: The Case of Turkey. *Strategic Planning for Energy and the Environment*, *38*(4), 7-28. doi:https://doi.org/10.1080/10485236.2019.1205 4409

Gyamfi, B. A., Ozturk, I., Bein, M. A., & Bekun, F. V. (2021). An investigation into the anthropogenic effect of biomass energy utilization and economic sustainability on environmental degradation in E7 economies. *Biofuels, Bioproducts and Biorefining*, *15*(3), 840-851. doi:https://doi.org/10.1002/bbb.2206

Habimana, O., Månsson, K., & Sjölander, P. (2021). A wavelet-based approach for Johansen's likelihood ratio test for cointegration in the presence of measurement errors: An application to CO2 emissions and real GDP data. *Communications in Statistics: Case Studies, Data Analysis and Applications*, *7*(2), 128-145. doi:https://doi.org/10.1080/23737484.2020.1850372

He, G., Zhao, Y., Wang, J., Li, H., Zhu, Y., & Jiang, S. (2019). The water–energy nexus: energy use for water supply in China. *International Journal of Water Resources Development*, *35*(4), 587-604. doi:https://doi.org/10.1080/07900627.2018.1469401

Henderson, K. E., & Sommer, J. (2022). Aiding fossil fuel dependency: a cross-national analysis of energy sector aid, national autonomy, and CO2 emissions in 122 nations. *International Journal of Sociology*, *52*(1), 25-48. doi:https://doi.org/10.1080/00207659.2021.2009273

Huang, S.-Z., Chien, F., & Sadiq, M. (2021b). A gateway towards a sustainable environment in emerging countries: the nexus between green energy and human Capital. *Economic research-Ekonomska*

istraživanja, 1-18. doi:https://doi.org/10.1080/1331677X.2021.2012218

Huang, S.-Z., Sadiq, M., & Chien, F. (2021). Dynamic nexus between transportation, urbanization, economic growth and environmental pollution in ASEAN countries: does environmental regulations matter? *Environmental Science and Pollution Research*. doi:https://doi.org/10.1007/s11356-021-17533-z

Huang, S.-Z., Sadiq, M., & Chien, F. (2021a). The impact of natural resource rent, financial development, and urbanization on carbon emission. *Environmental Science and Pollution Research*. doi:https://doi.org/10.1007/s11356-021-16818-7

Hussain, S., Shahzad, M., & Shafiq, Z. (2020). Influence of Indian lobby on the policymaking of the United States towards Pakistan. *Hamdard Islamicus*, *43*(2), 312-323.

Ibrahim Mohammed, A., Peter Nanpon, G., Martins, A., Ibrahim, A., Seungmin, O., & Jinsul, K. (2021). A Novel Interactive IoT-Based Smart Electricity Power Consumption Management System. *The Journal of Contents Computing*, *3*, 329-341. doi:https://doi.org/10.9728/jcc.2021.12.3.2.329

Juárez-Hernández, S., & Sheinbaum Pardo, C. (2019). Irrigation energy use and related greenhouse gas emissions of maize production in Mexico. *International Journal of Water Resources Development*, *35*(4), 701-723. doi:https://doi.org/10.1080/07900627.2018.1482739

Kahouli, B., Miled, K., & Aloui, Z. (2022). Do energy consumption, urbanization, and industrialization play a role in environmental degradation in the case of Saudi Arabia? *Energy Strategy Reviews*, *40*, 100814. doi:https://doi.org/10.1016/j.esr.2022.100814

Kamarudin, F., Anwar, N. A. M., Chien, F., & Sadiq, M. (2021). Efficiency of Microfinance Institutions and Economic Freedom Nexus: Empirical Evidence from Four Selected Asian Countries. *Transformations in business & economics*, *20*. Retrieved from https://web.s.ebscohost.com/abstract?direct=true&profile=ehost&scope=site&authtype=crawler&jrnl

Khan, I. (2019). Temporal carbon intensity analysis: renewable versus fossil fuel dominated electricity systems. *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, *41*(3), 309-323. doi:https://doi.org/10.1080/15567036.2018.1516013

Khan, Y., Hussain, A., & Shah, N. H. (2020). Analysis of Pakistan's Mutual Fund Performance Evidence from Traditional & Modern Methods. *Hamdard Islamicus*, *43*(2), 296-311. doi:https://doi.org/10.17051/ilkonline.2020.03.735553

Koengkan, M., & Fuinhas, J. A. (2020). Exploring the effect of the renewable energy transition on CO2 emissions of Latin American & Caribbean countries. *International Journal of Sustainable Energy*, *39*(6), 515-538. doi:https://doi.org/10.1080/14786451.2020.1731511

Koengkan, M., Fuinhas, J. A., & Santiago, R. (2020). The relationship between CO2 emissions, renewable and non-renewable energy consumption, economic growth, and urbanisation in the Southern Common Market. *Journal of Environmental Economics and Policy*, *9*(4), 383-401. doi:https://doi.org/10.1080/21606544.2019.1702902

Kryukov, I. V. (2017). Import substitution of technology and equipment in the Russian energy sector. *Problems of Economic Transition*, *59*(1-3), 58-71. doi:https://doi.org/10.1080/10611991.2017.1319186

Lan, J., Khan, S. U., Sadiq, M., Chien, F., & Baloch, Z. A. (2022). Evaluating energy poverty and its effects using multi-dimensional based DEA-like mathematical composite indicator approach: Findings from Asia. *Energy Policy*, *165*, 112933. doi:https://doi.org/10.1016/j.enpol.2022.112933

Le, D. N. (2019). Environmental degradation and economic growth in ASEAN-10: The perspective of EKC hypothesis. *Malaysian Journal of Economic Studies*, *56*(1), 43-62. Retrieved from https://search.informit.org/doi/10.3316/informit.447588307409809

Lee, J. W. (2019). Long-run dynamics of renewable energy consumption on carbon emissions and economic growth in the European union. *International Journal of Sustainable Development & World Ecology*, *26*(1), 69-78. doi:https://doi.org/10.1080/13504509.2018.1492998

Li, W., Chien, F., Kamran, H. W., Aldeehani, T. M., Sadiq, M., Nguyen, V. C., & Taghizadeh-Hesary, F. (2022). The nexus between COVID-19 fear and stock market volatility. *Economic research-Ekonomska istraživanja, 35*(1), 1765-1785. doi:https://doi.org/10.1080/1331677X.2021.1914125

Lisha, L., & Abdullah, N. H. B. (2021). The relationship between tourism development and sustainable development goals in Vietnam. *Cuadernos de Economía, 44*(124), 42-49. Retrieved from https://cude.es/submit-a-manuscript/index.php/CUDE/article/view/155

Liu, Z., Lan, J., Chien, F., Sadiq, M., & Nawaz, M. A. (2022). Role of tourism development in environmental degradation: A step towards emission reduction. *Journal of Environmental Management, 303*, 114078.

doi:https://doi.org/10.1016/j.jenvman.2021.114078

Liu, Z., Tang, Y. M., Chau, K. Y., Chien, F., Iqbal, W., & Sadiq, M. (2021). Incorporating strategic petroleum reserve and welfare losses: A way forward for the policy development of crude oil resources in South Asia. *Resources Policy*, *74*, 102309. doi:https://doi.org/10.1016/j.resourpol.2021.102309

Liu, Z., Yin, T., Putra, A. R. S., & Sadiq, M. (2022). Public Spending As A New Determinate Of Sustainable Development Goal and Green Economic Recovery: Policy Perspective Analysis in the Post-Covid Era. *Climate Change Economics*, *13*(03), 2240007. doi:https://doi.org/10.1142/S2010007822400073

Mensah, I. A., Sun, M., Gao, C., Omari-Sasu, A. Y., Zhu, D., Ampimah, B. C., & Quarcoo, A. (2019). Analysis on the nexus of economic growth, fossil fuel energy consumption, CO2 emissions and oil price in Africa based on a PMG panel ARDL approach. *Journal of Cleaner Production*, *228*, 161-174. doi:https://doi.org/10.1016/j.jclepro.2019.04.281

Moslehpour, M., Al-Fadly, A., Ehsanullah, S., Chong, K. W., Xuyen, N. T. M., & Tan, L. P. (2022). Assessing Financial Risk Spillover and Panic Impact of Covid-19 on European and Vietnam Stock market. *Environmental Science and Pollution Research*, *29*(19), 28226-28240. doi:https://doi.org/10.1007/s11356-021-18170-2

Moslehpour, M., Chang, M.-L., Pham, V. K., & Dadvari, A. (2022). Adopting the configurational approach to the analysis of job satisfaction in Mongolia. *European Research on Management and Business Economics*, *28*(1), 100179. doi:https://doi.org/10.1016/j.iedeen.2021.100179

Moslehpour, M., Ismail, T., Purba, B., & Wong, W.-K. (2022). What Makes GO-JEK Go in Indonesia? The Influences of Social Media Marketing Activities on Purchase Intention. *Journal of Theoretical and Applied Electronic Commerce Research*, *17*(1), 89-103. doi:https://doi.org/10.3390/jtaer17010005

Muhammad, B., Khan, M. K., Khan, M. I., & Khan, S. (2021). Impact of foreign direct investment, natural resources, renewable energy consumption, and economic growth on environmental degradation: evidence from BRICS, developing, developed and global countries. *Environmental Science and Pollution Research*, *28*(17), 21789-21798. doi:https://doi.org/10.1007/s11356-020-12084-1

Murshed, M., Mahmood, H., Alkhateeb, T. T. Y., & Bassim, M. (2020). The Impacts of Energy Consumption, Energy Prices and Energy Import-Dependency on Gross and Sectoral Value-Added in Sri Lanka. *Energies*, *13*(24), 6565. doi:https://doi.org/10.3390/en13246565

Nasir, M. A., Duc Huynh, T. L., & Xuan Tram, H. T. (2019). Role of financial development, economic growth & foreign direct investment in driving climate change: A case of emerging ASEAN. *Journal of Environmental Management*, *242*, 131-141. doi:https://doi.org/10.1016/j.jenvman.2019.03.112

Nathaniel, S. P. (2021). Environmental degradation in ASEAN: assessing the criticality of natural resources abundance, economic growth and human capital. *Environmental Science and Pollution Research*, *28*(17), 21766-21778. doi:https://doi.org/10.1007/s11356-020-12034-x

Nawaz, M. A., Azam, A., & Bhatti, M. A. (2019). Natural Resources Depletion and Economic Growth: Evidence from ASEAN Countries. *Pakistan Journal of Economic Studies (PJES)*, *2*(2), 155-172. Retrieved from https://journals.iub.edu.pk/index.php/pjes/article/view/16

Nishimura, H., Ambashi, M., Iwasaki, F., & Maeda, M. (2019). Harnessing New Technologies for Social and Economic Progress Towards ASEAN 20401. *Published in March 2019*, 50. Retrieved from https://www.researchgate.net/profile/Fusanori-Iwasaki/publication/357017573

Oanh, N. T. N., Trung, N. K. Q., Chi, N. T. K., Hang, T. X., Thi, U. H. N., Lien, D. T. T., & Hang, N. M. (2021). Factors Affecting Performance of Small and Medium-Sized Enterprises In Vietnam. *International Journal of Economics and Finance Studies*, *13*(1), 284-317. Retrieved from https://sobiad.org/menuscript/index.php/ijefs/article/view/582

Ojogiwa, O. T. (2021). The crux of strategic leadership for a transformed public sector management in Nigeria. *International Journal of Business and Management Studies*, *13*(1), 83-96. Retrieved from https://sobiad.org/menuscript/index.php/ijbms/article/view/481

Ozcan, B., & Ozturk, I. (2019). Renewable energy consumption-economic growth nexus in emerging countries: A bootstrap panel causality test. *Renewable and Sustainable Energy Reviews*, *104*, 30-37. doi:https://doi.org/10.1016/j.rser.2019.01.020

Pachauri, R., & Meyer, L. (2014). Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

Pereira, A. M., & Pereira, R. M. (2017). Reducing carbon emissions in Portugal: the relative roles of fossil fuel prices, energy efficiency, and carbon taxation. *Journal of Environmental Planning and Management*, *60*(10), 1825-1852. doi:https://doi.org/10.1080/09640568.2016.1262832

Pintuma, S., & Aunyawong, W. (2021). The Effect of Green Supply Chain Management Practices on Environmental, Operational and Organizational Performances of Seafood Manufacturers in Thailand. *International Journal of eBusiness and eGovernment Studies, 13*(2), 33-48.

Rahman, M. M. (2020). Environmental degradation: The role of electricity consumption, economic growth and globalisation. *Journal of Environmental Management, 253*, 109742. doi:https://doi.org/10.1016/j.jenvman.2019.109742

Sadiq, M., Alajlani, S., Hussain, M. S., Ahmad, R., Bashir, F., & Chupradit, S. (2022). Impact of credit, liquidity, and systematic risk on financial structure: comparative investigation from sustainable production. *Environmental Science and Pollution Research, 29*(14), 20963-20975. doi:https://doi.org/10.1007/s11356-021-17276-x

Sadiq, M., Amayri, M. A., Paramaiah, C., Mai, N. H., Ngo, T. Q., & Phan, T. T. H. (2022). How green finance and financial development promote green economic growth: deployment of clean energy sources in South Asia. *Environmental Science and Pollution Research*. doi:https://doi.org/10.1007/s11356-022-19947-9

Sadiq, M., Ngo, T. Q., Pantamee, A. A., Khudoykulov, K., Thi Ngan, T., & Tan, L. P. (2022). The role of environmental social and governance in achieving sustainable development goals: evidence from ASEAN countries. *Economic research-Ekonomska istraživanja*, 1-21. doi:https://doi.org/10.1080/1331677X.2022.2072357

Sebos, I. (2022). Fossil fraction of CO2 emissions of biofuels. *Carbon Management, 13*(1), 154-163. doi:https://doi.org/10.1080/17583004.2022.2046173

Sharif, A., Mishra, S., Sinha, A., Jiao, Z., Shahbaz, M., & Afshan, S. (2020). The renewable energy consumption-environmental degradation nexus in Top-10 polluted countries: Fresh insights from quantile-on-quantile regression approach. *Renewable Energy, 150*, 670-690. doi:https://doi.org/10.1016/j.renene.2019.12.149

Tan, L. P., Sadiq, M., Aldeehani, T. M., Ehsanullah, S., Mutira, P., & Vu, H. M. (2022). How COVID-19 induced panic on stock price and green finance markets: global economic recovery nexus from volatility dynamics. *Environmental Science and Pollution Research, 29*(18), 26322-26335. doi:https://doi.org/10.1007/s11356-021-17774-y

Thuy, L. T., Phuong Dio, T. T., Hoan, N. D., Ninh, V. V., & Thuy Nga, N. T. (2021). Factors affecting intention to purchase organic agriculture products among Vietnamese. Retrieved from https://hdl.handle.net/10355/88562

Turk, J. K., Reay, D. S., & Haszeldine, R. S. (2018). UK grid electricity carbon intensity can be reduced by enhanced oil recovery with CO2 sequestration. *Carbon Management, 9*(2), 115-126. doi:https://doi.org/10.1080/17583004.2018.1435959

Uddin, M. M. M. (2020). What are the dynamic links between agriculture and manufacturing growth and environmental degradation? Evidence from different panel income countries. *Environmental and Sustainability Indicators, 7*, 100041. doi:https://doi.org/10.1016/j.indic.2020.100041

Verbič, M., Satrovic, E., & Muslija, A. (2021). Environmental Kuznets curve in Southeastern Europe: the role of urbanization and energy consumption. *Environmental Science and Pollution Research, 28*(41), 57807-57817. doi:https://doi.org/10.1007/s11356-021-14732-6

Wang, H. (2022). Role of environmental degradation and energy use for agricultural economic growth: Sustainable implications based on ARDL estimation. *Environmental Technology & Innovation, 25*, 102028. doi:https://doi.org/10.1016/j.eti.2021.102028

Wang, J., & Dong, K. (2019). What drives environmental degradation? Evidence from 14 Sub-Saharan African countries. *Science of The Total Environment, 656*, 165-173. doi:https://doi.org/10.1016/j.scitotenv.2018.11.354

Zhao, L., Zhang, Y., Sadiq, M., Hieu, V. M., & Ngo, T. Q. (2021). Testing green fiscal policies for green investment, innovation and green productivity amid the COVID-19 era. *Economic Change and Restructuring*. doi:https://doi.org/10.1007/s10644-021-09367-z