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Globalization in Reducing Energy Intensity: Evidence from ASEAN Countries

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ABSTRACT

This paper investigates the effects of globalization on energy intensity in the ASEAN region from 2010-2020. Employing the panel data regression analysis to analyze the secondary dataset from the World Bank and Worldwide Governance Indicators, the results found that globalization, precisely through trade openness and FDI, significantly affects energy intensity in the ASEAN region. This suggests that heightened trade openness is linked to lower energy intensity; when a country becomes more engaged in international trade, its energy intensity decreases. Globalization considerably encourages adopting energy-efficient practices, enabling businesses to minimize operational costs. Meanwhile, FDI helps enhance operational efficiency, optimize energy usage in production processes, and reduce energy intensity. This paper contends that policies emphasizing the importance of globalization, particularly in promoting trade openness and FDI, are essential for facilitating a regional energy transition. ASEAN member states are advised to boost trade openness, liberalization, and policies related to FDI by reducing barriers and simplifying customs procedures. Enforcing stringent environmental standards for industries, especially those attracting FDI, will guarantee adherence to sustainable energy practices, resulting in increased energy efficiency and lower energy intensity across various business domains in the region.

Keywords: Globalization, Trade Openness, FDI, Energy Intensity, ASEAN

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Background and Significance of the Research Problem

Globalization has significantly altered international trade dynamics, fostering economic growth, country development, and trade liberalization worldwide, opening doors to tap into expansive markets, streamlining the movement of capital, and reshaping financial markets across diverse business sectors (Baddeley, 2006; Cook & Kirkpatrick, 1997; Eriksen, 2002; Garrett, 2000; Kirby, 2006; Todaro & Smith, 2021). According to Stiglitz (2002), globalization stimulated economic growth by encouraging Foreign Direct Investment (FDI) and exchanging information in most developing economies. From 1991 to 2007, empirical studies demonstrated that globalization was vital in boosting financial progress and driving economic growth in most Middle Eastern and North African countries, leading to the growing scale of cross-border trade of commodities and the flow of international capital (Demir et al., 2020; Falahaty & Law, 2012).

In the Association of Southeast Asian Nations (ASEAN) region, globalization has been poised as a driving force behind regional economic growth in multifaced dimensions, such as heightening trade openness and enlarging international investment (Chen & Lombaerde, 2019). Studies have shown that globalization, through trade liberalization and FDI, positively impacted transboundary investments in India (Pradhan & Prakash, 2010). It greatly influenced Gross Domestic Product (GDP) growth and income per capita in many East Asian and ASEAN economies (Law et al., 2015; Sardiyo & Dhasman, 2019). From 1990 to 2019, globalization vastly caused GDP expansion and country progress in Indonesia, Malaysia, the Philippines, and Thailand (Dizon et al., 2021). This includes its effects on social development by mitigating poverty and increasing GDP per capita (Li et al., 2022). Indeed, most ASEAN countries have leveraged the advantages of globalization to enhance their participation in international markets and attract FDI.

How does globalization influence the energy transition in the ASEAN region, mainly through reducing energy intensity? And in what ways do trade openness and FDI, as proxy variables for globalization, contribute to the realization of energy transition in the region? The empirical research into this matter exhibits notable advancements in international business and interdisciplinary studies within developed nations, as explicated in the recent works of Ozcan et al. (2022), Padhan et al. (2022), Rahman and Alam (2022); nevertheless, its application in the ASEAN context is comparatively limited.

Fueled by globalization, ASEAN economic growth has undesirably led to an increased energy demand, which is forecast to triple by 2050 from the 2020 level under the base case scenario; the Total Final Energy Consumption (TFEC) is predicted to reach 473.1 Mtoe by 2025

and 1,281.7 Mtoe by 2050, while fossil fuels will still be a dominant energy source, with oil accounting for 47.4% of TFEC, followed by electricity (20.3%), coal (14.5%), and bioenergy (9.2%) in 2050 (ASEAN Centre for Energy and GIZ, 2023). The regional energy demand has increased on average by around 3% a year over the past two decades, and this trend seems to continue until 2030 under the current policy settings (International Energy Agency, 2022). Therefore, ASEAN must establish a well-balanced energy system to tackle the future regional energy trilemma – energy security, equity, and sustainability (Safrina & Utama, 2023).

Still, much traditional research has analyzed energy intensity by investigating energy technology, innovation, financial incentives, and infrastructure. For instance, the empirical study of Suwanto et al. (2021) examined the effect of innovation on energy transition in the ASEAN region by concluding that embracing innovations like low-carbon and cutting-edge technologies could speed up the transition process. Chien et al. (2023) contended that financial mechanisms such as carbon finance, carbon taxes, and sustainable energy technologies (solar and hydroelectric) closely correlate to energy transition among ASEAN countries. In the case of Indonesia, a contemporary study by Resosudarmo et al. (2023) pinpointed critical determinants limiting the energy transition consisting of high capital investment in renewable energy infrastructure, regulatory uncertainty, and financing.

Given the significant increase in energy transition research, there remains a scholarly gap concerning the intricate dynamics of globalization factors—precisely, trade openness, FDI, and the various impacts stemming from institutional frameworks—on regional energy transition. This study addresses this gap by examining how these factors influenced the energy intensity landscape in the ASEAN region from 2010 to 2020. This period represents pivotal moments marked by notable milestones such as the establishment of the ASEAN Community in 2015, consisting of the ASEAN Political-Security Community (APSC), Socio-Cultural Community (ASCC), and the ASEAN Economic Community (AEC). It encompasses the formulation and extension of the ASEAN Plan of Action for Energy Cooperation (APAEC) from 2010 to 2015, a strategic framework for greater regional energy cooperation among ASEAN nations. Therefore, examining globalization's effects on energy intensity in the ASEAN region during this period is deemed valuable, offering novel insights and recommendations for policymakers, economists, and trade experts to leverage the benefits of globalization through FDI and trade openness in advancing the ASEAN's energy transition.

Research Objective

To examine the combined impacts of globalization, as manifested via the proxy variables of FDI and trade openness, on minimizing energy transition in the ASEAN region from 2010 to 2020.

Scope of Research

This paper mainly analyzes the impact of globalization on energy intensity in the ASEAN region by examining the proxy variables of trade openness and FDI from 2010 to 2020. The study includes ten ASEAN countries: Brunei, Indonesia, Cambodia, Laos, Myanmar, Malaysia, the Philippines, Singapore, Thailand, and Vietnam. By treating ASEAN as a single unit of analysis, the research provides a comprehensive overview of energy intensity dynamics in the region, irrespective of the varying levels of country development, diverse trade backgrounds, and political systems. Consequently, the findings offer broad insights applicable to ASEAN as a whole rather than representing ASEAN at the country level.

Literature Review

Concept of Energy Transition and Implications to ASEAN

The energy transition is nothing less than a revolutionary restructuring of the entire energy supply in the electricity, heat, and transportation sectors to be more environmentally friendly (Drewello, 2022). Energy transition refers to shifting away from fossil fuel utilization towards renewable energy sources, aiming to mitigate the adverse impact of CO2 emissions, as outlined in the Sustainable Development Goals (SDGs) of the United Nations (Deloitte, 2023). It primarily involves a systematic shift from conventional fossil fuels to renewable energy and lower energy intensity reduction, including changing the composition structure of the existing energy system (Mazzone, 2020).

In the context of ASEAN, the energy transition holds significant implications for all countries. It helps address the ongoing challenge of climate change, as most ASEAN nations are vulnerable to numerous adverse impacts, including increased energy demand, supply disruptions, and investment risks. Improving energy resilience through systematic transition is critical to mitigate such undesirable impacts and achieve self-sufficiency (Li et al., 2020). The energy transition will foster regional competitiveness and the realization of ASEAN's market integration in 2030, aiming to achieve the SDGs through investment in sustainable infrastructures

and economic recovery from COVID-19 (Wolff, 2022). Table 1 illustrates the energy intensity ratios in 10 ASEAN countries. A lower ratio indicates that less energy is required to produce one unit of output, reflecting more efficient energy usage.

Table 1 Energy Intensity Level of Primary Energy in ASEAN Countries (Unit: MJ/$2017 PPP GDP)

Country	2010	2012	2014	2015	2016	2017	2018	2019	2020
BRU	5.15	5.82	5.66	4.34	4.91	5.87	5.85	6.35	6.05
INDO	4.21	3.79	3.44	3.26	3.19	3.2	3.19	3.16	3.12
CAM	5.05	4.68	4.5	4.58	4.74	4.59	4.61	4.68	5.09
LAOS	3.31	2.93	2.93	3.83	4.75	4.9	4.7	4.35	4.33
MYAN	3.67	3.59	3.53	3.41	3.45	3.72	3.52	3.58	3.59
MALAY	5.24	4.99	5.18	4.72	4.69	4.28	4.5	4.25	4.51
PHIL	3.14	2.99	2.9	2.96	2.93	2.89	2.81	2.68	2.79
SING	2.48	2.31	2.52	2.68	2.66	2.8	2.51	2.57	2.5
THA	5.1	5.05	5.2	5.07	5.02	4.79	4.5	4.52	4.63
VIET	5.48	4.97	5.12	5.13	4.53	4.38	4.74	4.92	4.05

Source: Word Bank Open Data (https://data.worldbank.org/), Modified by Authors

Globalization

Globalization refers to the spread of goods, services, technology, and information across conventional borders. In business and economics, it is described as an interdependence of nations worldwide fostered through free trade (Investopedia, 2023). Globalization is also considered through trade liberalization, FDI, trade openness, and international trade agreements that facilitate the exchange of goods and services (Dicken, 2015). According to Amartya Sen, globalization is an interrelation and has contributed to the world's progress through trade, migration, the spread of cultural influences, and the dissemination of knowledge (Sen, 2002). Indeed, globalization is a complex phenomenon that surpasses geographical boundaries, nurturing the global interconnectedness of economies and societies, and plays a pivotal role in promoting global interconnectedness (Friedman, 2005).

Globalization has generated substantial economic impacts and intensified interdependence among countries, encouraging the exchange of goods, services, and ideas in multiple dimensions. The effects of globalization, via trade openness and associated policy settings, have been described in terms of comparative advantage that determines productivity differences, factor endowments, and diverse technological structures (OECD, 2011).

Nevertheless, the impact of globalization is not uniformly positive, as critics argued that it exacerbates income inequality, poverty, and distribution of wealth and poses challenges to national sovereignty, as exemplified in the case of China and some advanced countries like the United States, Germany, and Norway (Kacowicz, 2015; Luongo et al., 2015; Wan et al., 2007). The downside effects of the digital divide have become a rising concern in several sub-Saharan African countries; when the economies are closely linked to the world, unequal access to digital resources can worsen their income inequality (Ndoya & Asongu, 2022).

New Institutional Theory

New institutional theory is a perspective within the social sciences that concentrates on a broader comprehension of the role of institutions in shaping behavior, organizations, and societies. According to the seminal work of North (1989), institutions are humanly devised constraints that shape patterns of human interaction and serve as rules of the game in society, including formal and informal rules, norms, and structures that guide human behavior and interaction. Institutions can create order, reduce uncertainty, and determine transaction costs across various economic activities (North, 1991). Williamson (1979) argued that institutions include formal rules and regulations, informal norms, and the organizational structures in which economic transactions occur. Without effective institutions, these transaction costs would be uncertain; thus, well-structured institutions are needed to enable business and economic development (Faundez, 2016).

Contemporary studies suggested that effective institutions cause large-scale economic progress, trade flows, FDI, and employment across the countries; these studies analyzed institutions through the proxy variables of regulatory quality, control of corruption, rule of law, and government effectiveness (Agostino et al., 2020; Briggs, 2013; Buracom, 2014a; Cui, 2017; Grabowski & Self, 2012; Hayat, 2019b; Huynh & Hoang, 2019; Suksai, 2022). The findings illustrated that institutions could directly and indirectly affect the country's business prospects, trust, creditability, and the quality of local democracy (Filgueiras & Lui, 2023; Hollingsworth, 2000; Portes, 2021).

Within the energy sector, scholars also argued that institutions form an essential component of energy regimes and shape the policy options for supporting the energy transition (Andrews-Speed, 2016). The transition towards low-carbon energy systems is considerably shaped by rules and regulations driven by institutions that provide trust and govern those systems (Aalto, 2014; Milchram et al., 2019).

Comparative Advantage Theory

Comparative Advantage Theory is a term coined by David Riccardo in the early 19th Century, serving as a pivotal concept in international trade economics (Powell, 2015). Ricardo's groundbreaking work entitled "Principles of Political Economy and Taxation" posited that nations should specialize in producing goods with a lower opportunity cost than others. This leads to a mutually beneficial global trade environment and allows a nation to allocate its resources more efficiently by focusing on industries where it can produce goods and services more effectively (Ricardo, 1817). When countries engage in international trade based on their comparative advantages, it has the potential to unlock more efficient resource allocation, thereby stimulating economic growth and prosperity.

Recent investigations pinpointed the dynamic effect between the trade imbalance and the comparative advantage in developing countries from 1992 to 2017 and highlighted that having a comparative advantage makes most ASEAN countries more likely to become net exporters in the global market (Hunt & Morgan, 1995; Shen et al., 2022; Widodo, 2009). Comparative advantage also elucidated trade patterns among BRICS countries; Brazil and Russia specialize in natural resource-based products, while India and China excel in manufactured and processed goods (Maryam et al., 2018).

In the seminal work "Scale Economies, Product Differentiation, and the Pattern of Trade" (1980), Krugman analyzed the dynamics of international trade patterns and found that they were reinforced by comparative advantage. Dani Rodrik's exploration of industrial policy in "Normalizing Industrial Policy" (2008) illustrated the ongoing discussion about the practical implications of comparative advantage in shaping various industrial policies in El Salvador, Uruguay, and South Africa.

In a nutshell, comparative advantage theory guides countries in resource allocation and specialization, leading to enhanced productivity when producing goods or services where they excel. This can contribute to higher GDP growth rates as countries leverage their strengths in international trade. Moreover, larger GDP sizes have reshaped economic prosperity, enabling countries to sustain growth in the global market. This is apparent in the comparative analysis between richer and poorer nations within the manufacturing and service sectors (Bradford et al., 2022). However, it is crucial to acknowledge that the relationship between comparative advantage theory, GDP growth rate, and GDP size is complex and influenced by relevant trade policies, technological advancements, and global economic conditions.

Research Methodology

Research Design and Model Specification

This study employs a quantitative approach, utilizing panel data regression analysis, to investigate the intricate correlation between independent and dependent variables. The analysis is conducted to align with data conditions observed in ten ASEAN countries from 2010 to 2020. The dataset comprises approximately 110 observations, with the Logistic Performance Index (LPI) and Human Development Index (HDI) variables accounting for about 60 observations; this limitation arises from the primary data source, which does not collect data annually. The variables are classified into four primary groups based on underlying theories, and four control variables, namely CO2 Emission, Access to Energy, Logistic Performance Index, and Human Development Index, were incorporated into the equation to mitigate the possibility of analytical biases.

Nevertheless, it is worth noting that the undesirable multicollinearity effects arising from institutional domains, which include factors like government effectiveness, control of corruption, regulatory quality, and the rule of law, placed constraints on the regression model. These factors exhibited multicollinearity within the regression equation. To address this issue, researchers opted to exclude regulatory quality and the rule of law from the equation to maintain predictive accuracy, thereby ensuring analytical robustness and internal validity.

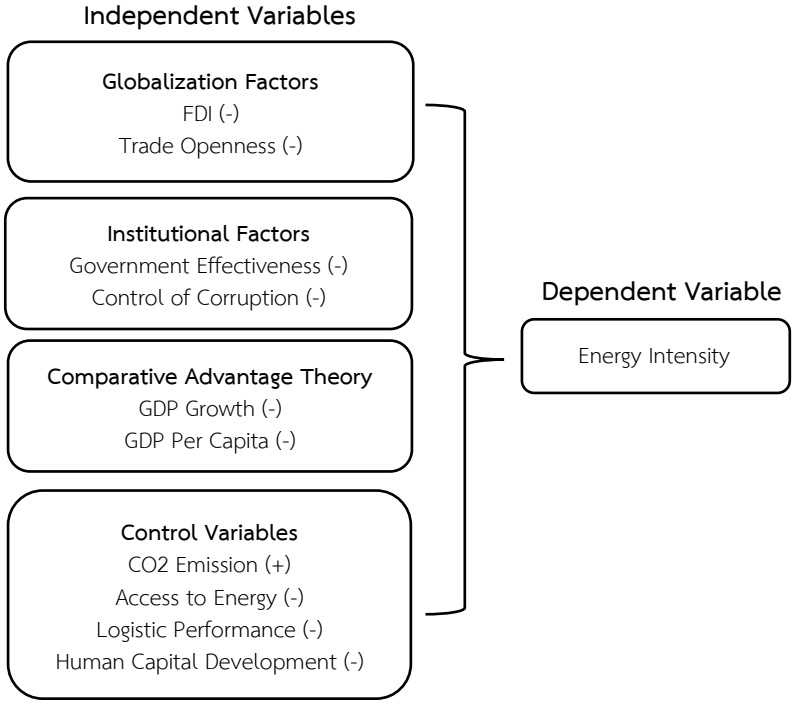

Figure 2 Conceptual Model (with the expected signs)

Data Collection and Analysis

This study employs secondary data from international organizations' databases from 2011 to 2020, including the World Bank and WGI (World Governance Indicators). These sources are recognized for their reliability and validity in quantitative research. Recent cross-country studies, including (Buracom, 2021; Dizon et al., 2021; Kacowicz, 2015; Law et al., 2015; Pradhan & Prakash, 2010; Wan et al., 2007), have utilized these sources to derive benefits in data collection and analysis. In terms of data analysis, studies conducted by Torstensson (1998), Bernhofen and Brown (2005), and Liargovas and Skandalis (2012) utilized quantitative metrics like country size, real income, FDI, and trade openness to evaluate the extent of comparative advantage and understand how globalization influences the pattern of economic well-being, both national and regional levels. While research, including those of Aziz et al. (2018), Buracom (2014b), Fukumi and Nishijima (2010), (Hayat, 2019a) assessed institutions using comprehensive governance indicators such as political stability, rule of law, control of corruption, government effectiveness, and regulatory quality. These studies examined the relationship between economic structure, trade dynamics, and institutional performance across countries. See Table 2 below for variables, symbols, and units of measurement for the multiple regression analysis.

Table 2 Variables, Symbol, Theories, and Unit of Measurement

Variables	Symbol	Theories	Unit of Measurement
Energy Intensity	ENIN	-	MJ/$2017 PPP GDP
Foreign Direct Investment	FDI	Globalization	Net Inflows (% of GDP)
Trade Openness	OPEN	Globalization	Import+Export (% of GDP)
Government Effectiveness	GOVE	Institutional Theory	Percentile Rank (0-100)
Control of Corruption	CONT	Institutional Theory	Percentile Rank (0-100)
GDP Growth Rate	GDPG	Comparative Advantage	GDP growth (annual %)
GDP Size	GDPS	Comparative Advantage	Current US$
CO2 Emissions	CO2	Control Variable	Kiloton (kt)
Access to Electricity	ACCESS	Control Variable	Urban (% of urban population)
Logistics Performance Index	LPI	Control Variable	Overall Index (0-5)
Human Development Index	HDI	Control Variable	Ranking Index (0-1)

Source: Authors' Study

Descriptive statistics below provide a bird's-eye description of independent variables and energy intensity dynamics under investigation for the eleven years across the ten ASEAN countries from 2010 to 2020. See details in Table 3.

Table 3 Descriptive Statistics

Sign	N	Minimum	Maximum	Mean	S.D.
ENIN	100	2.05	6.35	4.1105	0.1024
FDI	110	-1.320	29.760	6.188	6.452
OPEN	110	0.000	277.434	86.984	62.862
GOVE	110	2.369	100.000	53.447	26.761
CONT	110	0.476	99.038	42.668	27.0576
GDPG	110	-9.518	14.519	4.750	3.555
GDPS	110	7131773632.71	1119099868265.25	267435429568.82	274758080689.45
CO2	110	2877.1	605290.6	141866.681	157100.813
ACCESS	110	85.500	100.000	98.014	3.200
LPI	63	2.067	4.150	3.059	0.521
HDI	50	0.510	0.943	0.718	0.115

Source: Authors' Study

Results

The empirical results of the regression analysis, with an R-squared value of 0.628, indicate that approximately 62% of the variance observed in the dependent variable can be explained by the set of independent variables under scrutiny. The findings revealed that independent variables, including trade openness, CO2 emissions, GDP growth rate, and GDP size, significantly influenced energy intensity in the ASEAN region. These variables were found to decrease the energy intensity ratios at a significant level of 0.05. Meanwhile, FDI and access to energy factors significantly affected regional energy intensity at the 0.1 significance level. See full details below:

Table 4 Empirical Results of Regression on Energy Intensity the ASEAN Region

	Dependent Variable: Energy Intensity		
Independent variables	**Coefficients (b)**	**t**	**Sig.**
FDI	-0.269	1.931	0.056*
OPEN	-0.415	-2.662	0.009**
GOVE	0.106	0.730	0.467
CONT	0.123	0.786	0.433
CO2	1.908	7.409	0.000**
GDPG	-0.191	-2.651	0.009**
GDPS	-2.115	-9.166	0.000**
ACCESS	0.177	1.807	0.074*
LPI	0.006	0.060	0.952
HDI	0.053	0.635	0.527
(Constant)	-1.223	-0.428	

Table 4 (Continued)

	Dependent Variable: Energy Intensity		
Independent variables	**Coefficients (b)**	**t**	**Sig.**
R = .793; R-squared = .628; F = 16.741; p-value = .000			
**Statistically significant at 0.05 level, *Statistically significant at 0.1 level			

Source: Authors' Study

Considering the coefficient magnitudes, the results suggested that GDP size (-2.115) had the highest significant impact on energy intensity, followed by trade openness (-0.415) and GDP growth rate (-0.191). Notably, FDI showed a significant negative correlation with energy intensity at the 0.1 level. This suggests that a rise in FDI (-0.269) could diminish the energy needed to generate a unit of GDP, thereby reducing energy intensity within the region. The following regression equation represents the estimation of the determinants of energy intensity.

$$\widehat{ENIN} = -1.223-0.269FDI-0.415OPEN+1.908CO2-0.191GDPG-2.115GDPS+0.177ACCESS$$

However, when assessed through proxy variables like government effectiveness and control of corruption, institutional performance does not notably impact energy intensity. These surprising results defy the conventional notion that institutional robustness is presumed to be crucial in shaping economic structures, influencing trade dynamics, and encouraging increased uptake of renewable energy across diverse economies (Aziz et al., 2018; Fukumi & Nishijima, 2010; Tadesse et al., 2019; Uzar, 2020).

This phenomenon can be explained by the fact that the direct influence of institutions on energy intensity may not be straightforward. For instance, examining the varying regulatory frameworks and energy efficiency standards across ASEAN countries, it becomes evident that certain advanced nations like Singapore have robust regulatory bodies that enforce energy-efficient technologies and practices in the manufacturing, transportation, and construction sectors. In contrast, many developing ASEAN countries lack such stringent regulations. Furthermore, a tangible impact on energy intensity may not be immediate due to factors such as the time lag between policy formulation and outcomes, the duration needed for technology adoption, and the absence of coordinated efforts across various business sectors and stakeholders. This includes possible bureaucratic obstacles and funding constraints in some countries that can impede timely implementation, affecting energy intensity on a broader scale.

Discussion

Globalization Impacts

The results indicated a significant impact of globalization on energy intensity in the ASEAN region, especially through trade openness and FDI. It suggested that increased trade openness is correlated with a reduction in energy intensity. That is, as a nation engages more extensively in international trade, i.e., increasing imports and exports to the global market diminishes its energy intensity. In other words, a more open economy often benefits from the optimized allocation of energy resources, leading to a higher economic output per unit of energy consumed. Consequently, this reduces energy costs within the production and manufacturing processes. Therefore, encouraging trade openness not only contributes to economic prosperity but also indirectly facilitates the energy transition. The findings in this context align with Rehman et al. (2021), contending that globalization, trade, and energy usage consistently demonstrate positive interactions with short and long-term effects. This new insight is consolidated by the recent study of Gozgor et al. (2020), underlining that globalization tends to promote the adoption of renewable energy and reduce energy intensity among OECD countries. Besides, globalization intensifies competition, compelling and forcing businesses to enhance energy efficiency to stay competitive.

Simultaneously, FDI has the potential to bring in managerial expertise and operational efficiency, optimizing energy efficiency across production processes and consequently reducing energy intensity. Moreover, FDI could stimulate the cross-border transfer of energy technologies, fostering the adoption of energy-efficient methods and minimizing overall operational costs; the result in this context is in line with the empirical study of Şengül et al. (2015), claiming several aspects of globalization affect operational performance among enterprises in developing countries.

Comparative Advantage Impacts

The GDP expansion and a higher GDP growth rate in an economy correlate to reducing energy intensity through several mechanisms. As the GDP grows, businesses often prioritize technological advancements and innovation, resulting in the adoption of energy-efficient technologies. This enhances productivity while concurrently reducing energy consumption and lowering energy intensity. The findings in this context align with the recent study of Mahmood and Ahmad (2018), arguing that economic growth substantially reduces energy intensity, especially among European economies. Furthermore, GDP growth tends to drive structural

changes, shifting towards less energy-intensive industries, allowing for increased financial resources and favorable investments in energy-efficient infrastructure and technologies. All contribute to a reduction in energy intensity.

Other Impacts

CO2 emission and access to electricity statistically negatively impact the energy intensity in this context. This scenario can happen when industries with higher energy intensity, such as heavy manufacturing, coal mines, or chemical processes, may produce massive CO2 emissions. As energy-intensive industries expand, so does the CO2 emissions. Too rapid access to electricity in some areas might promote unexpectedly higher energy intensity because of a lack of proper planning and implementation of energy-efficient practices, contributing to higher energy intensity. These problems align with the contemporary investigation of Shakya et al. (2022), asserting that the energy intensity in several countries, like Bangladesh, India, Nepal, Pakistan, and Sri Lanka, is influenced by access to electricity. However, it should be noted that this correlation is not universal since the relationship among energy intensity, CO2 emissions, and access to electricity may vary based on various macroeconomic forces in each country.

Theoretical Contributions

The conceptualization of globalization vitally serves as a cornerstone in various interdisciplinary domains, particularly in international business and energy research. It involves a redefinition of existing knowledge boundaries in these fields by highlighting the causal relationship between globalization, trade openness, FDI, and their combined impact on regional energy transition. Drawing from previous empirical findings propelled by globalization, promoting trade openness and FDI can significantly impact business operations on a large scale. This influence manifests as a reduction in energy intensity in this analytical context.

In this connection, integrating multiple theories and concepts, especially the globalization concept, into contemporary research using this integrative approach can provide a more comprehensive understanding of this complex phenomenon. All contribute to developing a unified theoretical framework among international business and energy research.

Conclusion

Accelerating trade openness through increased facilitation of global imports and exports of goods and services will not only stimulate economic progress but also expedite the energy transition by reducing energy intensity in the ASEAN region, leading to higher economic output per unit of energy utilized. This implies that increased openness to trade is associated with

decreased energy intensity; as a nation becomes more involved in global trade, its energy intensity diminishes. Globalization significantly promotes the adoption of energy-efficient practices, allowing businesses to reduce operational costs. Meanwhile, FDI largely contributes to improved operational efficiency by optimizing energy usage, leading to a reduction in energy intensity. This paper contends that policies highlighting the significance of globalization, with a focus on fostering trade openness and encouraging FDI, are crucial for facilitating a regional energy transition. ASEAN member nations are recommended to strengthen trade openness, liberalization, and policies associated with FDI. Enforcing rigorous environmental standards, especially for industries that attract FDI, will guarantee compliance with sustainable energy practices. Ultimately, this paves the way for increased energy efficiency and reduced energy intensity across diverse business sectors in the ASEAN region.

Policy Recommendations

This paper argues that policies underscoring the importance of globalization, particularly those prioritizing trade openness and FDI, are crucial for ASEAN's energy transition. Therefore, a multifaceted policy implementation is recommended.

First, governments should prioritize advancing trade openness and liberalization by reducing barriers and streamlining customs processes to facilitate international investment and commercial cross-border activities in an economy. They are encouraged to enhance their exposure to globalization when engaging in substantial energy consumption (Huang et al., 2020).

Second, facilitating the introduction of new special economic zones and providing incentives to industries for adopting cleaner technologies through FDI, such as offering tax breaks or subsidies for large-scale implementations, is recommended. These measures can attract new investments from multinational companies and intra-ASEAN investors. For example, in the case of Korea, the government opted to enhance accessibility for foreign majority acquisitions to encourage foreign investors and streamline FDI decisions through policy reform. Similarly, in Taiwan, the government decided to protect fewer domestic firms from superior foreign counterparts to promote equal liberalization and foster fair competition in the market (Thurbon & Weiss, 2006).

Third, implementing stringent environmental standards for industries and large enterprises, particularly those attracting FDI, will ensure a commitment to sustainable energy utilization. This commitment will contribute to greater energy efficiency and a holistic reduction

in energy intensity. This implementing policy is quite effective in China, and it has been found that enforcing stringent environmental regulations in specific regions helps restrain the scale expansion of domestic carbon-intensive industries (Zhao et al., 2020). These policy recommendations will be critical steppingstones in realizing a regional energy transition, ultimately propelling each country towards a more sustainable energy future. These recommended policy measures are poised to play a pivotal role in nurturing economic prosperity and fostering overall country development productively.

Lastly, it is important to note that the immediate implementation of trade openness, FDI, liberalization, and energy policies across ASEAN countries may face substantial challenges due to the region's extensive diversification and unique conditions. This includes variations in socioeconomic settings, fragmented rules and regulations within the energy sector, differing levels of country development, and varying institutional performance. Consequently, promoting openness, implementing liberalization policies, and improving energy practices within the regional business sector have become critical challenges simultaneously.

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