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The role of green finance, eco-innovation, and creativity in the sustainable development goals of ASEAN countries

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ABSTRACT

Recently, sustainable development has become a global requirement. Every country strives to achieve this essential goal, and this attracts the attention of researchers and policymakers. This study investigates the impact of green finance, eco-innovation, and creativity on the sustainable development goals in ASEAN countries. Using CUP-FM and CUP-BC techniques, the study examines the association between variables, and finds that green finance (such as green credit), renewable energy production, eco-innovation, and creativity, have positive associations with sustainable development goals. The control variable, economic growth, has a negative association with sustainable development goals. Based on the evidence, the ASEAN region must increase the quantity of green bonds as a part of green finance. This financial measure would guarantee adequate returns for private investors.

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1. Introduction

Increased levels of economic growth and high population pressure are increasing greenhouse gas emissions and negatively affecting human and natural systems, and these adverse effects are now greater than ever. Today, international and national communities focus on climate change and global warming issues (Baloch et al., 2021; Peterson, 2017). Thus, this study of carbon dioxide (CO_2) emission is significant to every part of the world, especially Asian regions. The study forecasts the CO_2 emissions of developing countries. According to energy reports, the global CO_2 level has increased by about 7.6% since 2014, now equal to 43.2 billion metric tons, up from 35.6 billion metric tons (Chien et al., 2021a; Sikarwar et al., 2021). Over the last decade, many researchers have

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undertaken qualitative and quantitative studies, and this study offers a precise and effective method of forecasting CO_2 emissions empirically. This study explores the effects of green finance (such as green credit), renewable energy production, creativity, eco-innovation, and economic growth on carbon emissions.

Green finance is a crucial element of sustainable development. It enhances financial flows through credit loans, insurance, and investment from private, public, and non-profit organizations to green or sustainable projects. Public and private sector companies purchase oil and other resources from providers of electricity and gas under government supervision. If the cost of supply escalates, companies have to purchase energy at higher levels and thus risk their sales, as industry, agriculture, and distribution cannot avoid the increase. South Asia is dominated by governmental and political oil and gas firms, which are prohibited from increasing customer prices. This leads to reduced sales and hinders the growth of electricity and coal supply. However, a rise in gasoline prices or fuel costs has a direct impact on industry (Chien et al., 2021b; Hartani et al., 2021).

Creativity has a central importance in business organizations, as it leads organizations along the path to achieving sustainable development goals, and helps organizations cope with disasters such as the pandemic. Creativity is the main focus of this study because of its increasing significance in businesses. Creativity refers to the ability of individuals to ponder deeply on any task or problem, stir their imaginations about the topic, and tackle complex situations and complicated tasks, finding solutions to problems (Chien et al., 2021c; Sutanto, 2017). Creative people in firms generate new ideas, alternatives, or solutions. Increasing population, industrialization, and transportation cause pollution, such as CO_2 emission. Creativity is an effective tool to improve sustainable development (Chien et al., 2021d; Shibli et al., 2021).

Eco-innovation is any sort of innovation on the part of business organizations that leads to progress towards the achievement of sustainable development goals. Eco-innovation is newness, value addition, amendment, and invention in business practice, resources or techniques which brings improvements to business operations, products or services while reducing negative environmental impacts (Corrás-Arias, 2020; Roomi et al., 2021). Eco-innovation reduces the influence of business operations and production on the environment, increases nature's resilience, and protects the effective use of natural resources. A number of sustainable development goals, such as zero hunger, good health and well-being, quality clean water and sanitation, affordable and clean energy, consistency in work, economic growth, industry, innovation and infrastructure, sustainable cities and communities, responsible consumption and production, life on land, life below water, and climate action, are associated with eco-innovation (Dogaru, 2020; Habanabakize, 2020).

The ASEAN economies are the fastest growing economies in Asia. The region consists of a group of countries: Brunei, Burma [Myanmar], Cambodia, Indonesia, Laos, Malaysia, the Philippines, Singapore, Thailand and Vietnam. The region contributes 8.58% of world population growth and, if it were a single economy, it would be the fifth largest in the world. This underscores its significance at the international level. Even during the pandemic crisis, the region enhanced its economic output compared to pre-COVID levels, with Singapore and Thailand seeing the most significant growth in GDP (Ahmed et al., 2022; van Vuuren, 2020).

Despite its economic success, the ASEAN region faces an environmental crisis due to its huge reliance on fossil fuel. It is evident from documented reports that the non-renewable share of the energy mix is higher than the share of renewable energy. The trend for fossil fuel consumption is on a continuous rise because of economic expansion. In contrast, renewable energy is low in the energy mix. Brunei is in the most problematic situation, as its renewable energy consumption is less than 1%. Harmful emissions, specifically CO_2, have remained consistent over the years even though the region has put in maximum effort to curtail them (Huang et al., 2022; Phoumin et al., 2021). Figures from 2018 show the renewable energy consumption of ASEAN countries to be 25.4%, which is quite low compared to 2002, when it was 40.7%. However, the carbon emissions of the regions were 4.27 metric tons in 2018, compared to 3.16 metric tons in 2002. Over the period 2002 to 2018, Brunei was the highest carbon emitter (outputting a total of 16.64 metric tons), followed by Singapore and Malaysia. This situation shows that environmental sustainability is a major concern for these countries. Now is the correct time for the ASEAN region to increase its implementation of sustainable development via aggressive green initiatives on a large scale (Danielle & Masilela, 2020; Liang et al., 2021).

Projected estimates indicate that energy demand will increase by approximately 80% by 2035 in the ASEAN region. These countries are in a region threatened by global warming. The economies have vowed to increase their consumption of renewable resources by 80% by 2030. However, in order to achieve this target, the region needs to structure its policies to comply with it. Researchers and international administrations show concern that it is an impossible target, however, regional policymakers are finding ways to achieve sustainability with less reliance on non-renewable resources (Malla & Brewin, 2020; Sulaiman et al., 2022).

The present study addresses a lack of scientific literature by answering the following questions. Does ecological innovation help improve the environmental sustainability practices in ASEAN countries? Can green finance and creativity help the ASEAN economies to achieve their sustainable development goals? Does the evidence form this study sufficient to fill the policy void? To answer these questions, a blueprint of the association between green finance (such as green credit), renewable energy production, creativity, eco-innovation, and economic growth and carbon emissions, in light of past studies, is given in the second part of the study. The methods and techniques used to analyse the data are given in next part. The results are presented based on the analysis and contrasted with previous evidence. This leads the authors to some insightful implications and recommendations

2. Literature review

The world population is increasing, and there has been a rise in economic activity which has affected the planet. This causes challenges for human social and economic well-being. Considering this great threat, the United Nations General Assembly has proposed a sustainable development model containing 17 sustainable development goals for the world. This model is based on three pillars: environmental sustainability, social welfare, and economic well-being. Green finance (such as green credit), renewable energy production, creativity, eco-innovation, and economic growth can help establish these three

pillars and reduce CO_2 emissions (Apostoaie & Bilan, 2020; D'Adamo & Rosa, 2020). The picture of the relationships between these factors and the sustainable development goals is captured in several places in the literature, with some past authors expressing views on the nexus of green finance, renewable energy, creativity, eco-innovation, economic growth and the sustainable development goals (Jermsittiparsert, 2021; Wirsbinna & Grega, 2021).

The green concept or green behaviour has revolutionized the modern economy and the services of financial institutions and banks. Financial institutions are the backbone of the economy and stand erect in any critical situation or crisis, such as the COVID-19 pandemic. Green credit is an element of green finance, the basic objective of which is to handle environmental issues like CO_2. It is a helpful tool for business organizations to attain sustainable development objectives (Dong et al., 2018). Nawaz et al. (2021b) suggest that banks and other financial institutions issue loans to businesses to raise capital and improve their investing potential. They can abandon antiquated business practices and focus all their resources and infrastructure on innovation in business processes. By acting this way, they ensure that their business operations do not hurt the environment by generating CO_2 and their companies maintain solid relationships with stakeholders. Green credits help achieve sustainable business performance. Nawaz et al. (2021a) focus on the critical role of green finance in creating or developing business sustainability. This study examines green investment, green credit, green bonds, and green securities, positing that, when firms have the facility to acquire instant green loans from banks, with easy conditions, to mitigate the negative impact of the economic activities they undertake on the natural environment, they protect natural resources, the quality of the work environment, and healthy human resources. Thus, they can ensure future business effectiveness. Shair et al. (2021) present a strong argument in support of green credit meeting sustainable performance objectives by encouraging programmes that are helpful for bringing improvements to business processes and resources (physical, informational, or human) to meet the environmental and social requirements of customers.

Most business processes, infrastructure, logistics, communication, and production are dependent on energy resources. There are two basic sorts of energy resource, renewable and non-renewable. Like consumption, the production of energy affects environmental quality and an organization's sustainable performance (Ahmed et al., 2021; Al Mamun et al., 2021). The production of energy from renewable resources has a positive influence on the environment, while the production of non-renewable energy creates harmful gases and causes CO_2 emissions. Sun et al. (2020) show that, when renewable energy sources such as biomass, wind, solar, hydropower, and geothermal power are prioritized to meet the needs of domestic and commercial entities, CO_2 emissions are reduced because renewable energy absorbs carbon dioxide from the air, excess water from the soil, and heat from the atmosphere. Thereby, CO_2 emissions are reduced, preserving the quality of natural resources for future use. Thus, renewable energy production is a guarantee of sustainable business development. Sadiq et al. (2022) analyse the role of energy production in enhancing sustainable business performance. Unlike non-renewable energy sources such as fossil fuel and nuclear power, renewable energy sources such as forestation, plantation, solar panel installation, wind, or hydropower generation do not require materials or processes that contribute to CO_2

emissions. In order to reach the sustainable development goals, environmental development is required, which is only achievable when CO_2 emissions are reduced.

Technologies, processes, and logistics are becoming more modern, and competition in the market is becoming stricter, as people become more aware of the significance of the environmental and social performance of firms. Creativity is necessary for business organizations to compete against rival businesses, as it respond to changes in technologies and market requirements (Ojogiwa, 2021; Sadiq et al., 2021a). The abilities of organizational personnel to produce novel ideas, question antiquated ways of thinking, find solutions to complex problems, and find new ways to address these problems, enable firms to meet environmental and social requirements by removing hurdles. Faggian et al. (2017) and Kot et al. (2021) argue that creative skills such as curiosity, quick analysis, observation, imagination, decision making, and problem-solving enable firms to not only handle environmental issues, such as CO_2 emissions, but to find new opportunities. Thus, the environmental, social, and financial performance of firms with such skills are high. Employees with creative skills and the ability to share ideas with administrative authorities, and see those ideas implemented can reduce CO_2 emissions and other pollutants. Novelty, innovation, and value addition are common in organizations, and problems that have an impact on company reputation are regularly identified and resolved. Innovation is made in technologies, raw materials, human resource quality, and manufacturing processes. Thus, sustainability improves the business development of firms (Kümmel & Lindenberger, 2020; Wu et al., 2021; Zhuang et al., 2021).

Stankevičienė and Nikanorova (2020) consider the role of eco-innovation in addressing sustainable development goals in a circular economy. Their data on eco-innovation and sustainable development goals relates to the Baltic Sea region. To assess the relationship between eco-innovation and sustainable development goals, multi-criteria analytical techniques, MULTIMOORA and TOPSIS, are employed. The study focuses on eco-innovation in the context of recycling, material efficiency, circular material usage, and waste management. The study finds that eco-innovation in these forms is helpful for sustainable development. Lee et al. (2018) examine eco-innovation in resource management practice and its role in sustainable development. The study posits that eco-innovation helps firms assure clean and efficient resources and allocate them in an ecologically friendly manner, enhancing productivity and reducing manufacturing waste. Hence, the sustainable development goals associated with environmental performance, innovation, and economic growth can be accomplished. Triguero et al. (2022) investigate eco-innovation leading a circular economy towards sustainable development. They collect empirical information for eco-innovative practices such as recycling, reducing and redesigning technological processes, and the achievement of sustainable development goals by European Union firms. The study suggests that the implementation of eco-innovation practices makes firms achieve green goals effectively. Ji et al. (2021) shed light on eco-innovation, the environmental consequences, and sustainable development. To evaluate the relationships among these factors, data are acquired from seven fiscally decentralized countries, Australia, Austria, Canada, Belgium, Germany, Spain, and Switzerland, for 1990 to 2018. With panel data and econometric tools, the authors confirm that eco-innovation helps protect the environment without a break in economic activity, so it is useful for attaining sustainable development goals.

3. Data and methodology

3.1. Model specification

To answer the research questions, the study explores the impact of various economic and financial indicators on environmental quality. Carbon emissions are the leading concern across the world, and particularly in the ASEAN region. Since fossil fuel consumption is depleting natural resources and causing severe harm to the climate, it is crucial to analyse innovative factors such as green finance, eco-innovation and creativity, and how they could help economies achieve their zero-carbon goals. Specifically, the study evaluates the impact of green finance, eco-innovation, creativity, economic growth and renewable consumption on carbon emissions. In the present environment, countries struggle to enhance green finance and other environmental innovations to curb carbon emissions. However, the literature does not offer viable evidence due to contrasting statements that are different due to context. Therefore, empirical exploration of these constructs is needed to develop appropriate policy implications for environmental objectives. The control variable economic growth is added to the model as some evidence suggests that the variable is responsible for environmental destruction. It is critical to evaluate the influence of these variables together on carbon emissions in an ASEAN context. The research collects data from the world development indicators (WDI) of twenty developing countries, from 2011 to 2019. This research examines the nexus among the constructs using continuously updated full modified (CUP-FM) and continuously updated bias-corrected (CUP-BC) estimators. The equation of the study is:

$$CO_{2it} = \alpha_0 + \beta_1 GC_{it} + \beta_2 REP_{it} + \beta_3 CR_{it} + \beta_4 ECI_{it} + \beta_5 EG_{it} + e_{it} \quad (1)$$

where
CO_2 = carbon emissions
i = country
t = time period
GC = green credit
REP = renewable energy production
CR = creativity
ECI = eco-innovation
EG = economic growth.

The measurements of the constructs are given in Table 1.

This study uses descriptives to evaluate data normality. Moreover, the study performs the correlation matrix. Cross-sectional dependence (CSD) is investigated using the Breusch & Pagan Lagrange multiplier (BP-LM) test and the Pesaran cross-sectional

Table 1. Measurements of variables.

S#	Variable	Measurement
01	Carbon emission	Carbon dioxide damage (% of GNI)
02	Green credit	Green credit provided by the financial sector (% of GDP)
03	Renewable energy production	Renewable energy output (% of total energy output)
04	Creativity	Research and development expenditure (% of GDP)
05	Eco-innovation	Eco-innovation index
06	Economic growth	GDP growth (annual %)

Source: Authors' estimation.

dependence (P-CD) test. CSD is a critical issue which is normally present in panel data, because of the substantial interdependencies among countries. The equation for the BP-LM test is:

$$LM_1 = \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} T_{ij} \hat{\rho}_{ij}^2 \rightarrow X^2 \frac{N(N-1)}{2} \tag{2}$$

A second Lagrange multiplier (LM) test introduced by Pesaran has the equation:

$$\mathrm{LM}_2 = \sqrt{\frac{1}{\mathrm{N}(\mathrm{N}-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \left(T_{ij} \hat{\rho}_{ij}^2 - 1 \right) \rightarrow N(0,1) \tag{3}$$

The P-CD test equation is:

$$CD = \sqrt{\frac{2}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} T_{ij} \hat{\rho}_{ij}^2 \rightarrow N(0,1) \tag{4}$$

where $\hat{\rho}_{ij}$ represents the correlation coefficients obtained from the residuals.

The cross-sectional augmented Dickey Fuller (CADF) test is used to examine the unit root among variables. The CADF equation is:

$$y_{it} = \alpha_i + b_i y_{it-1} + c_i \overline{y}_{it-1} + d_i \Delta \overline{y}_t + e_{it} \tag{5}$$

An additional cross-sectionally augmented Im-Pesaran-Shin (IPS) test (CIPS), introduced by Pesaran, is used to check the unit root, because it controls for the CSD issue (Chang et al., 2017). The CIPS equation is:

$$\Delta W_{i,t} = \ \emptyset_i + \emptyset_i Z_{i,t-1} + \emptyset_i \overline{Z}_{t-1} \ + \sum_{l=0}^{p} \emptyset_{il} \Delta \overline{W}_{t-1} \ + \ \sum_{l=0}^{p} \emptyset_{il} \Delta W_{i,t-1} \ + \mu_{it} \tag{6}$$

where $\overline{W}$ shows the average cross-section represented as:

$$W^{i,t} = \emptyset^1 \ \overline{GC}^{i,t} + \ \emptyset^2 \ \overline{REP}^{i,t} + \emptyset^3 \overline{CR}^{i,t} \ + \ \emptyset^4 \ \overline{ECI}^{i,t} + \ \emptyset^5 \ \overline{EG}^{i,t} \tag{7}$$

The CIPS test statistics are:

$$\widehat{CIPS} = N^{\bar{1}} \ \sum_{i=1}^{n} CADF_i \tag{8}$$

The study uses the Westerlund and Edgerton (2008) approach to check the co-integration among the variables. The null hypothesis of the test reveals no co-integration, and vice versa. The equations are:

$$\mathrm{LM}_{\varphi}(\mathrm{i}) = \mathrm{T}\hat{\varphi}_{\mathrm{i}} \ (\hat{\mathrm{r}}_{\mathrm{i}}/\hat{\sigma}_{\mathrm{i}}) \tag{9}$$

$$LM_{\tau}(i) = \hat{\varphi}_i / SE(\hat{\varphi}_i) \tag{10}$$

where $\hat{\varphi}_i$ denotes the approximation against $\hat{\sigma}_i$ standard error; $\hat{r}^2{}_i$ denotes its long-run assessed variance; $\varphi i\ (L) = 1 - \sum \varphi_{ij} L^j$ denotes a scalar polynomial with L lag length; and ρ_i denotes the factor loading parameter vector.

Finally, the study finds the long-run effect of regressors on carbon emissions using the CUP-FM and CUP-BC tests. These tests are fully modified, and bias-corrected tests introduced by Bai et al. (2009), which provide solutions to various panel data issues including CSD, endogeneity, serial correlation and heteroscedasticity (Ahmed et al., 2020). These techniques are used for fractionally integrated explanatory variables, as they provide continuous parameters, covariance matrix estimation and factor loadings until convergence is achieved. Lastly, these techniques are used by scholars in recent literature as they solve CSD issues and get rid of overlooked nonlinearity and fractional integration issues (Wang et al., 2020). The equation for the test is:

$$\beta_{cup} = \left[\sum_{i=1}^{N}\left(\sum_{t=1}^{T}\hat{y}_{it} + \hat{\beta}_{cup}\right)\left(x_{it} - \overline{X}_i\right)' - T\left(\lambda'_i\left(\hat{\beta}_{CUP}\right)\hat{\Delta}_{F\varepsilon i}\left(\hat{\beta}_{CUP}\right) + \hat{\Delta}_{u\varepsilon i}\left(\hat{\beta}_{CUP}\right)\right)\right] \times \left[\sum_{i=1}^{N}\sum_{t=1}^{T}\left(x_{it} - \overline{X}_i\right)\ \left(x_{it} - \overline{X}_i\right)'\right] \tag{11}$$

where $\hat{\Delta}_{F\varepsilon i}$ and $\hat{\Delta}_{u\varepsilon i}$ are one-sided estimated covariance.

4. Results of the study

This study presents descriptive statistics showing the means and standard deviations and highlights the minimum and maximum values. The mean value of CO_2 emissions is 11.511, while the renewable energy production average value is 0.537. The mean value of green credit is 0.211, while the creativity average value is 1.039, the ECI average value is 73.093%, and the mean value of economic growth is 5.088. These figures are given in Table 2.

The correlation matrix shows the relationships among the constructs. Renewable energy production, green credit, eco-innovation, and creativity have negative associations with CO_2 emissions or positive associations with sustainable development goals. However, the findings also show that economic growth has a positive association with CO_2 emissions or a negative association with sustainable development goals. These relationships are given in Table 3.

Table 2. Descriptive statistics.

Variable	Obs	Mean	Std. dev.	Min	Max
CO_2	90	11.511	16.82	4.380	45.33
REP	90	0.537	0.487	0.179	0.718
GC	90	0.211	0.178	0.145	0.756
ECI	90	73.093	0.654	69.874	79.027
CR	90	1.039	1.750	0.180	5.116
EG	90	5.088	0.813	3.037	6.399

Source: Authors' estimation.

Table 3. Correlation matrix.

Variable	(1)	(2)	(3)	(4)	(6)	(5)
(1) CO_2	1.000					
(2) REP	−0.618	1.000				
(3) GC	−0.104	0.240	1.000			
(4) CR	−0.795	0.456	0.108	1.000		
(5) ECI	−3.720	0.673	0.362	0.534	1.000	
(6) EG	0.310	0.266	−0.499	0.133	0.539	1.000

Source: Authors' estimation.

Cross-sectional dependence (CSD) is investigated using the BP-LM test introduced by Breusch & Pagan and P-CD test introduced by Pesaran. The findings indicate that the t-value is larger than 1.64, hence there is no CSD issue. The values are given in Table 4.

The CADF and CIPS tests are applied to test the unit root. Both tests indicate that GC and REP are stationary at level, while CO_2, CR, ECI, and EG are stationary at first difference. These results are given in Table 5.

The study applies the Westerlund and Edgerton (2008) approach to check the co-integration. The results indicate that the t-values are higher than 1.64 and the p-values are less than 0.05, which indicates that co-integration exists. These results are given in Table 6.

The results of the CUP-BC and CUP-FM tests reveal that GC, REP, CR, and ECI have negative and significant associations with CO_2 emissions, in other words positive links with sustainable development goals. In contrast, economic growth has a positive and significant association with CO_2 emissions, or a negative link with sustainable development goals. These relationships are given in Table 7.

Table 4. CSD test results.

Variable	Breusch-Pagan LM	Pesaran Scaled LM	Pesaran CD
CO_2	254.787***	65.524***	9.235***
GC	276.827***	54.872***	12.880***
REP	289.924***	33.827***	7.292***
CR	134.887***	32.627***	12.028***
ECI	321.845***	37.911***	31.827***
EG	176.082***	31.360***	22.257***

Source: Authors' estimation.

Table 5. CADF and CIPS unit root tests.

	CIPS		CADF	
Variable	Level	1st Difference	Level	1st Difference
CO_2	–	−6.029***	–	−5.777***
GC	−4.093***	–	−5.192***	–
REP	−3.892***	–	−3.328***	–
CR	–	−5.893***	–	−6.093***
ECI	–	−6.219***	–	−5.862***
EG	–	−5.552***	–	−4.292***

Source: Authors' estimation.

Table 6. Co-integration test.

	No Shift		Mean Shift		Regime Shift	
Model	Test Stat	p-value	Test Stat	p-value	Test Stat	p-value
$\mathbf{LM}_{\tau}$	−3.092	0.000	−4.732	0.000	−6.773	0.000
$\mathbf{LM}_{\varphi}$	−3.982	0.000	−4.332	0.000	−5.672	0.000

Source: Authors' estimation.

Table 7. CUP-BC and CUP-FM tests.

	CUP-FM		CUP-BC	
Variable	Coeff	t-stat	Coeff	t-stat
GC	−0.674***	−4.554	−0.893***	−3.534
REP	−1.902***	−3.229	−0.556***	−5.230
CR	−1.223***	−2.102	−0.885***	−4.879
ECI	−0.876***	−2.333	−2.902***	−2.981
EG	0.784***	5.933	0.663***	5.430

Source: Authors' estimation.

5. Discussion and implications

The study results show a positive relationship between green credit, a dimension of green finance, and sustainable development and a negative association with carbon emissions. The study reveals that the issuance of loans by banks or other financial institutions raises funds for business organizations and strengthens their investment power. They can quit backward business techniques and turn towards innovation in business processes along with resources and infrastructure. Applying such behaviour, they can keep a check on business operations so that they do not cause any harm to the environment by emitting CO_2, and the organizations can maintain strong relations with the stakeholders. Thus, green credit helps achieve sustainable development goals. These results are in line with Zhang and Wang (2021). This study examines green finance along with green investment, green credit, green bonds, and green securities, and their role in achieving high sustainability in business development. The study finds that the facility of loans enables business organizations to mitigate the adverse impacts on the environment of their activities. In this way, the quality of natural resources and the health of human resources can be secured, which are assets for future functioning. This creates sustainability in business performance. These results are supported by Taghizadeh-Hesary, Yoshino, and Phoumin et al. (2021), who highlight that the facility of green credits for business firms enables them to tackle issue of CO_2 emissions, even during COVID-19. The study posits that, by having a large number of loans from banks or other financial institutions for green purposes, businesses can spend on employing renewable energy resources, which are less likely to emit CO_2. Thus, the work atmosphere remains protected and safe for the labour-force, who can focus on sustainable development goals.

The findings indicate that renewable energy production has a positive association with sustainable development goals and a negative association with carbon emissions. As renewable energy production is a helpful way of controlling pollutants such as CO_2 in the air, the environmental and social performance of economic institutions can be improved, and they may achieve sustainable business goals. This supports the results of Kirikkaleli and Adebayo (2021), who state that, when there is a focus on the production of renewable energy to meet emerging requirements of both domestic and commercial entities, it is likely to control CO_2 emissions, as the production of renewable energy absorbs carbon dioxide from the air, excessive water from the soil, and heat from the atmosphere. The reduction of CO_2 emissions maintains the quality of natural resources, which can be saved for future use. This leads to the achievement of sustainable business goals. These results are in line with Umar et al. (2020), who focus on the importance of renewable energy in achieving sustainability development goals in comparison to the

production of non-renewable energy. The study implies that, unlike the production of non-renewable energy through the combustion of fossil fuels and nuclear power, the production of renewable energy, including forestation, plantation, installation of solar panels, and wind or hydropower, does not use material or processes that cause CO_2 emissions. Environmental development is compulsory for the achievement of sustainable development goals, which is possible when there is less CO_2 emission.

The results reveal that eco-innovation has a positive association with sustainable development goals and a negative association with carbon emissions. These results are in line with Mahmood et al. (2022), who show that, when firms apply eco-innovation in the form of energy transition from non-renewable to renewable energy, using energy-efficient technologies and effective wastage management, they get rid of the waste from manufacturing or other business operations. As waste is a big source of CO_2, firms are able to control emissions. As a result, the health-related sustainable development goals can be achieved. These results are in line with Toha et al. (2020), who posit that the execution of eco-innovative practices such as eco-friendly infrastructure, green marketing, eco-friendly production processes, and recycling, minimizes the negative environmental impacts of business practices. The reduction of CO_2 emissions maintains atmospheric quality, and thereby, the sustainable development goals related to the environment, natural resources, and living beings' health can be attained.

The findings show that creativity has a positive association with sustainable development goals and a negative association with carbon emissions. This is in line with Awan et al. (2019), who suggest that, in today's market, people are aware of the importance of the environmental and social performance of firms. The creation and retention of customers are dependent on the extent to which the organization meets their environmental and social requirements, which is possible through innovation and creativity in business processes. These results are supported by Chang and Chen (2020), who give a detailed description of the role of creativity in achieving sustainable business goals. Their research is conducted by management, to discover the changes in technologies or energy resources to apply for energy efficiency and minimum CO_2 emissions to maintain environmental quality. The findings reveal that economic growth is negatively associated with sustainable development. Consistent with Ehigiamusoe and Lean (2019), who show a dual impact of economic growth on the country and on the sustainable development goals, this study finds that, on one hand, economic growth is responsible for CO_2 emissions due to increased economic activities, and is thus a great threat to the environment, but on the other, economic growth leads to a rise in financial resources, which can be used to increase the environmental performance of the firm, building good relationships with stakeholders, and enhancing profitability.

The findings of the study show that, in order to achieve sustainable economic growth, governments and other institutions must develop policies that focus on long-term strategy. This is necessary to increase private participation in green projects. Offering remittances of revenue and return on investment appear to be two of the most effective strategies to encourage the participation of the private sector in environmentally friendly products. Moreover, the ASEAN region must increase the quantity of green bonds as a part of green finance. This financial measure would guarantee adequate returns for private investors. This policy seems to be more applicable in the post-COVID era, because,

after the pandemic, green projects are suffering due to a shortage of funds as the economy is contracting. In addition, governments must also pay attention to energy efficiency in order to restrict the pollutants released into the environment. Therefore, it is highly recommended that eco-innovation and creative policies are used to expand green energy use in the industrial sector and renewable electricity generation, the two most significant carbon producing sectors.

Lastly, this study can act as a guideline for achieving sustainable development goals. The study highlights how the organizational goal of sustainable development can be achieved with green finance (such as green credit), renewable energy production, creativity, and management of economic growth.

6. Conclusion and limitations

The ASEAN countries are Asian countries facing problems of CO_2 emissions, which affect their industries. There is a need to find out how to cope with CO_2 issues so that organizations can achieve highly sustainable development. This study presents ways in which management can achieve sustainable development goals. Thus, the objective of the study is to show the influence of green finance (such as green credit), renewable energy production, creativity, eco-innovation, and economic growth on sustainable development goals. The data come from ASEAN countries. The results indicate that the availability of funds through credit issuance from banks for green purposes such as the improvement of building structures, logistics, and disposal systems, brings improvements in sustainable business performance. The results show that renewable energy production is an effective way to control the amount of CO_2 in the atmosphere and achieve sustainable development goals. Moreover, creativity can remove flaws in business processes and ensure the environmental and financial status of firms, which constitutes sustainable business development.

The current study makes a significant addition to the green literature but has some limitations. These weak points of this study, in the future, may prove to be an opportunity for researchers. The current study addresses only a limited number of factors that lead to sustainable development goals, such as green finance, creativity, and economic growth. Other factors such as geographical characteristics, government policies, organizational climate etc. may also affect sustainable development goals. The discussion of a limited number of factors confines the scope of the study, which could be expanded. Similarly, the results of the study are based only on empirical analysis of developing countries. A study conducted in developing countries is not equally valid in developed countries. Therefore, authors who wish to write on the same topic should also pay attention to developed economies. This study deals only with renewable energy production while analysing sustainable business development, without paying any attention to renewable energy consumption.

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