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## Article

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# The Impact of Corporate Social Responsibility, Energy Consumption, Energy Import and Usages and Carbon Emission on Sustainable Economic Development: Evidence from ASEAN countries

Tien-Dung Nguyen<sup>1</sup> and Quang-Thanh Ngo<sup>2</sup>

## ABSTRACT

Recently, sustainable economic development has become a global requirement and also has gained the attention of recent studies and policymakers nowadays. Thus, the present study has examined the impact of corporate social responsibility (CSR) along with renewable energy consumption, energy usage and import and carbon emission on the sustainable economic development of the Association of South-East Asian Nations (ASEAN). This study has adopted the quantitative method of data collection and used secondary data collection sources. The data has been extracted from the world development indicators (WDI) and reports published on the sustainability of the countries. This study has gathered the post-financial crisis data from 2011 to 2020. This study has executed the robust standard error and fixed effect model (FEM) to examine the relationships among variables. The results revealed that CSR, renewable energy consumption, and energy usage and import have a positive and significant associations with the sustainable economic development of the ASEAN countries. The outcomes also exposed that carbon emission has a negative but significant nexus with the sustainable economic development of the ASEAN countries. These outcomes provide the guidelines to the regulation-making authorities while formulating policies related to sustainable economic development in accordance with CSR and energy policies.

## KEY WORDS:

corporate social responsibility, renewable energy consumption, energy usage, energy import, carbon emission, sustainable economic development.

**JEL Classification:** O11, Q43, D22, C33.

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## 1. Introduction

Nowadays, sustainable economic development has gained the considerations of recent studies and policymakers. The phenomenon of sustainability always remained under the core attention of scholars. The prime aim of any country is to ensure the maximum efforts to bring its economy on the right path as well as to keep its momentum on. The countries ensure maximum efforts

to achieve this aim as the governments are well aware that the nation's prosperity stands behind the sustainable development of the country economy. The standard of living of any country's people is directly associated with the economic conditions. There are many sectors associated with the economy that help it bring it on the right path. Some factors influence it in most ways, i.e., the factors having a direct association with the environment and society. The core reason behind this is that these factors are beyond the country's control.

In the recent era, the importance of corporate social responsibilities (CSR) is getting more attention in the literature. The world is careful about its CSR, which en-

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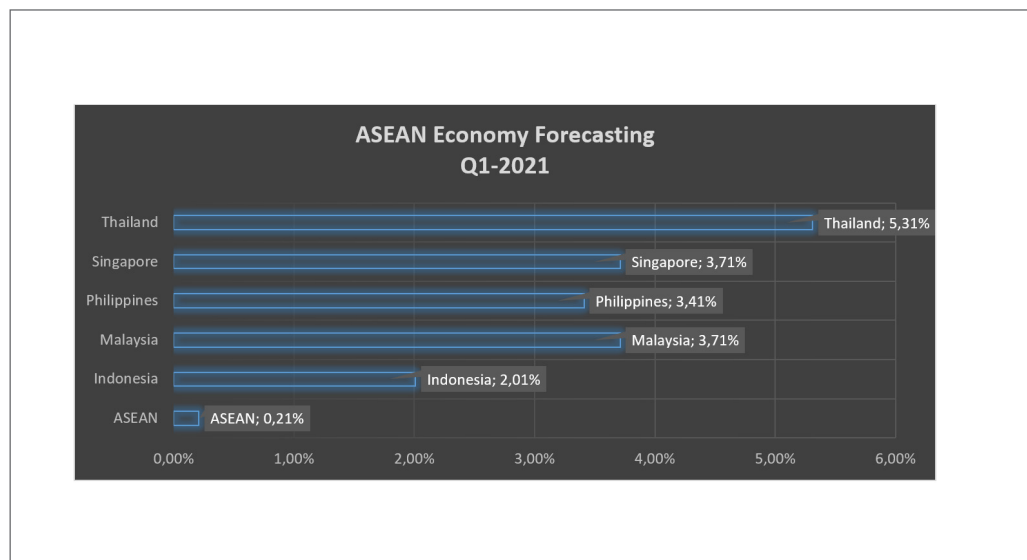
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forces the nations to ensure its safety in all aspects of life. The impact of CSR on the economy of the country also forces the business community to revise their strategies to safeguard the environment, namely, green financing etc. (Giraud, Giudici, & Grilli, 2019). In addition to this, another factor of CSR which influence the economy in a strong manner is societal factors. Society always remains careful about its benefits. However, the welfare of society is the ultimate aim of any country which enforce it to stabilize its economy (Farooq et al., 2019). Despite that, society always enforces the government to ensure its welfare to the maximum. The factor which acts as a bridge between economic development and the related factors is the government. The government, on one side, ensure the sustainable development of the economy. On the other side ensure the fulfilment of the requirement of these factors (Chinedu, Daniel, & Ezekwe, 2018). Likewise, some other factors have a direct association with the environmental factors that directly influence the sustainable development of the economy. Another phenomenon of this era is energy. Almost every nation of the globe is worried about this factor. The nations play core attentions while formulating the policies regarding energy. Since the world has globalized, the usage of energy is enhanced at a rapid pace. To bring the balance between energy consumption and usage is the core focus. The countries explore more ways for energy creation. There are different forms of energy creation like solar, wind etc. Another aspect added here is the consumption of renewable energy and carbon emission (Nawaz et al., 2021). All these factors are considered by any country while formulating the energy policy. Many times, the countries decide to import the energy to fill the country's energy gap. The countries usually do not prefer to go with this decision. There is an association reported between economic development and environmental factors (Sussan & Obamuyi, 2018).

In the global economy, ASEAN economies play a critical role. Although the COVID-19 pandemic also indicates a declining pattern in the economy of the ASEAN economies. It is reported that the real economic conditions of ASEAN dropped by -3.8 per cent in the fourth quarter of 2020. When we talk about Indonesia, in the fourth quarter of 2020, there was a fall of -1.60%. The same applies to Malaysia. There was a drop of -0.5% during the fourth quarter of 2020. The declining pat-

tern in the Philippines was higher, that is, -4.2 per cent relative to Malaysia. In Singapore, the downward rate was less than in the Philippines, which is -2.10 per cent. The highest decline was recorded in Thailand due to this COVID-19 pandemic during the fourth quarter of 2020, as the ASEAN economy has a significant influence because of this COVID-19 pandemic. The ASEAN outlook is not satisfactory. In addition, this prediction relies on the existence of this pandemic COVID-19. The further the lifetime of this COVID-19 pandemic, the less probable it is to foresee. In line with current projections, the total ASEAN economy will shift by 0.2% after Q1 of 2021. This number is not high, though, but it is at least optimistic. While evaluating the region, the full recovery in Malaysia's economy is predicted. This pattern of recovery stands at 3.7%. On the other side, there has been a negative trend of 3.7% and 5.3%, respectively, in the economy of Singapore and Thailand. The forecast positions of the ASEAN economies at the end of Q2 of 2021 are satisfactory. At the end of Q2 of 2021, the gross recovery in the ASEAN economies was 7.2 per cent. On the other side, in Indonesia, Malaysia, Philippines, Singapore and Thailand, respectively, 3.6%, 7.3%, 6.2%, 4.8% and 1.3% were retrieved. The fast recovery in Malaysia was recorded at 7.3%. The slowest recovery in Thailand is expected to be 1.3 per cent. The ASEAN economy projection for 2021 is seen in Figure 1.

Economic growth determines its position in the international market, and once a higher position can be attained, it needs to be maintained, which is possible by creating sustainability in the economic development. With the globalization and severity in the competition, the achievement of sustainability in economic development has become the need of the hour. That is why both the factors which contribute to and the factors which retards the sustainability creation in economic development must be researched by the scholars. Thus, our study aims to examine corporate social responsibility, renewable energy consumption, energy import, energy usage, and carbon emission and their impacts on sustainable economic development. The study aims to test how much corporate social responsibility, renewable energy consumption, energy import & usage, and carbon emission contributes to or retards the sustainability creation in economic development. Our study is a great contribution to the existing literature. First, in the past study like Ozturk and Acaravci (2010), which

**Figure 1***ASEAN Economy Forecasting*

deals with the role of effective energy sources in getting sustainable economic development, it is required that the role of renewable and non-renewable energy sources in getting sustainable economic development must be explored separately. So, the exploration of renewable energy consumption and energy usage in relation to sustainable economic development. Second, the exploration of corporate social responsibility, carbon emission and energy consumption as determiners of the sustainable economic development of a country is one of the study's contributions to literature. Third, the analysis of the impact of corporate social responsibility, renewable energy consumption, and energy import & usage and carbon emission on the sustainability creation in economic development in ASEAN countries is also the contribution of this study. This study proves to be a guideline to the ASEAN countries on how they can create sustainability in their economic development with the adoption of corporate social responsibility, effective choice and use of energy sources, and controlling the amount of carbon emission in the atmosphere.

The present investigation will investigate the impact of CSR and energy policy on the sustainable economic development of the ASEAN economies. The next sec-

tion deals with a review of the past studies, and further study sections are research methods, findings, discussions, implications, limitations and future directions. The future structure of the study includes the past study literature in the second part of the study, while research methods are shown in the third part, and the fourth part is related to the analysis of the data. The last part of the study includes the discussions of the results and conclusion, implications and limitations.

## 2. Literature Review

Plenty of pursuits extend the excellence toward economic development while shaping the governance, social and environmental index under CSR. These extensions positively describe the natural environment that helps to uplift sustainable economic development. Therefore, a significant association of some governing factors is linked with economic sustainability. The enactment of sustainable economic development dominates some plausible and alternative environmental indexes (Remeikienė et al., 2020). This inducement of environmental elements states the other factors associated with economic development. There is the significance of interrelationship among the carbon emissions, eco-

economic growth, energy consumption, and environmental index. A variety of factors related to environmental issues enlarges the agenda over sustainable economic development. Wide linkage is also depicted among the social elements and economic development (Batabyal et al., 2020). This linkage is also widely described with the significance of some social and physical infrastructures that influence sustainable economic development (Z. A. Baloch et al., 2021; Kumari & Sharma, 2017). The influence of economic development is also stated in many natural impacts that induce the importance of the social index. The enactment of some relevant factors enhances economic development in many ASEAN countries. These factors could positively affect the economy and development of ASEAN countries while focusing on a social index with slight integrations. Natural roots are also prevalent in economic development, which is stated by social influences.

Some factors of CSR, such as socio-economic and environment are bringing influence toward sustainable economic development. Therefore, the government structure is also required to be established to manage the actual influences of these factors. Although some governance indexes have positive enumeration toward sustainability in development, the determination in governance could uplift economic development (Chien et al., 2021; Khalid et al., 2020; Sułkowski et al., 2020). CSR disclosures are obtained among the factors of governance, social and environmental integration. These disclosures determine the influence on sustainable economic development by engagement in policy development. It is among the enlargement of stakeholders who are indulged in governance disclosers to motivate the sustainable development of an economy. There is a triple bottom line among the factors of sustainable economic development (Barłózewski & Trąpczyński, 2021; Chien et al., 2021). These lines are positively illustrated by the dominance of environmental, social, and governing elements. These elements have a significant influence on sustainable economic development. Comprehensive relationships exist among the eminence of sustainable economic development and the triple bottom line of such factors (Hammer & Pivo, 2016). Socio-economic status is also prevalent in development concepts, which are derailed by some lack of attention in economic sustainability. It is essential to use the values of environment and social investments linked with the

sustainable development contexts (Roszko-Wójtowicz & Grzelak, 2020).

Although many factors have an essential role in sustainable economic development, renewable energy consumption is essential. This role has positive enumeration by some elements of consumption which are non-renewable and renewable (Rahman & Velayutham, 2020). It is dependent on the factors of economic growth that are having an impact on renewable energy consumption and other factors. This contributes significantly to some proxy variables that influence the formation of parts prevailing in renewable energy consumption (Kolozi & Lentner, 2020). These parts are stated dominant nexus among the consumption of energy and economic growth in many ASEAN countries facing sustainability issues. The increasing crisis of the environment has been coming up with an essential issue in a debate with other control variables. The acceleration of problems is placed in considerable renewable energy factors, which dominate the sustainable economic development. It is among the policymakers, governments, and individuals who play a positive role in economic growth. These have also associations which many other factors that bring positive enhancement in sustainable economic development. Renewable energy consumption has dependent on a political economy where the quality of institutions dominates with differences (Uzar, 2020). To solve the problems, these institution qualities refer to strategic choices with various renewable energy consumption elements.

The asymmetric prevailing among the factors of renewable energy consumption states relationships on the long term and short term (Nizam et al., 2020). This is aimed to establish the approaches between economic growth, non-renewable and renewable energy consumption. It helps to consider the benefits of independence of renewable energy consumption and other socio-economic conditions (Chien, Chau, et al., 2021). This will result in consequences that could enumerate significant interpretations of renewable energy consumptions and sustainable economic development. Some renewable and non-renewable energy consumption issues are dominant among the economic grounds that represent economic growth (Chien, Anwar, et al., 2021). Strong support is asserted after evaluating the linkages between energy consumption and sustainable economic development. Different directions are in-

clusive of the economic growth by the inducement of environmental management and sustainable economic development. This is positively measured by the heterogeneous growth indicated in the development of an economy. It could be considered an existing state that plays a positive role in the development of sustainability in the economy. The role of institutions' qualities in the management of the environment is connected with sustainable economic development (Kostetska et al., 2020). Many elements of socioeconomic and environmental practices extend the support with the means of prosperity toward economic development. These are the material approaches to economic achievements attained with the visionary formation of some energy elements (Chien, Kamran, Albashar, & Iqbal, 2021).

The dependence on energy and environmental factors dominates economic development (Hussain et al., 2020). Therefore, the prevalence of energy imports also plays an essential role in the sustainability of the economy (Slavinskaite et al., 2020). This wide association of energy import asserts targeted effects on economic growth. There is a rapid background of urbanization in the developing ASEAN countries, which are essential in the formation of energy. Although, many associations are eminent in the energy import, which could bring certain changes to economic sustainability. The energy import and its rebound effects are more dependent on the megacities of developing countries (Anh Tu et al., 2021). The hot issues of renewable energy consumption are described in the economic conditions of many ASEAN countries. It asserts a significant portion of benefits to the economies of ASEAN countries. Although, the significance of renewable energy consumption contributes an eminent portion to the GDP of any country. Therefore, the importance of renewable energy consumption induces the potential of increasing utilization with the relevance of sustainability in economic development (Haseeb, Kot, Hussain, & Kamarudin, 2021). It also dominates as an efficient portion among the industries that provide significant support to the GDP with a certain share. The use of renewable energy contributes toward economic activities and mitigates the problems of the environment.

Various diversifications prevail in the economies of developing ASEAN countries. These diversifications of energy imports contribute positive patterns to sustainable economic development. Many ASEAN countries

are more dominant towards export, and a certain portion is also connected with imports. The portion of the energy is specifically associating with the economic development of developing ASEAN countries. Therefore, the importance of LNG is eminent in ASEAN countries which comprises the elements of energy security differentiating across many other ASEAN countries (Vivoda, 2019). Many ASEAN countries like India, Japan, Taiwan, and China are essential and concerned with energy imports due to the economy's growth. The common features of social and economic objectives are clear with respect to the goals and economic distributions. These distributions are associated with societal objectives and social responsibilities and are more particular in profits to the economies. Therefore, the identification is unclear in some parts due to the variety of energy imports with apparent goals and objectives (Chien, Pantamee, et al., 2021). Comprehensive requirements in the majority of cases provide accuracy in a variety of energy projects which help in a sustainable environment. Social entrepreneurship asserts a significant contribution toward sustainable economic development, which emphasized the respected share of markets (Bilan et al., 2017). It is among the sustainable development regulations induced by the economic conditions where energy comparison plays a dominant role.

With the relevance of various energy factors, its usage inserts an important role in the economic conditions. It is essential to assert the efficiency with the occupancy of behaviors associated with energy usage. Some performances of energy efficiency and energy conservation could bring participated role to the sustainable economic development. The use of energy is analyzed with the dominance of residential buildings and household behaviors with urbanization (Chien, Sadiq, Kamran, et al., 2021). Some general trends prevail in the energy usage that spreads the high-quality demands with increment in lives. The size and growth of energy usage are induced in the levels of intensive targets with traditional behaviors for sustainable economic development. While assessing the feasibility of some substantial energy usage among the process of economic conditions. The usage of energy with other factors induces some eminent elements which are essential in uplifting the economic conditions. It is also essential to assess the feasibility of mitigating options of carbon dioxide with the relevance of energy usage to

assert importance toward economic development (Babacan et al., 2020). With the measurement of carbon dioxide, carbon emissions are relevant to energy usage, which endorse positive economic results (Nawaz et al., 2020). The routes calculation is assessed with the costs, which are beard on the electricity, chemicals, and fuels (Chien, Wang, Nguyen, Nguyen, & Chau, 2020; Li et al., 2021).

The use of energy is consistent in various ASEAN countries and is prevailing on similar sources. These are usually endorsing portions toward sustainability in the economy. Although, energy usage is essential in many sectors, which could positively change sustainable economic development (Mohsin et al., 2021; Nawaz et al., 2020). Therefore, the ASEAN countries are inducing looks on the alternative source of energy usage to enable sustainable environments for economies. It is also clear that alternative energy usage converges toward many ASEAN countries positively enhances sustainable environments (Demir & Cergibozan, 2020). The productiveness of alternative energy plays a significant role but could also be harmful to certain sectors of the economy. Energy is usually denoted as the economic element which plays an essential role in sustainable economic development. Therefore, the exploration of energy is associated with financing elements of emerging markets. The proportion of renewable energy consumption is linked with energy usage, which helps to sustain economic development. Sustainable economic development is significantly associated with energy projects while financing emerging markets' economies (Huang et al., 2020). The promotion of energy usage asserts the development of stock markets which enables the sustainability of economic growth. It also reveals carbon emissions and economic development, which are influenced by the positive inducement of energy usage.

Overview of the carbon emission describes the energy usage and its impact on the economies. This also specifies the bifurcation in energy elements usually extracted from the carbon (Li, Chien, Kamran, et al., 2021). This extension of specifications supports the instances of economic growth, which is essential for economies. There is a wide relationship between the factors of carbon emission CO<sub>2</sub> and the growth of the economy. Among the numerous elements of economic growth, there is a significant relationship between car-

bon emission CO<sub>2</sub> and economic conditions (Nguyen et al., 2021; Shair et al., 2021). Some demonstrations are also eminently described in the economic growth, which specifies the emergence of carbon emission CO<sub>2</sub> and sustainable economic development. Various causes belong to the factors that are linked with economic growth. These elements are applied with a variety of systematic moments that examines the importance of carbon emission CO<sub>2</sub>. The significant association also asserts casual relevance with the energy consumption, carbon emission CO<sub>2</sub> and economic growth. While analyzing the role of economic factors, energy consumption, economic development, and carbon emission are significantly connected (Acheampong, 2018). It is prevalent in the policies that could be developed to contribute to positive economic growth (Othman et al., 2020; Sun et al., 2020). These policies are prevalent on the margins associated with carbon emission CO<sub>2</sub> and other elements of sustainable economic development (Sadiq et al., 2020).

Some ASEAN countries are more emphasizing the largest commitments in carbon economies with significant efficiencies. These efficiencies are connected with the CO<sub>2</sub> emitting and energy consumption initiated by the governments of developing and developed ASEAN countries. It is meaningful to enumerate low carbon emission CO<sub>2</sub> efficiency, which could establish positive results in sustainable economic conditions at regional grounds (Zhang et al., 2017). The measurements are based on the outputs that are undesirable combinations of carbon emission CO<sub>2</sub> efficiency. It dominates in certain industries' rationalization levels, which indices the proposed outputs of carbon emission CO<sub>2</sub> toward sustainable economic development. Numerous gateways are prevalent in the economic conditions for carbon emission CO<sub>2</sub>, which helps tackle various challenges. These challenges enhance the contributions of projects which discuss the significant spillovers. The economy corridors are also denoted as a positive gateway to sustainable economic development in some ASEAN countries that are usually neighbors (Kousar et al., 2018). The huge amounts of foreign investments in carbon emission CO<sub>2</sub> are considered significant contributors to the economic developments. Therefore, the improvements in carbon emission with the relevance of the productivity index also helps to sustain the economic developments.



### 3. Research Methods

The current research aims to investigate the impact of CSR and renewable energy consumption, energy usage, and import and carbon emissions on the sustainable economic development of the ASEAN countries after the financial crisis 2007 and 2008. This study has adopted the quantitative method of data collection and used secondary data collection sources. The data has been extracted from the WDI and reports published on the sustainability of the countries from 2011 to 2020. This study has executed the robust standard error and FEM to examine the relationships among variables. Based on past studies, the present study estimated the equation as follow:

$$SED_{it} = \alpha_0 + \beta_1 ESGI_{it} + \beta_2 REC_{it} + \beta_3 ENI_{it} + \beta_4 ENU_{it} + \beta_5 CO2_{it} + e_{it} \quad (1)$$

Where;

SED = Sustainable Economic Development

i = Country

t = Time Period

ESGI = Environmental, Social, Governance Index

REC = Renewable Energy Consumption

ENI = Energy Import

EU = Energy Usage

CO2 = Carbon Emission

The present study has used sustainable economic

development (SED) as the study's dependent variable and measured the GDP growth (annual %). In addition, CSR is used as a predictive variable and measured as the environmental, social, governance index. Moreover, renewable energy consumption is measured as the % of total consumption, energy import that is measured as the % energy use, energy usage that is measured as the kg of oil equivalent per capita and carbon emission that is measured as the carbon dioxide damage (% of GNI) are used as the predictors of the study. These are mentioned in Table 1.

The present study firstly examines the correlation among the variables and examines the model's multicollinearity issue. For this purpose, the present study has adopted the variance inflation factor (VIF). If the results of VIF show, the values are less than five, which means no high correlation among variables and no issue of multicollinearity. The estimation equations related to the VIF are given below:

$$R^2_Y \rightarrow Y_{it} = \alpha_0 + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + e_{it} \quad (2)$$

$$j = R_Y^2, R_{X1}^2, R_{X2}^2, R_{X3}^2, R_{X4}^2, R_{X5}^2 \quad (3)$$

$$Tolerance = 1 - R_j^2 \quad VIF = \frac{1}{Tolerance} \quad (4)$$

This study also executed the Hausman test to check the appropriate model for the analysis, and the results indicated that the FEM model is appropriate. A

**Table 1**  
*Measurements of Variables*

S#	Variables	Measurements	Source
01	Sustainable Economic Development	GDP growth (annual %)	World Development Indicator
02	Corporate Social Responsibility (CSR)	Environmental, Social, Governance Index	ASEAN CSR Networks
03	Renewable Energy Consumption	Renewable energy consumption (% of total consumption)	World Development Indicator
04	Energy Import	Energy import (% energy use)	World Development Indicator
05	Energy Usage	Energy use (kg of oil equivalent per capita)	World Development Indicator
06	Carbon Emission	Carbon dioxide damage (% of GNI)	World Development Indicator



FEM is a statistical model in which parameters are non-random quantities. In addition, FEM means a regression model in which the group means are fixed. Generally, data can be grouped according to several experimental factors. In a FEM, each group mean is a group-specific fixed quantity. The estimation equation for FEM is given below:

$$Y_{it} = \beta_{1i} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + u_{it} \tag{5}$$

Furthermore, FEM handle the issues of violation of assumptions of regression, and the present study has used the variables and estimated the FEM equation as follow:

$$SED_{it} = \beta_{1i} + \beta_2 ESGI_{it} + \beta_3 REC_{it} + \beta_4 EI_{it} + \beta_5 EU_{it} + \beta_6 CO2_{it} + u_{it} \tag{6}$$

The present study has also examined the nexus among CSR, renewable energy consumption, energy usage and import, carbon emission and sustainable economic development by using the robust standard error. The major characteristic of the robust standard error is that it controls the issues of heteroscedasticity and auto-correlation. The estimation equation for the robust standard error is given below:

$$SED_{it} = \beta_1 ESGI_{it} + \beta_2 REC_{it} + \beta_3 EI_{it} + \beta_4 EU_{it} + \beta_5 CO2_{it} + \epsilon_{it} \tag{7}$$

Finally, the Granger causality test has also been used to check the nexus among the variables, and results indicated the bilateral, unilateral, and no relationships among the variables. The estimation equations for granger causality is given below:

$$Y_t = \beta_0 + \sum_{j=1} \beta_{1j} Y_{t-1} + \sum_{h=1} \beta_{2h} Y_{t-p} + \epsilon_t \tag{8}$$

$$X_t = \alpha_0 + \sum_{s=1} \alpha_{1s} Y_{t-s} + \sum_{t=1} \alpha_{2t} X_{t-m} + \epsilon_{t(9)}$$

4. Findings

The findings section shows the descriptive statistics showing the minimum and maximum values and the variables' standard deviation and means values. The results indicated that the mean economic growth of the ASEAN countries is 1.777 percent while the mean energy import of ASEAN countries is 0.132 with reference to the total energy usage. In addition, the figures also show that the average CO2 emission is 8.627 percent, while the mean usage of renewable energy is 0.189 of total energy usage. Finally, the average energy usage is 0.149, and the average ESG index is 45.247 in ASEAN countries. These values are mentioned in Table 2.

The finding section also shows the correlation matrix that shows the nexus among the variables, and the figures highlighted that EI, REC, EU and CSR have a positive association with SED while CO2 has a negative association with SED. The re-

Table 2  
Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
SED	100	1.777	0.412	1.028	2.733
EI	100	0.132	0.156	0.321	0.593
CO2	98	8.627	0.342	7.767	9.128
REC	100	0.189	0.195	0.010	0.761
EU	100	0.149	0.202	0.310	0.873
ESGI	100	45.247	15.962	0.172	79.36

**Table 3**  
*Correlation Matrix*

Variables	SED	EI	CO2	REC	EU	ESGI
SED	1.000	0.501	0.453	2.733		
EI	0.196	1.000	0.811	9.319		
CO2	-0.167	0.152	1.000	1		
REC	0.041	-0.148	-0.476	1.000		
EU	0.017	-0.139	-0.534	-0.132	1.000	
ESGI	0.056	0.345	-0.026	0.036	-0.145	1.000

sults exposed that if one per cent changes energy import, then sustainable economic development will change by 19.6 percent. In addition, the figures also indicated that one percent increase in CO2 emission would decrease sustainable economic development by 16.7 per cent and vice versa. Moreover, the results also exposed that if one per cent change renewable energy consumption, then sustainable economic development will change by 4.1 percent. Additionally, the figures also indicated that one per cent increase in energy usage would increase sustainable economic development by 1.7 per cent and vice versa. Finally, the statistics exposed that if one per cent change the CSR index, then sustainable economic development will

change by 5.6 percent. These values are shown in Table 3.

This study has also shown the VIF that exposed the multicollinearity issue in the data, and the results show that the values of VIF are lower than five. These values indicate that no multicollinearity issue in the data, and the variables are not highly correlated. These values have been mentioned in Table 4.

The results also show the Hausman test is used to check the appropriate model for the analysis. The test results have exposed that FEM is appropriate because the probability value of the Hausman test is higher than 0.05, which rejects the null hypotheses related to the random effect model is appropriate. These values are mentioned in Table 5.

**Table 4**  
*Variance Inflation Factor (VIF)*

	VIF	1/VIF
CO2	2.49	.402
EU	2.008	.498
REC	1.81	.553
EI	1.188	.842
ESGI	1.181	.847
Mean VIF	1.735	.

**Table 5**  
*Hausman Test*

	Coef.
Chi-square test value	4.699
P-value	0.454

**Table 6**  
*Fixed Effect Model (FEM)*

SED	Beta	S.D	t-value	p-value	L.L.	U.L.	Sig
EI	1.182	0.325	3.63	0.000	0.535	1.830	***
CO2	-0.741	0.172	-4.30	0.000	-1.083	-0.398	***
REC	0.843	0.392	2.15	0.027	0.219	2.533	**
EU	0.119	0.028	4.25	0.000	0.911	2.674	***
ESGI	0.101	0.052	1.94	0.032	0.006	1.004	**
Constant	6.992	1.608	4.35	0.000	3.794	10.190	***
R-squared		0.577	Number of obs			98.000	
F-test		6.374	Prob > F			0.000	

\*\*\* p<.01, \*\* p<.05, \* p<.1

The finding also includes the testing of relationships among the variables. The results of FEM revealed that CSR, renewable energy consumption, and energy usage and import have a positive and significant association with the sustainable economic development of the ASEAN countries. However, the outcomes also exposed that carbon emission has a negative but significant nexus with the sustainable economic development of the ASEAN countries. The values of R square exposed that 57.7 per cent variation in SED is due to the selected predictors of the study. These values are shown in Table 6.

The robust standard error was also executed to test the relationships among the variables. The results revealed that CSR, renewable energy consumption, and energy usage and import have positive and significant associations with the sustainable economic development of the ASEAN countries because the beta values have a positive sign. The t-values are larger than 1.64, and the p-values are less than 0.05. The outcomes also exposed that carbon emission has a negative but significant nexus with the sustainable economic development of the ASEAN countries. These links are highlighted in Table 7 given below.

**Table 7**  
*Robust Standard Error*

SED	Beta	S.D.	t	P>t	L.L.	U.L.
EI	1.182	0.419	2.820	0.020	0.235	2.130
CO2	-0.741	0.245	-3.020	0.014	-1.295	-0.186
REC	0.843	0.314	2.680	0.025	1.554	2.132
EU	0.919	0.484	1.898	0.042	0.212	1.975
ESGI	0.101	0.042	2.405	0.029	0.005	1.003
_cons	6.992	2.030	3.450	0.007	2.401	11.583

The granger casualty test results have shown that EI, ESGI, EU and REC has unidirectional relationships with SED while CO<sub>2</sub> has no relationship with SED. Table 8 shows these figures below.

## 5. Discussions

Renewable energy consumption, energy import, energy usage and carbon emission have a significant role in the sustainable economic development of the Association of Southeast Asian Nations (ASEAN). This study prevails on the impact of CSR measured as the environmental, social, and governance index on ASEAN countries' sustainable economic development as ASEAN economies have been growing rapidly with deep concern on sustainable economic development since last two decades. Moreover, M. A. Baloch, Mahmood, and Zhang (2019) concluded that renewable energy depletion significantly impacts sustainable economic development. In addition, Azam (2020) discovered that renewable energy consumption has a significant positive impact on the sustainable economic development of ASEAN countries. The empirical results indicate the positive impact of renewable energy consumption on the country's economy and development in the short and long run. Statistically shows that the 1% significance of renewable energy consumption will increase the same level of GDP per capita. The finding achieved a positive re-

lationship between CSR and sustainable economic development reported by Ng, Lye, Chan, Lim, and Lim (2020). The result through analysis implies that when the sustainable economy develops, the index of ESG becomes higher. It has a causal relationship between these two variables that the sustainable economic development of a country indicates a better financial position in the sense of market size, liquidity and accessibility of funds which may be due to the better CSR implementation stated by (Adams & Klobodu, 2018).

The results indicate that energy trade and energy usage both are interconnected with sustainable economic development. Besides other factors, the most important factor affecting energy consumption is the import and export trade. Since the ASEAN countries take membership in WTO, it impacts on economies of the ASEAN region positively. Foreign trade may cause to enhance economic development as well as it also increases the usage of energy. However, import and export positively impact the energy sector and indulge in economic boosting; export cause more renewable energy production because renewable energy consumption stimulates excess export volume. The increase in export enhances more energy and produces more energy to transport goods from one country to another. The energy trade may play a vital role in the energy sector due to energy usage in transferring in advanced

**Table 8**  
*Granger Casualty Test*

Null Hypothesis	F-Statistic	Prob.	Decisions
EI does not Granger Cause SED	2.99893	0.0174	Unidirectional
SED does not Granger Cause EI	1.29543	0.2798	
ESGI does not Granger Cause SED	4.65723	0.0124	
SED does not Granger Cause ESGI	0.20739	0.8132	Unidirectional
EU does not Granger Cause SED	3.63507	0.0327	
SED does not Granger Cause EU	0.08524	0.9184	
REC does not Granger Cause SED	4.34572	0.0088	Unidirectional
SED does not Granger Cause REC	0.01629	0.9838	
CO <sub>2</sub> does not Granger Cause SED	0.01158	0.9885	
SED does not Granger Cause CO <sub>2</sub>	1.69118	0.1914	No relationship

technology. Furthermore, past researchers also studied and agreed that there is a significant positive relation between energy import and sustainable economic development (Chen, 2018).

In light of the study results, a country's economy is not fully dependent only on energy usage but suggests a positive relationship between these variables. In addition, Sinha, Jawahar, Ghosh, and Mishra (2019), predicted in their research the energy usage in trade has a significant positive relationship with sustainable economic development. As higher the usage of energy, the more economic growth. Energy usage also impacts climate change. So economic development is considered the driving force for the promotion of energy usage. Most of the previous researchers discussed the relationship between carbon emission and sustainable economic development. Yao, Zhang, and Zhang (2019), also depicted in their study that a negative relationship exists between carbon emission and sustainable economic development. As in industrialized countries, carbon emission produces while operating, which has negatively impacted economic development.

The findings from the ASEAN economies reported that the relationship is significant negative between economic development and carbon emission. It is suggested through the results that carbon emission significantly negatively affected economic growth. These results are also approved by Lee et al. (2017). They reveal that less carbon emission and their impact on the environment than more production negatively affect economic development as income pollution has been mainly debatable for several years. Globally it is to be concerned that the development of environment, social and governance index is connected with sustainable economic growth. Their concern on the holistic management system for sustainable development. By keeping into consideration environmental pollution with less carbon emission and compare to the high level of production consuming more carbon. Climate change and environmental sustainability are the two main factors of sustainable economic development.

## 6. Conclusion and Implications

Energy plays a vital role in the development of any economy. With a brief discussion, it is concluded that efficient energy policy measures are necessary to improve social well-being and develop ASEAN countries' sustainable economies. Therefore, policymakers' responsibility

may increase in this sense to formulate environmentally friendly policy to grow the region's sustainable economy. The maximum level of energy resources must be utilized by keeping in mind the supply percentage of resources. Securing renewable energy resources and the contribution of energy to maintain environmentally friendly are two overriding challenges faced by the emerging economies of the ASEAN region. The economy's financial sector should be improved by making, reshaping, and formulating suitable policies. The resources of energy supply should not be less than energy demand. To achieve sustainable economic development, it is essential to sustain energy supply resources on a sustainable basis. It will only be possible through effective policies. Government policies, it is to be ensured that the energy sector was contributing to sustainable development. There are many policy domains where policies can be influenced by production, conversion, distribution, and energy usage. The energy system must be developed in such a manner that it coordinates with sustainable economic development. For this purpose, the ASEAN countries should strengthen the institutions with energy management and development cooperation.

This research's main implication is that most of the ASEAN economies have considered that the long-run economies have contributed less carbon emission. It is suggested that policymakers reduce carbon emissions to provide a safe and protective environment for all living creatures. To formulate new policies is not the objective of this study but give attention to this aspect. One feature of the environmentally friendly policy is carbon emission tax could be imposed on pollutant factors. A carbon emission trading scheme is another feature of the carbon emission policy. These outcomes have provided the guidelines to the regulation-making authorities while formulating policies related to sustainable economic development according to CSR and energy policies. The question is not which policy will be more effective, but the more important is further implementing the policy on a regional or government level.

## 7. Limitations and Future Directions

Several limitations are involved in this study. These limitations may become the strength of upcoming researchers, academic concerns, policymakers and economists. Limitations may provide further directions to researchers. The study has discussed the energy policy

of ASEAN countries with the relationship of CSR, renewable energy consumption, energy import, energy usage and carbon emission as independent variables. In this study, the impact of the above-stated factors on sustainable economic development is discussed, but many other factors like regional development, government policies, and the performance of financial institutions etc., also have a significant impact on the sustainability in economic development. But these factors have been entirely neglected by this study, and this study reliability is limited. So, future authors are recommended to discuss more factors while analyzing sustainability in economic development. The data has been collected for 2011 to 2020, but it is considered a limited time span. Thus, the data acquired is limited and does not fulfil the requirements of a comprehensive study. So, it is recommended to future researchers or academics to take the data more than this period because of technological development and energy policies. The results show the positive relationship between variables in the Association of South-east Asian Nations, but we cannot consider the same European countries' results. As the results cannot be equally implemented on economies, the study lacks generalizability; therefore, further scholars should give proper attention to this aspect. As carbon emission economically affects ASEAN countries, being the industrial and agriculture economies. The amount of carbon emission into the air increased during the operation of industries, transportation, and ploughing and harvesting in fields. It is suggested to future researchers that there must be a focus on green transport, water and energy conservation and low emission technology, which impact positively on climate change that has a little attention in ASEAN countries.

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