Vol 2 No 7 2025||E-ISSN2997-7258

TheJournalofAcademicScience

journal homepage:
https://thejoas.com/index.php/

Sustainable Development Trajectory of Southeast Asia Emerging Economy Countries

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KEYWORDS
sustainable development; sustainability window analysis; southeast asia.

ABSTRACT
Indonesia, Malaysia, the Philippines, Thailand, and Vietnam are emerging economies in Southeast Asia (ESEA), as identified by the Emerging Market Index and the IMF. Currently, ESEA faces the challenge of continuously improving its economies, formulating strategies to mitigate and adapt to climate change, and fulfilling global commitments toward achieving the Sustainable Development Goals (SDGs). Using the Sustainability Window analysis, this study aims to examine the development trajectories of these countries to determine whether they are moving toward a sustainable direction or not. The Sustainability Window analysis accommodates various indicators within a single analytical framework, allowing for a comparative assessment of sustainability across countries. The findings reveal that, in general, economic growth in ESEA is accompanied by improvements in social welfare, but also by significant environmental degradation. This indicates that the region's development is not environmentally sustainable. As a result, ESEA shows a low potential for achieving the SDGs and faces a high risk of adverse climate change impacts. Without sufficient efforts to steer economic growth in a more environmentally sustainable direction, climate change will likely undermine the region's social welfare and negate the development achievements made so far.

1. INTRODUCTION

Based on the Emerging Market Index issued by the Emerging Market Institute (Casanova & Miroux, 2021), five Southeast Asian countries that are ranked in the top 20 emerging economies, namely Indonesia, Malaysia, Thailand, the Philippines, and Vietnam (Emerging Southeast Asia, ESEA). ESEA's economic growth is driven by consumption from a growing population, industrialization, trade in the manufacturing sector, and exports of natural resource commodities (Alston, et al., 2018). The ESEA region has abundant natural resources from mining, forests, plantations, and agriculture. ESEA is part of the largest countries producing petroleum, natural gas, coal, chromium, nickel, copper, tin, and gold. In addition, ESEA is among the largest exporters of forestry products such as roundwood, processed wood, bamboo, and rattan, as well as plantation products such as palm oil, chocolate, coffee, and spices (Şengör, et. al., 2021).

Exploitative economic growth based on natural resources can result in environmental damage and pollution, especially if management is unsustainable. This is the case in ESEA, where economic growth has led to forest conversion and deforestation, contributing to greenhouse gas emissions, as well as land burning, which increases carbon release and causes transboundary haze (Prakash, 2018). ESEA also remains heavily dependent on unsustainable fossil fuels to drive the industrial sector (Indonesia, Thailand, Vietnam) and transportation (Malaysia, the Philippines) (IEA, 2019).

On the other hand, ESEA has managed to reduce poverty rates and has succeeded in improving the quality of education and healthcare for its people. However, the World Bank notes that stunting, malnutrition, and illiteracy remain issues affecting children in the region. Meanwhile, the adult population is experiencing a decline in quality of life due to non-communicable diseases such as diabetes, cancer, respiratory illnesses, and cardiovascular diseases (World Bank, 2019).

ESEA is also among the most vulnerable regions to climate change. Currently, the frequency of floods and storms is increasing in Vietnam and Southeast Asia in general. Rising sea levels threaten populations living along the coastlines of Indonesia and the Philippines. Projections of temperature increases of up to 6°C by the end of the 21st century are expected to reduce agricultural output in Indonesia, the Philippines, Thailand, and Vietnam by as much as 50%. Without strong commitments to mitigate and slow the impacts of climate change, the region could face estimated economic losses of up to 11% of GDP by the 2100s (ADB, 2015).

Based on this description, ESEA faces three challenges: (1) maintaining economic growth to continue improving social welfare, (2) developing strategies to adapt to the impacts of climate change, and (3) achieving sustainable development targets by 2030.

These challenges are summarized within the sustainable development paradigm, which has three main dimensions: environmental, social, and economic growth, all of which interact with each other in balance. One concept that comprehensively describes sustainable development is the Doughnut Economy (DE) diagram. DE illustrates the space for sustainable human life that lies above the social limits and below the ecological ceiling. The social foundation represents the minimum standards for fulfilling human needs such as food, water, health, income, gender equality, education, and freedom of expression. The environmental limits represents the maximum environmental limits, including biodiversity loss, climate change, pollution, and water use (Raworth, 2012).

Sustainability Window Analysis (SuWi Analysis) can be used as an approach to construct a DE diagram. This analysis is a development of the Advanced Sustainability Analysis (ASA) framework initiated by Kaivo-oja, Luukkanen and Malaska (2001), which states that to achieve sustainable development alongside economic growth, a country must (1) reduce the level of pressure on the environment and (2) increase the level of community welfare.

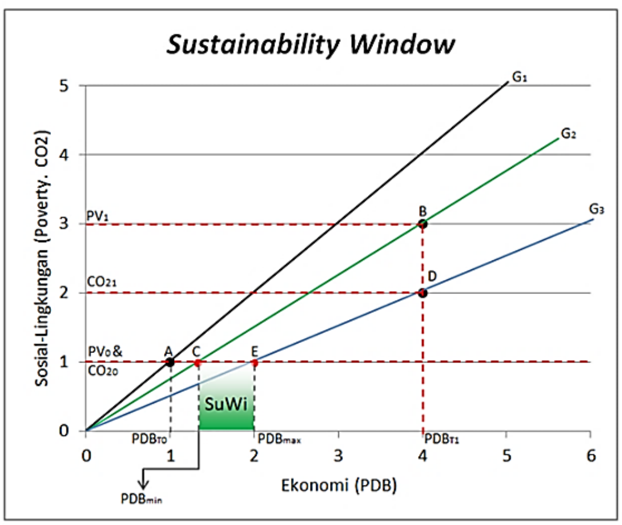
SuWi Analysis can determine the minimum limit of economic growth that must be maintained to prevent a decline in social conditions, and the maximum limit of economic growth that should not be exceeded to avoid environmental degradation. The space between these minimum and maximum limits of economic growth is called the Sustainability Window, or sustainability space (Luukkanen, 2015).

SuWi analysis uses indicators that represent each dimension of sustainable development. Indicators with different units can be equally operationalized within the SuWi framework (Luukkanen, 2015). The selection of indicators is flexible and allows researchers to choose the most representative indicators for the dimensions represented. SuWi analysis can help policymakers visualize and compare all development sectors, and identify priority sectors that require intervention to achieve sustainable development goals. This, in turn, policy planning efficiency can be achieved (Saunders & Luukkanen, 2021).

This study aims to examine the direction of ESEA's development, whether it is heading towards sustainable or otherwise, while demonstrating how SuWi Analysis is used to assess and compare sustainable development across countries. This study can valuable insights into the state of sustainable development in ESEA for policymakers and development actors.

2. METHOD

SuWi analysis requires a set of indicators representing economic, social, and environmental dimensions. The social indicators used are those that reflect an increase in social welfare when their values are higher. Conversely, the environmental indicators reflect an increase in environmental sustainability when their values are lower. The principle of the SuWi analysis method is to compare the conditions of each dimension between the initial year of the research period (T0) and the final year (T1). Development can be considered sustainable if economic growth is above the minimum limit set by the social dimension and below the maximum limit set by the environmental dimension.



Source (Source): Lukkanen, et. al. (2015)

Figure 1. Illustration of Sustainability Window Analysis

The simulation of SuWi analysis is depicted in Figure 1. To obtain the minimum limit of SuWi, the poverty indicator (percentage of population below the poverty line) is used for the social dimension and the GDP indicator for the economic dimension. The initial year poverty indicator value (PV0) and the initial year GDP indicator value (PDBT0) are indexed at 1 (point A). Line G1 represent the socio-techno-economic conditions in the initial year (Lukkanen., 2015) and if these conditions remain unchanged, the dynamics of PV and GDP will follow line G1. The development of the social dimension in the final year is indicated by the PV1 value, and the development of the economic dimension in the final year is indicated by the PDBT1 value, at point B. Line G2 represents changing socio-techno-economic conditions. Sustainable development requires the social dimension to improve along with economic growth, so the minimum economic growth based on the performance of line G2 is at point C. At point C, the PDBmin value is needed to ensure that the population above the poverty line, as an indicator of the social dimension, does not decrease.

To obtain the maximum limit of SuWi, the CO2 emission indicator is used for the environmental dimension and the GDP indicator for the economic dimension. The initial year CO2 indicator value (CO20) and the initial year GDP indicator value (PDBT0) are indexed at a value of 1 (point A). The development of the environmental dimension in the final year is indicated by the CO21 value and the development of the economic dimension in the final year is indicated by the PDBT1 value, at point D. Line G3 represent the productivity of CO2 emissions relative to GDP in the final year of the research period. The maximum economic growth that can be achieved without increasing environmental impact is at point E, where the PDBmax value marks the limit beyond which greenhouse gas emission, as an indicator of the environmental dimension, should not cross. The simulation in Figure 1 shows that economic growth (PDBT1) exceeds the maximum SuWi limit, indicating that the economic growth is not environmentally sustainable. Secondary data of the indicators used are as in Table 1.

Based on the graphical approach, the minimum and maximum limits of economic growth can be calculated using the formula:

$$SW_{Max\,t0-t1} = \frac{\frac{Econ_{t1}}{Econ_{t0}}}{\frac{Env_{t1}}{Env_{t0}}} \qquad SW_{Min\,t0-t1} = \frac{\frac{Econ_{t1}}{Econ_{t0}}}{\frac{Soc_{t1}}{Soc_{t0}}}$$

SWMax t0-t1	:	Maximum limits of economic growth
SWMin t0-t1	:	Minimum limit of economic growth
Econt0	:	Value of economic indicators in the initial year of the research period
Econt1	:	Value of economic indicators at the end of the research period
Envt0	:	Environmental indicator values in the initial year of the research period
Envt1	:	Environmental indicator values at the end of the research period
Soct0	:	Social indicator values in the initial year of the research period
Soct1	:	Social indicator values in the final year of the research period

The long-term analysis period spans from 2001 to 2019. To observe the dynamics occurring in each dimension, the analysis is divided into three medium-term periods: 2001–2006 (I), 2007–2012 (II), and 2013–2019 (III), with 2001 serving as the initial year following the Asian financial crisis. The maximum and minimum limits are then plotted on a radar diagram as a representation of the DE diagram.

Table 1. Description and data sources of indicators

Indicator	Explanation and Units	Source	Initials
Social			
Access to drinking water	People who have access to basic drinking water services. (Percentage (%) of population)	World Bank (2022)	S1
Nutritional adequacy	People whose daily food consumption is sufficient to maintain energy to live a healthy and normal life. (Percentage (%) of population)	World Bank (2022)	S2

Education	Average length of schooling of the population aged 25 years and over. (Year)	HDI; UNESCO Institute for Statistics (2022)	S3
Life expectancy	Life expectancy at birth, assuming a constant mortality pattern in a population. (Year)	World Bank (2022)	S4

Indicator	**Explanation and Units**	**Source**	**Initials**
Access to clean energy for cooking	Access to clean energy and technology for cooking. (Percentage (%) of population)	World Bank (2022)	S5
Effective-ness of government	Measuring the quality of public services, policy quality and government credibility. (Ranking 1 – 100)	World Bank (2022)	S6
Ratio of female to male labor force participa-tion	Comparison of the ratio of female labor force participation to male labor force participation. A value of 100% indicates the same level of participation between women and men. (Percentage (%) ratio)	World Bank (2022)	S7
Environment*(strong sustainability)*			
GHG emissions	Emissions include all greenhouse gases (CH4, CO2, F-Gas, N2O) produced by all sectors. (MtCO2e)	climatewatchdat a.org (2022)	E1
Energy consump-tion	Total energy consumption from coal, biofuels, electricity, and natural gas. (TJ (Terajoule))	International Energy Agency (2022)	E2
Forested area	Areas with tree stands up to 5 meters, or reforestation areas where the stands will reach a height of 5 meters, or a minimum canopy cover of 10%. Except for tree stands in plantation areas. (Km2 (square kilometer))	World Bank (2022)	E3
Renewable energy	Renewable energy mix (Percentage (%))	BP Statistical Review of World Energy (2022)	E4
Red list index	Calculation between the number of species in the red list categories (low risk, near threatened, vulnerable, endangered, critically endangered, extinct in the wild, or extinct) & the number that changed categories due to improvement/worsening of status. (Index 0 – 1)	Biodiversity Indicators Partnership (2022)	E5
Deaths from outdoor air pollution (PM)	Number of deaths due to outdoor air pollution (PM2.5) (Number of deaths per 100,000 people)	Ourworldindata. org Global Burden of Disease Study 2019 (GBD, 2019)	E6
Economy			
GDP	Gross Domestic Product (Current US$)	World Bank	

RESULT AND DISCUSSION

Results of SuWi Analysis of Social Dimensions

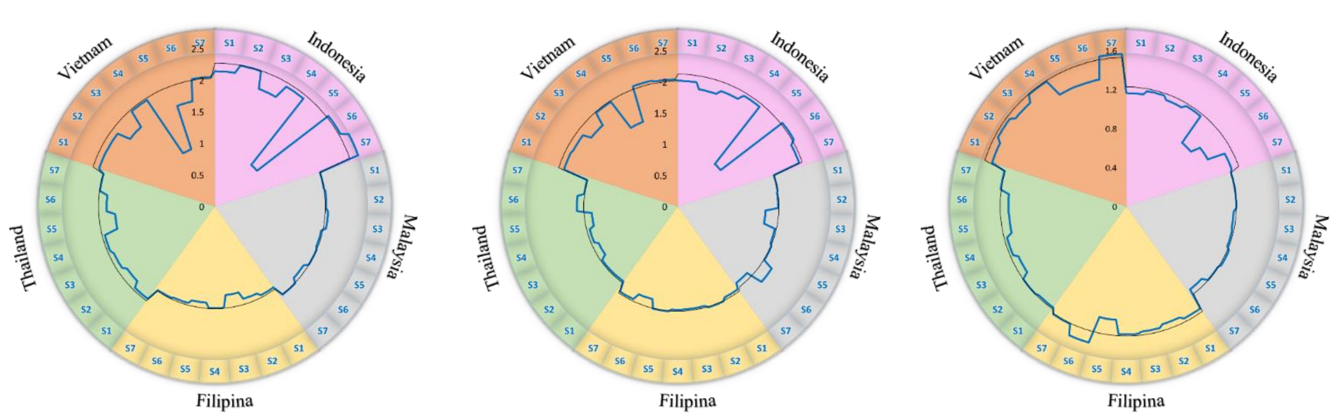
The DE diagram visualization in Figure 2 shows that economic growth in ESEA is generally above the SuWi minimum limit, indicating that economic growth in ESEA align with improvement in the social dimension. ESEAs perform well in improving indicators S1 and S4. Indicators S2, S3, and S5 have increased in Indonesia, Thailand, and Vietnam, while ESEA face challenges with indicators S6 and S7.

Results of SuWi Analysis of Environmental Dimensions

Figure 3 shows that, in general, the economic growth in ESEA exceeds the maximum limit of SuWi, indicating that economic growth in ESEA continues to have a deteriorating impact on environmental conditions and is environmentally unsustainable. Indicators E1, E2, and E5 are continue to deteriorate throughout the study period in all ESEA countries. Indicator E3 increased in Vietnam, indicator E4 fluctuated across country, and only indicator E6 showed an increase over the study period.

Sustainability in Socio-Economic Dimensions

SuWi analysis and DE diagram visualization show that GDP growth in ESEA is above the minimum limit of the social dimension based on indicators of access to clean water, adequate nutrition, education, and life expectancy.



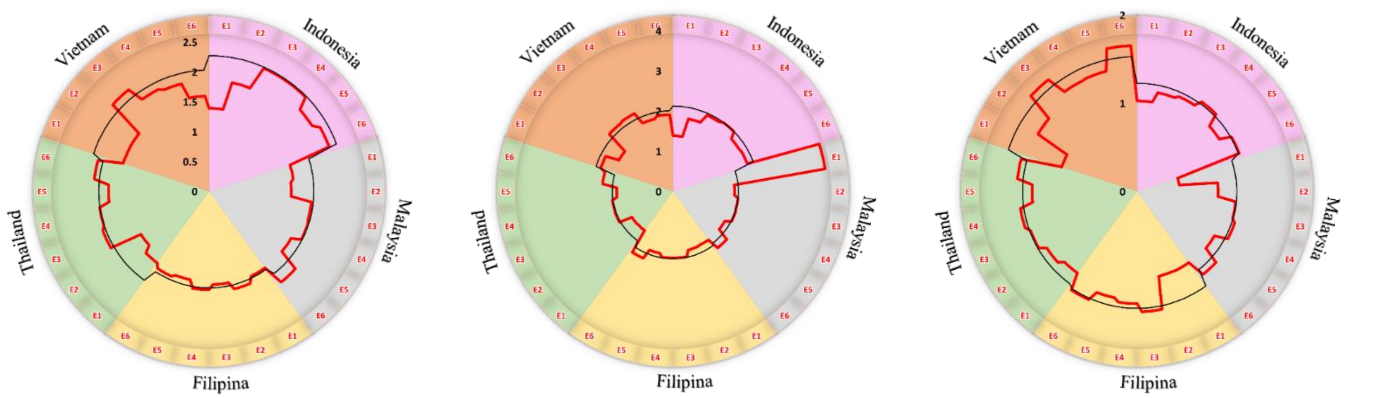
Period 2001 – 2006 period 2007 – 2012 period 2013 – 2019

Information:

S1 Access to drinking water
S2 Nutritional adequacy
S3 Education
S4 Life expectancy
S5 Access to clean energy for cooking
S6 Effectiveness of government
S7 Labor force participation ratio P/L

SuWi minimum limit
GDP growth

Figure 2. Doughnut economy diagram representation of the SuWi minimum limit and GDP growth. GDP growth is sustainable if it is above the SuWi minimum limit.



(a) (b) (c)

Information:

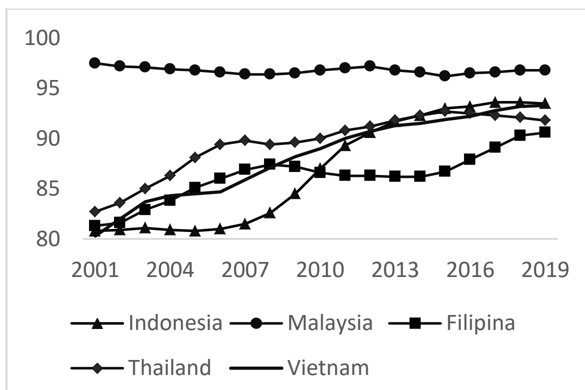
E1	GHG emissions	E4	Renewable energy
E2	Energy Consumption	E5	Red List Index
E3	Forested Area	E6	PM 2.5 Pollution

SuWi maximum limit
GDP growth

Figure 3. Doughnut economy diagram representation of SuWi maximum limit and GDP growth. GDP growth is sustainable if it is below the SuWi maximum boundary

The DE diagram shows similar trends between Malaysia and the Philippines in the nutritional adequacy indicator (S2) and the indicator of access to clean energy for cooking (S5). Further analysis of the development of the indicators from 2001 to 2019 in Figures 4 and 5 reveals that Malaysia has the highest percentage of the population with adequate nutrition, and the highest percentage with access to clean energy, while these indicators are stagnant in the Philippines.

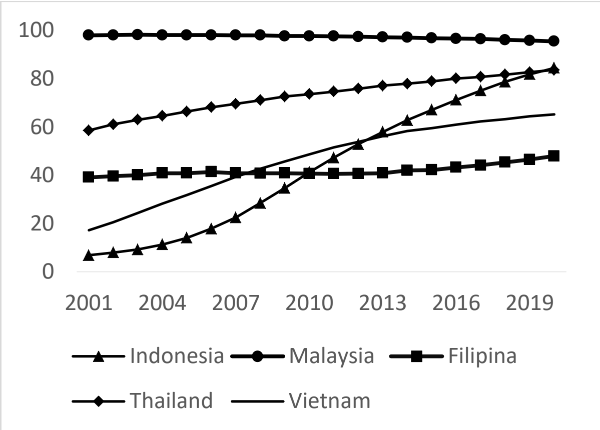
In 2020, the Philippines had the highest percentage of malnutrition (9.4%) compared to Thailand (8.2%), Vietnam (6.7%), Indonesia (6.5%) and Malaysia (3.2%). According to a report by ASEAN, UNICEF, and WFP (2022).The Philippines has the highest prevalence of low birth weight and the highest percentage of stunting among children. More than 50% of the population experiences moderate food insecurity, and nearly 15% of the rest experience extreme food insecurity. Food insecurity in the Philippines tends to occur in the poor household population and those without stable income, whose earnings are insufficient to meet daily needs (IPC, 2015).



Source:World Bank (2002)

Figure 4. Percentage of population with adequate nutrition in Malaysia and the Philippines

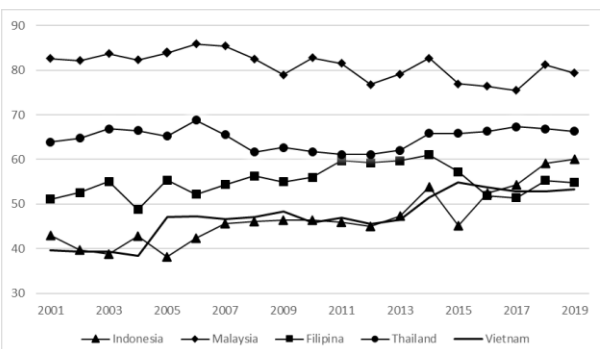
Regarding the indicator of access to clean energy for cooking (S5), Malaysia demonstrates the best performance, although there was a decline over the study period. In contrast, the Philippines has remained stagnant at below 50%. According to the ADB (2021), access to clean energy for cooking in the Philippines increased by only 8% between 2010 and 2018.



Source:World Bank(2022)

Figure 5. Percentage of population value with access to clean energy in Malaysia and the Philippines

The government effectiveness indicator (S6) declined in Indonesia, Malaysia, the Philippines, and Vietnam, and the F/M labor force ratio (S7) did not change significantly during the study period (Figure 6).



Source:World Bank(2022)

Figure 6. ESEA Government Effectiveness Ranking

This suggests that public perception in each country regarding public services, the quality of laws and regulations, and the credibility of the government in implementing policies has not changed much over the past two decades.

All ESEAs need to continue to improve the P/L labor force ratio indicator (S7). This indicator is also used in the labor market dimension which is part of the Gender Inequality Index (GII) measurement, making it essential for ESEAs to adopt women-friendly policies in the employment sector in order to achieve the gender equality targets outlined in the SDGs.

The results of the SuWi analysis for Malaysia and the Philippines, as represented in the DE diagram show a similar trend, namely a narrow gap between the minimum SuWi limit and the GDP growth line. Discussion of each indicator reveals that Malaysia has shown the best performance on the selected indicators since the beginning of the study period. Although some indicator values declined over time, the fluctuations were minimal and remained close to the maximum level (100%). This suggests that improvements in social indicators slightly lagged behind population growth. In contrast, the Philippines has shown stagnation in indicator values at a moderate level and needs to make further progress in strengthening its social dimension.

Based on the results and discussion, the weaknesses of the SuWi analysis can be identified as follows: (1) if stagnation occurs during the research period, the SuWi analysis cannot indicate the level at which the stagnation happens; and (2) the SuWi analysis clearly illustrates the minimum or maximum limits only when there is a significant change in the indicator values. This becomes problematic when percentage-based indicators have already reached their maximum value.

To address these weaknesses, the use of SuWi analysis as a tool for assessing sustainable development should be supplemented with: (1) an analysis of annual changes in the data over the research period, and (2) additional analysis using absolute indicator values that reflect the actual performance level of each indicator.

Environmental – Economic Dimensions of Sustainability

Economic growth in ESEA is accompanied by increasing GHG emissions and energy consumption. Although ESEA, as part of ASEAN, has made climate change a priority issue since 2007. The analysis results indicate inefficiencies in both GHG emission and energy consumption indicators. Only Malaysia experienced a decrease in GHG emissions during the 2011–2015 period, as a result of its forest area designation policy implemented in 2011. However, the worsening GHG emission indicators in the subsequent period suggest a failure in the implementation of low-emission development policies in Malaysia.

A study conducted by Sandu, et. al. (2019) shows that in the period 1971 - 2016 GHG emissions from the energy sector in ASEAN continued to increase due to population growth, increasing income, and increasing dependence on fossil fuels. All ESEAs are the largest emitters of fossil fuel use for power generation, manufacturing and transportation, and Indonesia is the largest emitter of greenhouse gases due to deforestation and peatland fires (ASEAN, 2021). Although ESEA is committed to Nationally Determined Contributions (NDC) under the Paris Agreement, the ASEAN Center for Energy projects that per capita CO2 emissions will increase by 140% between 2015 and 2040. This is contrary to the statement of Paltsev, et. al (2018) that to achieve the unconditional NDC target in 2030, emissions must be reduced by 11% from their current growth direction.

Energy consumption in ESEA will continue to increase along with population growth, and coal-fired power plants are still the main source of abundant and cheap energy. The IEA estimates that there will be an increase in coal consumption of up to 150% from 2013 to 2035 and its percentage will also increase from 32% to 48% of total energy use (IEA, 2019). The limited fossil energy will make ESEA countries vulnerable to energy crises. The profile of ESEA as an emerging economy with an energy mix that is still dominated by fossil energy, can make ESEA the focus of implementing global policies related to climate change, where the implementation of energy efficient and low-carbon technologies can reduce GHG emissions in multiples that are greater than the implementation of the same technology in developed countries (Umbach, 2021).

GDP growth in Thailand and Vietnam has consistently remain below the SuWi maximum limit based on the non-forested area indicator, indicating that along with economic growth in Thailand and Vietnam, the area of forest cover has increased. In Thailand, in the period 2001-2016, the area of forest cover remained stable around 31% - 33%. The Thai government claims that the decrease in deforestation is due to the shift in the economic base in the community and law enforcement in the forestry sector (Trisurat, Shirakawa, & Johnston, 2019). In Vietnam, the occurrence of reforestation is an indication of the success of the Vietnamese government in encouraging community involvement in managing forests, developing effective policies related to forestry and ecosystem protection, and government support for international organizations to contribute to forestry-related programs (Nguyen & Singh, 2020). The successful Doi Moi program in the forestry sector includes shifting forest management from the government to multi-sector management and the government providing subsidies through the payment for ecosystem services (PFES) scheme. Vietnam also received international support when in 2008 it became one of the first countries to collaborate with the UN on the REDD+ program (Tatarski & Johnson, 2016).

Forest areas in ESEA are natural capital that can be a solution to climate change, biodiversity conservation, and support rural households and indigenous lives that are widely spread in the interior of ESEA (UNREDD, 2022). Within the framework of cooperation through the ASEAN Centre for Biodiversity, ESEA can coordinate efforts to create a credible policy environment in Southeast Asia that attracts investment in nature-based solution projects. Increasing the credibility of nature-based solution policies can be done by strengthening the database and information on the potential for carbon emission mitigation that can be met by forests in ESEA as well as by formulating policies that support the creation of an effective carbon market (Sambhi, 2021).

The development of renewable energy indicators is inconsistent in ESEA. The IEA report (2019) stated that in the period 2000-2018 there was stagnation in the growth of renewable energy sources in ASEAN. ESEA has a target to increase the renewable energy mix by 23% by 2025, but with a business as usual policy, the percentage of renewable energy mix will only reach 17%. To meet the 2025 renewable energy target, it is necessary to diversify renewable energy sources by exploring alternatives such as solar, wind, or wave power, especially in countries with an archipelagic geological profile such as Indonesia and the Philippines. The development of renewable energy projects requires large investments, so ESEA must formulate policies that can attract investment. Although capital intensive, replacing fossil fuels with renewable energy can save the state up to 1.7 billion US$ per year and if air pollution losses are taken into account, the benefits can reach 15-50 billion US$ (Tachev, 2022).

Global trade and resource use have triggered land use changes where natural ecosystems are disrupted by urban and infrastructure development, as well as the expansion of agriculture and monoculture plantations. These activities contribute to the loss of biodiversity (Otero, et. al., 2020). Although ESEA has had regional cooperation in the ASEAN Centre for Biodiversity since 2005 in response to the loss of biodiversity in the Southeast Asia region, the red list index indicator in ESEA has continued to decline in the period 2001-2019. This indicates that the cooperation program has not been enough to change the condition of species extinction in ESEA.

The air pollution mortality indicator showed improvement in period III in Indonesia, the Philippines, and Vietnam. However, in absolute terms, the three countries had the highest number of deaths compared to Thailand and Malaysia which had the lowest. The 2019 World Air Quality Report document states that emissions from biomass burning are the main cause of air pollution (PM 2.5) in Southeast Asia. Indonesia contributes greatly to transboundary air pollution due to forest and peatland fires. Meanwhile, in big cities, the main causes of air pollution are from motor vehicle emissions, industrial emissions, construction and the use of coal as an energy source for power plants (IQAir, 2020).

Overview of Sustainable Development in ESEA

Figure 6 shows that Malaysia is the most sustainable country, despite having the smallest economic growth compared to the other four countries. In contrast, Indonesia and Vietnam are the least sustainable countries despite having the largest economic growth compared to other ESEA countries.

These results are in accordance with the meta-analysis study of Saqib & Benhmad (2021) on the Environmental Kuznets Curve (EKC) which concluded that in the early stages of a country's development, economic growth will have an impact on environmental damage. This phase is a condition before the EKC reaches a turning point until then environmental conditions will improve as the economy improves. However, reaching the EKC turning point is a long-term phenomenon (Saqib & Benhmad, 2021). Waiting for the EKC turning point in the long term is certainly in line with the use of natural resources, energy, land, and the release of pollution into the environment. In the current situation, the long term means racing against the impacts of climate change. There is a risk that environmental damage may become irreversible, resulting in impacts that future generations will have to bear—for example, the irreversible extinction of biodiversity.

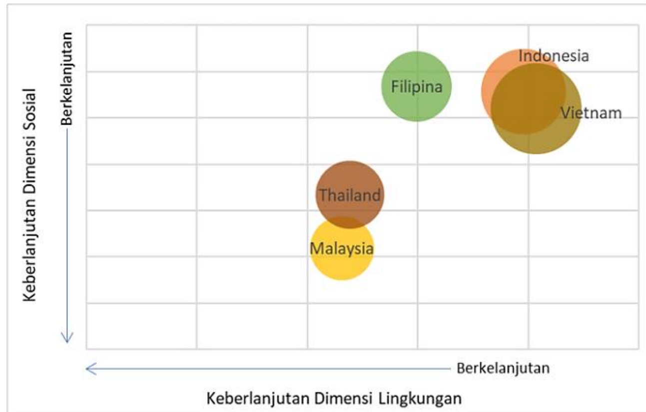


Figure 7. Sustainability positions of ESEA countries.

3. CONCLUSION

In general, GDP growth in ESEA aligns with improvements in the social dimension based on the indicators used, indicating social sustainability. Although Malaysia's indicator values have declined over the study period, Malaysia has consistently shown the best performance in meeting the social dimension from the beginning. The decline suggests that Malaysia's population growth slightly outpaced the improvements in its social indicators. Indonesia, the Philippines, and Vietnam still need to improve the efficiency between economic growth and progress in the social dimension, based on the indicators used, in order to widen the gap between the minimum limit and GDP growth.

In the environmental dimension, ESEA's economic growth is not sustainable. The focus of improving environmental conditions is on two sectors. First, improving the energy sector which can simultaneously enhance four indicators: GHG emissions, energy consumption, renewable energy mix, and deaths due to PM2.5 air pollution. Policy interventions in the energy sector include transitioning to renewable and low-carbon energy sources, as well as adopting more efficient technological innovations will increase ESEA's potential to reduce GHG emissions, achieve NDC targets, and enhance future energy security. Currently, ESEA faces a choice: to start investing in renewable and low-carbon energy sources for emission-producing sectors or to allocate state resources to address the future impacts of climate change.

The second focus of improvement is on biodiversity and ecosystem conservation, which can improve forest indicators and the red list index, while also has the potential to reduce GHG emissions. ESEA is a priority area for global biodiversity conservation due to its extensive tropical natural forests and its role as a habitat for various endemic fauna species.

This natural wealth can be leveraged to attract investment in nature-based climate solutions aimed at ecosystem conservation and restoration, mitigating GHG emissions from the forestry and land-use sectors, and improving the welfare of rural and indigenous communities.

This study demonstrates the operationalization of SuWi analysis to compare sustainable development in ESEA using seven social indicators and six environmental indicators. It can be concluded that SuWi analysis effectively shows the trajectory of economic growth relative to the initial year and its relationship with performance in the social and environmental dimensions. However, if stagnation occurs during the research period, SuWi analysis cannot identify the level at which the indicator values stagnate. To address this limitation, an analysis of the development of indicator values throughout the research period should be conducted, along with additional analysis using absolute indicator values.

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