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Factors Affecting the Human Development Index in Southeast Asia

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Abstract

The aim of this paper was to evaluate the associations between the human development index and economic growth, energy use, trade openness, carbon dioxide emissions, and urbanization in Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam between 1991 and 2020 using the fixed effect and random effect models. Due to autocorrelation and heteroscedasticity issues of the fixed effect and random effect models, the feasible generalized least squares model was employed to deal with this problem. The results stated that human development of the five selected Southeast Asian countries may be supported by economic growth and urbanization. However, the relationships between human development and renewable energy consumption, trade openness, and CO_2 emissions were insignificant. Finally, policies were recommended to improve the human development index for the region. First, economic growth should be encouraged because it fosters human development. Second, although the urbanization process may improve human development in the region, urbanization should be carefully considered by governments along with creating employment, strengthening education and health quality, and improving living standards for inhabitants. Finally, the nexus between human development and renewable energy consumption, trade openness, and CO_2 emissions should be reassessed to carry out appropriate policies for enhancing human development in the region.

Keywords

Factor, human development index, Southeast Asia

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Introduction

Human development as measured by the Human Development Index (HDI) includes life quality, education, and the standard of living (UNDP, 2019). A high HDI reveals the achievement of a country in terms of economic development, education, and human resource quality improvement. The effects of economic, social, and environmental factors on the HDI have been strongly discussed by scholars in previous studies. Zheng & Wang (2022) argued that

renewable energy and the HDI did not have a relationship, but information and communication technologies (ICTs) accelerate the HDI in the short run, while their influence was insignificant in the long run, and the impacts of these two factors have facilitated the HDI of 26 countries. Sarkodie & Adams (2020) argued that income inequality may decelerate the HDI in Sub-Saharan Africa. Eras *et al*. (2022) claimed that the per capita electricity consumption will have little impact on the HDI of Colombia up to 2030. According to Wang *et al.* (2018), higher income reduces the HDI, while the increase of carbon dioxide emissions may improve the HDI, and trade openness has a negative influence on the HDI in Pakistan. Sadiq *et al.* (2022) stated that the HDI can be enhanced by nuclear energy and world trade, but public debt has decelerated the human development of 16 OECD countries.

There are ten member countries in the Association of Southeast Asian Nations (ASEAN), which was founded to encourage cooperation amongst its members and Asian nations in economic, political, security, military, educational, and social-cultural aspects (Arisman, 2018). The total gross domestic product (GDP) of the members of ASEAN recently reached USD 3.0 trillion, which was ranked in the fifth position of the global economy after the United States (USD 20.9 trillion), China (USD 14.7 trillion), Japan (USD 5.0 trillion), and Germany (US$3.8 trillion). The GDP of ASEAN increased between 2000 and 2019. Among the ASEAN members, education, health, and unemployment differed from 2010 to 2020. In ASEAN, a high adult literacy rate was dominated by Brunei Darussalam (97.3%), followed by Singapore (97.1%), Viet Nam (96.7%), the Philippines (96.3%), Indonesia (96.0%), and Malaysia (95.0%). In terms of health, by 2019, Brunei Darussalam achieved the target of having skilled health personnel present during all childbirths, and Malaysia, Singapore, and Thailand also obtained remarkable outcomes with more than 99% of childbirths being attended by skilled health personnel. However, only 64.4% of childbirths were attended by skilled health personnel in Lao PDR. By 2020, the unemployment rate in most ASEAN Member States (AMS) increased due mainly to the disruption to economic activities caused by the pandemic. For instance, by 2020, the unemployment rates of the Philippines and Lao PDR rose by 10.3 percent and 9.4 percent, respectively, compared to the rates in 2010 (ASEAN, 2021). As a result, Singapore and Brunei Darussalam belong to the very high HDI countries, while Malaysia and Thailand are ranked in the high HDI countries, and Indonesia, Viet Nam, the Philippines, Cambodia, Lao PDR, and Myanmar have medium HDI (Arisman, 2018). Although ASEAN has gained achievements in social-economic development, several lower and middle-income countries in the region face obstacles related to high income inequality and poor infrastructure, health, and education outcomes (IMF, 2018).

In ASEAN, since 1991, hydro power generation has presented an upward trend through increasing energy consumption. Oil consumption reached the highest level at 203,108 million tonnes reflecting that nonrenewable energy sources emit high emissions and can harm the environment. Thus, the major energy consumed by ASEAN was non-renewable energy (Ansari, 2022).

Carbon dioxide (CO_2) emissions have been defined as the largest emitter generating greenhouse gas (GHG) emissions in ASEAN – one of the greatest difficulties that humans are facing today (Mofijur *et al.*, 2019). For instance, the demand for primary energy consumption in ASEAN rose by 70% to reach 639 million tonnes of oil equivalents (Mtoe) from 2000 to 2017. The increase in CO_2 emissions has been indicated as the main cause of global warming (Chontanawat, 2019). According to a World Bank report, by 2020, Indonesia was the largest emitter in ASEAN with more than 590 MT, and Malaysia overcome Thailand to be the second largest emitter in the region (Ansari, 2022). The total population of Southeast Asia accounted for more than 630 million people in 2015 and has been forecasted to reach more than 720 million by 2030. Urbanization often presents a positive relationship with economic growth and development. Southeast Asia countries may obtain benefits and deal with urban socio-economic and environmental issues through

urban cooperation on priority problems (Arfannuzzaman & Dahiya, 2018).

Several previous studies have investigated the nexus between the HDI and energy use, trade, CO_2 emissions, and urbanization in different regions and nations all over the world (Wang *et al.*, 2018; Sarkodie & Adams, 2020; Ladi *et al.*, 2021; Eras *et al.*, 2022; Sadiq *et al.*, 2022; Zheng & Wang, 2022; Kaewnern *et al.*, 2023). In Southeast Asia, the relationship between social and economic indicators and the HDI has been examined by scholars. Arisman (2018) concluded that the HDI of ASEAN members may be facilitated by population and per capita income, while Elistia & Syahzuni (2018) found a significant and positive relationship between the GDP per capita and the HDI in the region. Bhowmik (2019) concluded that the increase of the GDP and education expenditures have accelerated the HDI of ASEAN-9, and Kaukab & Surwandono (2021) argued that economic growth and foreign direct investments (FDI) have supported the HDI in ASEAN. However, in Southeast Asia, none of the previous studies evaluated the association between the HDI and economic growth, renewable energy consumption, trade openness, CO_2 emissions, and urbanization. Therefore, employing the fixed effect (FE) and random effect (RE) models, this paper aimed to explore the influence of the economy, renewable energy consumption, trade openness, CO_2 emissions, and urbanization on the HDI in Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam between 1986 and 2020. Moreover, policies were recommended to improve the HDI for the region.

Methodology

Data and sources

Employing data released by the World Bank, this paper analyzed the association between the HDI and GDP per capita, renewable energy consumption, trade openness, CO_2 emissions, and urbanization in Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam during the period of 1991-2020. The Asian financial crisis occurred in 1997 and it had vast influences on social and economic aspects of Southeast Asian countries, and therefore, this period was selected for the research, which consequently resulted in 150 observations being used to run the model. Panel data was employed in the study because it allows a large sample size, more degrees of freedom, more information, reduces multi-collinearity, and deals with issues related to control of individual or time heterogeneity of the cross-sectional data (Hsiao, 2014).

The fixed effect and random effect models

First, the variance inflation factor (VIF) was employed to check the multicollinearity between the independent variables in the model, and if VIF was greater than or equal to 10, multicollinearity may exist (Gujarati, 2003). Second, we ran both the fixed effect model (FEM) and random effect model (REM). Third, the most suitable model was determined by the Hausman test. Lastly, the Wooldridge test and Wald test were used to check for autocorrelation and heteroscedasticity in the selected model. If autocorrelation and heteroscedasticity occurred in the model, these issues could be fixed by the feasible generalized least squares (FGLS) technique to ensure that the obtained estimates were viable and effective (Wooldridge, 2002).

The model specification was constructed based on the work of Wang *et al.* (2018) as follows:

$$\mathrm{HDI} = \mathrm{f}(\mathrm{GDP}, \mathrm{RE}, \mathrm{TR}, \mathrm{CO}_{2,}, \mathrm{UR}) \quad (1)$$

where HDI represents the human development index; GDP denotes the GDP per capita (constant 2015US$); RE is the renewable energy consumption (%); TR presents the trade openness (% of GDP); CO_2 presents the carbon dioxide emissions (metric tonne per capita); and UR presents the urban population rate (% of the total population).

The dependent and independent variables in the model were justified as shown in **Table 1**.

Equation 1 can be transformed into the natural logarithmic form as follows:

$$\mathrm{LnHDI} = \beta_0 + \beta_1 \mathrm{lnGDP} + \beta_2 \mathrm{lnRE} + \beta_3 \mathrm{lnTR} + \beta_4 \mathrm{lnCO}_{2,} + \beta_5 \mathrm{lnUR} + \mathcal{E} \quad (2)$$

where lnHDI, lnGDP, lnRE, lnTR, $\mathrm{lnCO_2}$, and lnUR denote the natural logarithms of the HDI, GDP per capita, renewable energy consumption, trade openness, CO_2 emissions per capita, and urbanization, respectively; β_0 is the intercept; (β_1,…,β_5) are parameters to be estimated; and $\mathcal{E}$ presents the error term.

Both the FEM and REM were estimated using the Stata MP 14.2 software. The FEM had advantages in the case of variables being omitted, and when these were correlated with other explanatory variables in the model. Moreover, this model can control for differences in time-invariant and unobservable characteristics, which may influence the HDI. The REM was useful if there were no omitted variables, and when these variables were uncorrelated with the explanatory variables in the model. In this model, the specific effect on the HDI was a random variable that was uncorrelated with the explanatory variables (Schmidheiny, 2016).

Results

General information on the HDI, GDP per capita, renewable energy consumption, trade openness, CO_2 emissions, and urbanization in Southeast Asia

As seen in **Table 2**, the average HDI and GDP per capita of the five selected Southeast Asian countries accounted for 0.67 and USD 3,727.64, respectively. The rates of renewable energy use and trade openness of the region accounted for 28.8% and 105.1%, respectively, on average. The average CO_2 emissions per capita and urban population percentage in Southeast Asia accounted for 2.71 metric tonnes and nearly 45%, respectively **(Table 2)**.

As seen in **Figure 1**, between 1991 and 2020, the HDI of the five countries in the region was dominated by Malaysia, followed by Thailand, Indonesia, the Philippines, and Viet Nam. The HDI of the five Southeast Asian countries ranged from 0.5 to 0.8 **(Figure 1)**.

Figure 2 shows that the average GDP per capita of the five countries in the region presented an upward trend and was dominated by Malaysia, followed by Thailand, Indonesia, the Philippines, and Viet Nam. Specifically, the GDP per capita of Malaysia increased by USD 5,836 from about USD 4,537 in 1991 to USD 10,374 in 2020, while the GDP per capita of Viet

Table 1. Covariates of the model

Variable name	Description	Source	Previous references
HDI		UNDP	Feriyanto (2016); Caglayan-Akay & Van (2017); Elistia & Syahzuni (2018); Bhowmik (2019)
GDP per capita	constant 2015USD	World Development Indicators	Feriyanto (2016); Caglayan-Akay & Van (2017); Elistia & Syahzuni (2018); Bhowmik (2019)
Renewable energy consumption	%	World Development Indicators	Zheng & Wang (2022); Kaewnern *et al*. (2023)
Trade openness	%	World Development Indicators	Mustafa *et al*. (2017); Wang *et al*. (2018); Sadiq *et al*. (2022)
CO_2 emissions per capita	metric tonne	World Development Indicators	Wang *et al*. (2018)
Urbanization	%	World Development Indicators	Arfanuzzaman & Dahiya (2019)

Table 2. Descriptive statistics on the HDI, GDP per capita, renewable energy consumption, trade openness, CO_2 emissions, and urbanization in Southeast Asia

Variable	Mean	SD	Min	Max
HDI	0.67	0.07	0.49	0.81
GDP per capita	3727.64	2414.37	698.43	11114.54
Renewable energy consumption	28.88	17.91	0	75.64
Trade openness	105.17	47.41	32.98	220.41
CO_2 emissions per capita	2.71	2.24	0.30	8.72
Urbanization	44.92	13.94	20.63	77.16

Source: Author's calculations (2024)

Note: SD denotes standard deviation

Nam increased by about USD 2,653 in the same period **(Figure 2)**.

Renewable energy consumption of the five Southeast Asian countries tended to decline during the period 1991-2019. For instance, the renewable energy consumption of Viet Nam decreased by nearly 57% from about 75% in 1991 to about 18% in 2019, while the proportion of renewable energy consumption of Malaysia dropped about six percent in the same period **(Figure 3)**.

As seen in **Figure 4**, the trade openness of the five Southeast Asian countries fluctuated during the period 1991-2020. For instance, the trade openness of Malaysia decreased by about 42% from nearly 160% in 1991 to about 116% in 2020. By contrast, the trade openness of Viet Nam presented a strong increase of about 96% in the same period **(Figure 4)**.

The CO_2 emissions per capita of the five Southeast Asian countries showed an upward trend between 1991 and 2020. By 2020, Malaysia had become the largest emitter in the region with 8.4 tons, followed by Thailand (3.6 tons), Viet Nam (2.6 tons), Indonesia (2.1 tons), and the Philippines (1.2 tons) **(Figure 5)**.

The rate of urban population changes of the five Southeast Asian countries tended to increase for the period 1991-2020 and was dominated by Malaysia, Indonesia, Thailand, the Philippines, and Viet Nam. For example, the urban population of Malaysia increased by about 26% from about 50% in 1991 to about 77% in 2020, while the proportions of Indonesia and the Philippines increased by about 25% and 21%, respectively. These imply the expansion of urbanization in the region **(Figure 6)**.

The influence of economic growth, renewable energy consumption, trade openness, CO2 emissions, and urbanization on the HDI in Southeast Asia

First, the correlation matrix and VIF were used to diagnose the multicollinearity of the independent variables in the pooled ordinary least squares (POLS) model.

Table 3 states that the correlation coefficients among the covariates were appropriate, implying that there was no multicollinearity among the independent variables of the model **(Table 3)**.

Table 4 shows that the adjusted R-squared value was equal to 0.818 reflecting that 81.8% of the HDI variability was explained by the independent variables in the model. The GDP per capita, trade openness, and urbanization presented significant and positive influences on human development, but the increase of CO_2 emissions discouraged the HDI in the region **(Table 4)**.

The VIF was equal to 9.71 (VIF < 10) and this represented that there was no multicollinearity among the independent variables of the POLS model **(Table 5)**.

Second, the regression results of the FEM and REM are illustrated in **Table 6**.

Third, the most suitable model was determined by running the Hausman test. The *P*-value of the Hausman test was equal to 0.000 (*P*-value = 0.000) and therefore we concluded that the FEM was the most suitable model. According to the FEM, human development in the region may be accelerated by economic development, trade openness, and urbanization, but CO_2 emissions had a negative influence on the HDI, while the relationship between renewable energy use and human development was not statistically significant **(Table 6)**.

Fourth, the Wooldridge test and Wald test were employed to examine autocorrelation and heteroscedasticity of the selected model.

The Wooldridge test stated that the *P*-value was equal to 0.011 (*P*-value <0.05) and this implied that the null hypothesis should be rejected, reflecting that there was autocorrelation in the FEM. In terms of the Wald test, the *P*-value was equal to 0.000 (*P*-value <0.05), representing that the null hypothesis should be rejected and therefore there was heteroscedasticity in the FEM **(Table 7)**. Consequently, the feasible generalized least squares (FGLS) model was run to deal with the autocorrelation and heteroscedasticity issues of the FEM. The regression of the FGLS model is represented in **Table 8**.

As seen in **Table 8**, economic development and urbanization support the HDI. However, the

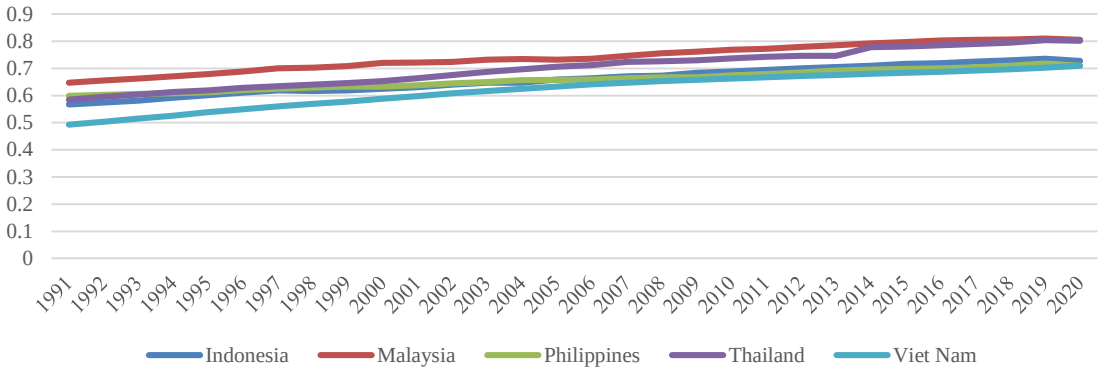

Figure 1. HDI of the five selected Southeast Asian countries between 1991 and 2020
Source: UNDP (2023)

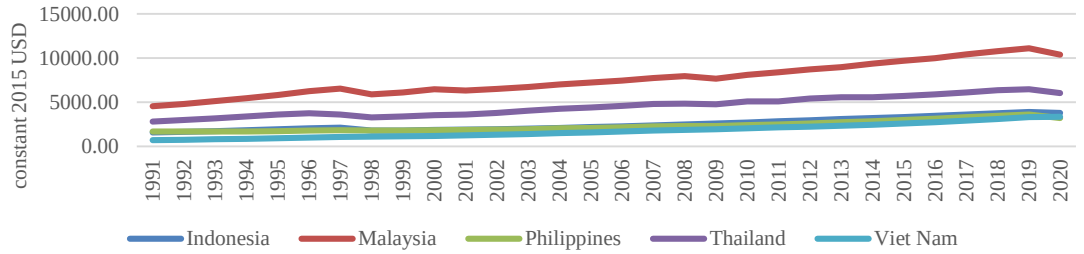

Figure 2. GDP per capita of the five selected Southeast Asian countries between 1991 and 2020
Source: World Bank (2023b)

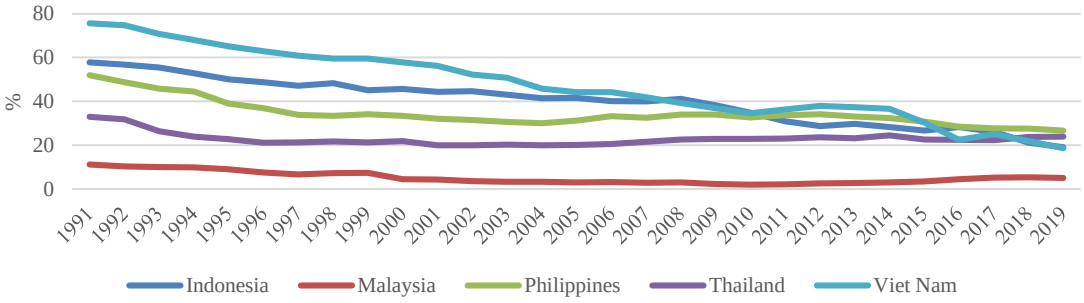

Figure 3. Renewable energy consumption of the five selected Southeast Asian countries between 1991 and 2019
Source: World Bank (2023c)

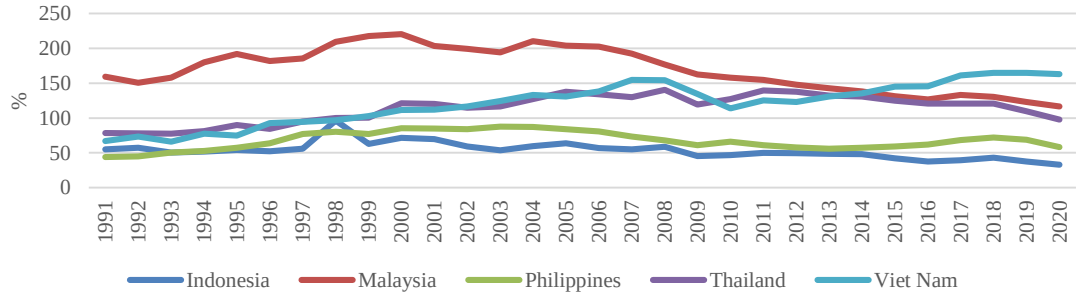

Figure 4. Trade openness of the five selected Southeast Asian countries between 1991 and 2020
Source: World Bank (2023d)

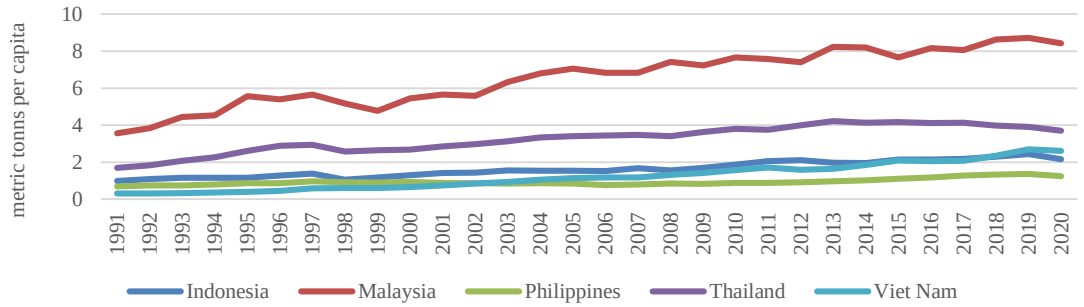

Figure 5. CO_2 emissions per capita of the five selected Southeast Asian countries between 1991 and 2020
Source: World Bank (2023a)

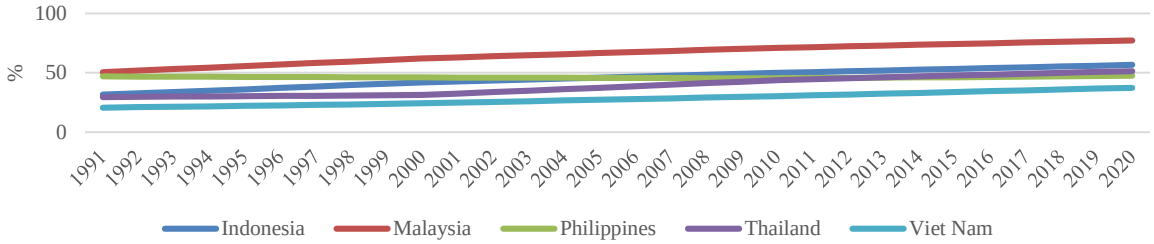

Figure 6. Urbanization of the five selected Southeast Asian countries between 1991 and 2020
Source: World Bank (2023e)

Table 3. Correlation matrix

Variable	LnHDI	LnGDP	LnEnergy	LnTrade openness	$LnCO_2$ emissions	LnUrbanization
LnHDI	1.00					
LnGDP	0.88	1.00				
LnEnergy	-0.70	-0.80	1.00			
LnTrade openness	0.44	0.50	-0.49	1.00		
$LnCO_2$ emissions	0.80	0.96	-0.77	0.59	1.00	
LnUrbanization	0.74	0.78	-0.69	0.14	0.69	1.00

Source: Author's calculation (2023)

Table 4. Regression of the POLS model

Variables	Coefficients	Standard Errors	t	P-value
LnGDP	0.250***	0.027	8.99	0.000
LnEnergy	0.006	0.006	1.05	0.297
LnTrade openness	0.032***	0.011	2.76	0.006
$LnCO_2$ emissions	-0.093***	0.019	-4.85	0.000
LnUrbanization	0.039*	0.022	1.73	0.086
Constant	-2.673***	0.215	-12.39	0.000
Number of obs.	150			
F(4, 115)	135.13			
Prob > F	0.000			
R-squared	0.824			
Adj R-squared	0.818			
Root MSE	0.046			

Source: Author's calculations, 2023
*Note: *** and * denote statistical significance at 1% and 10%, respectively*

relationship between the HDI and renewable energy use, trade openness, and CO_2 emissions was not statistically significant. These imply that the HDI can be enhanced by economic growth and urbanization, while renewable energy use, trade openness, and CO_2 emissions do not have relationships with human development in the region **(Table 8)**.

Discussion

The results demonstrated that economic growth and urbanization accelerated the HDI in the region, implying that the human development of these countries can be improved because of economic growth and urbanization expansion. Our findings are consistent with the conclusions of Arisman (2018), Elistia & Syahzuni (2018), Bhowmik (2019), and Kaukab & Surwandono (2021), who found that economic growth supported the HDI in ASEAN. By contrast, a study by Wang *et al.* (2018) showed a different tendency because they argued that economic growth may have decelerated the human development of Pakistan between 1990 and 2014. The significant and positive association between economic growth, urbanization, and human development in the five selected Southeast Asian countries can be interpreted as follows. First, the GDP of ASEAN presented an upward trend between 2000 and 2019. Similarly, the GDP per capita also increased during the same period. For instance, by 2020, the GDP per capita of ASEAN reached USD 4,533, which was one and a half times higher than that in 2010

Table 5. The VIF test for the multicollinearity

Variables	VIF	1/VIF
LnGDP	21.69	0.04
LnEnergy	17.78	0.05
LnTrade openness	3.81	0.26
LnCO_2 emissions	3.13	0.31
LnUrbanization	2.15	0.46
Mean VIF	9.71	

Source: Author's calculations (2023)

Table 6. Regression of the FEM and REM

Variables	FEM	REM
LnGDP	0.213***	0.250***
LnEnergy	0.001	0.006
LnTrade openness	0.034***	0.032***
LnCO_2 emissions	-0.053***	-0.093***
LnUrbanization	0.247***	0.039*
Constant	-3.171***	-2.673***
Number of observations	150	150
Number of groups	5	5
F(5, 140)	636.74	
Prob > F	0.000	
Wald chi2(5)		675.66
Prob > chi2		0.000
R squared:		
Within	0.957	0.905
Between	0.881	0.984
Overall	0.781	0.824
Correlation (u_i, X_b)	-0.838	0 (assumed)

Source: Author's calculations (2023)

*Note: *** and * denote statistical significance at 1% and 10%, respectively.*

Table 7. The Wooldridge test and Wald test for the FEM

Variables	Wooldridge test (Autocorrelation)	Wald test (Heteroscedasticity)
	Null hypothesis: There is no autocorrelation	Null hypothesis: There is no heteroscedasticity
LnGDP	Alternative hypothesis: There is autocorrelation	Alternative hypothesis: There is heteroscedasticity
LnEnergy	F(1, 4) = 19.873	$Chi^2(5)$ = 210.47
LnTrade openness	Prob > F = 0.011	Prob > chi^2 = 0.000
$LnCO_2$ emissions		
LnUrbanization		

Source: Author's calculation (2023)

Table 8. Regression of the FGLS model

Variables	Coefficients	Standard Errors	z	P-value
LnGDP	0.152***	0.021	6.96	0.000
LnEnergy	-0.002	0.001	-1.48	0.138
LnTrade openness	0.003	0.007	0.51	0.609
$LnCO_2$ emissions	-0.015	0.013	-1.15	0.251
LnUrbanization	0.097***	0.028	3.36	0.001
Constant	-1.999***	0.143	-13.92	0.000
Number of observations	150			
Number of groups	5			
Wald chi2(4)	411.71			
Prob > chi2	0.000			

Source: Author's calculation (2023)

*Note: *** denotes statistical significance at 1%.*

(USD 3,299) and more than four times higher than that in 2000 (USD 1,200). Second, the outcomes of economic development generated achievements in education, health, and poverty reduction in Southeast Asia. For example, the adult literacy rate of six AMS was high at 95% or above, which was dominated by Brunei Darussalam (97.3%), followed by Singapore (97.1%), Viet Nam (96.7%), the Philippines (96.3%), Indonesia (96.0%), and Malaysia (95.0%). In terms of health, by 2019, the target on skilled health personnel was achieved by Brunei Darussalam, and 99% of childbirths in Malaysia, Singapore, and Thailand were attended by skilled health personnel. Between 2005 and 2019, the rate of poverty reduction in Thailand was the highest and the proportion of the population living below the national poverty line dropped from 26.8% in 2005 to 6.2% in 2019. Viet Nam and Indonesia also obtained remarkable achievements in poverty reduction with the poverty rates decreasing from 18.1% to 5.7% and from 16.0% to 9.4%, respectively, over the same period (ASEAN, 2021). Third, in Asia and the Pacific, a huge migration from rural to urban areas was driven by greater employment opportunities in cities and improved access to urban services, such as health care and education. The urban population in the region has been predicted to reach 3.4 billion people by 2050 (Dahiya, 2012). Urbanization often presents a positive relationship with economic growth and development. Southeast Asia countries may obtain benefits and deal with urban socio-economic and environmental issues through urban cooperation on priority problems (Arfannuzzaman & Dahiya, 2018).

However, surprisingly, the results addressed that the associations between the HDI and renewable energy consumption, trade openness,

and CO_2 emissions were not statistically significant, and this reflects that renewable energy use, trade openness, and CO_2 emissions do not have effects on human development in the five selected Southeast Asian countries. Thus, renewable energy use, trade openness, and CO_2 emissions present negligible roles in terms of improving the HDI in the region.

The major contribution of this study is to confirm the importance of economic development and urbanization to the HDI improvement in Southeast Asia. Also, the findings suggest that the relationship between renewable energy use, trade openness, CO_2 emissions, and human development should be re-examined to establish feasible policies in terms of improving the HDI in the region.

Conclusions and Policy Implications

The aim of this article was to seek the causality between human development and economic growth, renewable energy use, trade openness, CO_2 emissions, and urbanization in Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam from 1991 to 2020. The results indicated that economic growth and urbanization supported the HDI of the five selected Southeast Asian countries. However, surprisingly, the impacts of renewable energy consumption, trade openness, and CO_2 emissions on human development were not statistically significant.

The following are recommended policies to improve the human development index for the region. First, economic growth should be encouraged since it accelerates the HDI of Southeast Asian countries. Economic development may support countries in the region in terms of improving the education, health, and livelihoods of inhabitants and consequently, it facilitates human development. Second, although the urbanization process improves human development in the region, the urbanization process should be carefully considered by governments along with creating employment, strengthening the quality of education and health services, and improving living standards for inhabitants. Lastly, the nexus between human development and renewable energy consumption, trade openness, and CO_2 emissions in the region should be reassessed to carry out appropriate policies for enhancing the HDI in the region.

The study was unable to avoid limitations as follows. First, the research sample only included Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam between 1991 and 2020 because of data availability, and therefore, it was very difficult to include all aspects of the Southeast Asia region. Second, the study model was unable to cover all variables that affect the HDI. Thus, further studies should be carried out to deal with these limitations.

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