DO ECONOMIC GROWTH, RENEWABLE ENERGY CONSUMPTION, INTERNATIONALIZATION, URBANIZATION AND VALUE-ADDED PRODUCTS FROM INDUSTRIES IMPACT ON ENVIRONMENTAL QUALITY? A NEW LOOK AT MYANMAR'S ECONOMY

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Abstract

Myanmar has the greatest potential for renewable energy generation while non-renewable energy still dominates the total energy mix in the country. The study examines the effect of economic growth, renewable energy consumption, internationalization, urbanization, and value-added industry on environmental quality of Myanmar over the period between 1990 and 2020 by applying multiple regression analysis. The result found that an increase in GDP per capita and an increase in renewable energy consumption improve the environmental quality of Myanmar due to reduction in CO_2 emission. Increasing value-added industry and net inflow of foreign direct investment worsen the environmental quality as a result of increasing CO_2 emission. The findings of this study revealed that renewable energy consumption significantly contributes to the improvement in environmental quality of Myanmar. The study recommended that it should encourage the consumption of clean energy sources in order to improve environmental quality in Myanmar and thereby leading to green growth and green economy and achieve SDGs.

Keywords: CO_2 emission, Economic growth, Internationalization, Renewable energy consumption, Value- added industry

Introduction

Myanmar has the greatest potential for renewable energy generation while non-renewable energy still dominates the total energy mix in the country. The renewable energy generation and consumption depends on the economic growth, net inflow of FDI, use of energy in the manufacturing sector due to structural change in attempting to achieve economic development, rapid growth of urban population which all are contributing factor to environmental quality. As long as country shifts from agriculture (low stage of development) to industry (intermediate stage of development) which could give emphasis to growth in manufacturing industries over a sustainable environment as well as inflow of FDI, it may worsen its environmental concerns. Most of the FDI in Myanmar are focused in extraction of natural resource sectors such as mining, oil and gas. This results in extensive adverse impact on environment (The Myanmar Centre for Responsible Businesses, 2015, as cited in Thiri Shwesin Aung & Behnaz Saboori & Ehsan Rasoulinezhad 2017).

According to the World Bank (2014), the total emissions of greenhouse gas in Myanmar were the second highest after Indonesia in the whole ASEAN countries in 2011. UNDP (2013) reported that Myanmar had overall carbon equivalent emissions which ranked as the 60^{th} in the world. Due to structural change, country shifts to manufacture-based economies which raise CO_2 emission along with urban affluence. Myanmar however prioritizes the sustainability of environment; it, therefore, shifts towards a service-based economy because share of service sector contributed to (40.2%) of GDP in 2020-2021 (CSO 2022) which tends to alleviate

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environmental deterioration. The alleviation of worsening environment improves environmental quality and sustainability. If country has better environmental legislation, environmental quality will improve due to becoming affluent country (Hassan Radoine, Salwa Bajja, Jerome Chenal and Zahoor Ahmed 2022). To achieve level of zero-carbon by 2030 keeps one of the crucial SDGs. The renewable energy thus becomes important. This study intends to analyze how economic growth, renewable energy consumption, internationalization, urbanization and value-added products from industries impact on environmental quality of Myanmar.

The study is separated into different sections: objective and significance of the study, CO_2 emission in Myanmar**,** materials and methods, the result/findings and the discussion.

The Objective of the Study

The objective of the study is to analyze the impact of economic growth, renewable energy consumption, internationalization, urbanization and value added in industry on environmental quality in Myanmar.

Significance of the Study

According to the objective, the reason for selecting the above variables is due to the fact that these variables are main contributors to the environmental quality in terms of CO_2 emissions as well as playing a vital role in achieving SDGs: SDG 1 (no poverty), SDG 2 (zero hunger), SDG 7 (affordable and clean energy), SDG 8 (decent work and economic growth), SDG 9 (industry, innovation, and infrastructure) and SDG 10 (reduced inequalities), SDG 11 (sustainable cities and communities) and SDG 13 (climate action) (UNDP 2023).

CO_2 Emission per capita, GDP per capita, Renewable Energy Consumption, Net Inflow of FDI, Urban population and Value Added in Industry in Myanmar

Figure (1) shows CO_2 emission per capita, GDP per capita, renewable energy consumption, net inflow of FDI, urban population and value-added products from industries in Myanmar during the period between 1990-1991 and 2020-2021 respectively.

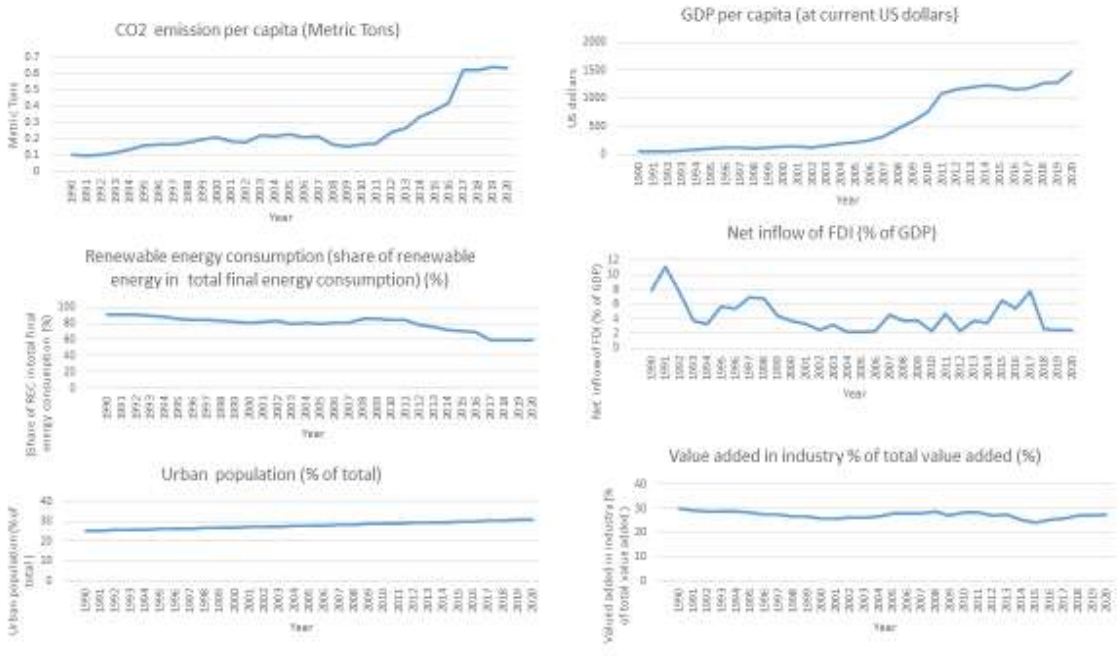

Figure (1) CO_2 emission per capita, GDP per capita, Renewable energy consumption, Net inflow of FDI, Urban population, Value added in industry in Myanmar

Source: World Bank, 2022.

Materials and Methods

Literature Review

The economic activities are measured as GDP variables, indicating that economic pollutions increase with an increase in scale of economic activity. During the period of structural change in an economy, industrial sector which uses greater amount of energy will grow while the share of agriculture decreases. In this period, coefficient of GDP is expected to have a positive sign because when economy moves to higher stage of development, the share of industry which concentrates pollution-intensive begins to decrease while the share of service which concentrates on non-pollution-intensive increases. On the other hand, people have environmental awareness and country has environmental regulations at the higher stage of development. It drives the economy towards reducing energy intensity and thus the coefficient of GDP is expected to have a negative sign (Soytas et al. 2007). According to the study of Grossman et al. (1991), the income levels and environmental pollution can be explained by two effects: scale composition effect and technical effect. According to the scale effects, it is likely to increase environmental pollution along with economic growth due to new market expansion. The composition effect occurs from the trade liberalization. Depending on whether a country has comparative advantage in pollution-intensive production or non-pollution intensive production, the compositional effect exists. According to the technical effects, if production techniques become improved, the quantity of pollution emission per value-added product from an industry will decrease. It can be said that production techniques strongly affect the relationship between income and pollution. EKC

hypothesis has been widely applied in the field of energy economics over the past three decades. According to the hypothesis, there is an inverse relationship between income and environmental degradation, indicating that environmental degradation begins to increase at first as income increases and then decreases after income goes above a certain threshold level (Emine Kılavuz and ˙Ibrahim Dogan.2020, p.478).

Apergis et al. (2010) analyzed the causal effects between the use of green energy, GDP, environmental degradation, and other variables in a sample of 19 economies by using a Granger test. The result found that renewable energy plays a vital role for achieving sustainable development. This is confirmed that renewable energy consumption improved the quality of environment through decreasing CO_2 emission while non-renewable energy consumption degraded the quality of environment through increasing CO_2 emission (Ali et al. 2017). Bilgili, et al. (2016) and Zoundi (2017) also confirmed these findings for a sample of African countries (cited in Urszula Gierałtowska, et al. 2022). De Souza et al (2018) looked into the effect of non-renewable energy consumption, renewable energy consumption, and income on CO_2 emission in five MERCOSUR countries. The result showed that the renewable energy significantly reduced the CO_2 emission. All these results are confirmed according to the outcome of Alola et al. (2019) who studied in the context of 16 EU-members during the period between 1997 and 2014 that the use of green energy improved the quality of environment but the consumption of non-renewable energy led to the degradation of environment. Urszula Gierałtowska et al. (2022) also confirmed that renewable energy is an essential tool for reducing CO_2 emissions globally (p.8). It pointed that renewable energy became critical to green growth and green economy and suggested that the energy intensity should be lowered, use of green energy should be increased, and regulations should be developed to mitigate the effect of climate change in line with local demands (Chen et al. (2021).

In studying the FDI-pollution nexus, there are two conflicting hypotheses such as halo effect hypothesis and pollution haven hypothesis. Cole (2004) analyzed trade, migration or displacement of dirty industries from the developed countries to developing countries on emission based on EKC inverted U relationship, using data on North-South flows of trade for the pollution-intensive products to assess pollution haven hypothesis. The result found that there is an evidence of pollution haven effects. The literature of analyzing the impact of FDI on the environment of host country is very rare in the case of ASEAN regions. Merican et al. (2007) examined the nexus between FDI and pollution in the ASEAN 5- by applying Autoregressive Distributive Lag estimation. The result found that FDI increases emission in Philippines, Malaysia and Thailand whereas an inverse relationship between FDI and pollution in Indonesia. Asghari (2013) assessed the validity of the halo pollution and pollution haven hypotheses on FDI by analyzing the correlation between FDI inflow and CO_2 emission during the period between 1980-2011 in selected MENA countries. The result found that inflow of FDI has ą weak and negatively significant with CO_2 emission, suggesting that halo pollution hypothesis is found to exit as a weak support. According to the study of Atici (2012), the result found that FDI has a negative impact on CO_2 emissions, implying that FDI benefits the ASEAN countries through reducing overall pollution whereas FDI does not have any significant effect on CO_2 emissions in Malaysia, Philippines, Indonesia and Thailand.

According to particular studies, urbanization has a positive impact (Parikh and Shukla, 1995; Cole and Neumayer, 2004; Liddle and Lung, 2010; Poumanyvong and Kaneko, 2010; Ahmed et al. 2019) and beneficial impact (York et al. 2003) on CO_2 emission. Moreover, some studies found that there was a positive correlation between urbanization and CO_2 emission for 86 nations between 1975 and 1998 (Cole and Neumayer 2004). Liu et al. (2021) investigated whether renewable energy, urbanization and economic progress affect the environment eco-friendlier in selected Asian countries during the period between 1995 and 2014. The result showed that urbanization and consumption of energy increase CO_2 emission while economic growth decreases CO_2 emission. The result also confirmed for all income groups: low, middle, and high-income countries particularly for middle-income country group which indicated the strongest correlation (Poumanyvong and Kaneko 2010) cited in the study of Hassan Radoine, Salwa Bajja, Jerome Chenal and Zahoor Ahmed (2022). This result is confirmed with the outcome of Urszula Gierałtowska et al. (2022) that urbanization is positively related with environmental degradation.

In the study of Harun et al. (2013), CO_2 emission was influenced by manufacturing sector, depending on the use of input materials, use of energy, design of product and use of resources. The reason is that manufacturing industry which used a large amount of energy and resources had a significant impact on economic growth and its expansion increased production and further increase in economic growth with CO_2 emission in an economy. In the industrialized economies, manufacturing contributes to some levels of pollution (Rauf et al., 2018); and energy consumption and industrial production have a positive and significant impact on carbon emission due to the reason that they largely relied on fossil fuel energy (Rahman and Kashem, 2018). Hassan et al (2022) confirmed and recommended that there should be innovation-driven sustainable industrialization in a country. Attempting to achieve higher economic growth, manufacturing requires higher consumption of energy, and highly relied on sources of non-renewable in the absence of renewable energy sources. The result confirms the study of Hocaoglu and Karanfil, (2011) that industrial production is the main force of CO_2 emission; Zafar et al. (2020) for 46 Asian countries; Banerjee and Rahman (2012); Canh et al., (2019); and Lin et al., (2014).

The main interest in these circumstances on the Myanmar economy leads to the study of examining how economic growth, renewable energy consumption, internationalization, urbanization and value-added product from an industry impact on environmental quality. Thiri Shwesin Aung & Behnaz Saboori & Ehsan Rasoulinezhad (2017) who examined analysis of economic growth and environmental pollution in Myanmar depending on environmental Kuznets curve in term of different emissions, GDP, trade intensity, urbanization, and financial openness in Myanmar but not examine the inflow of FDI, value added products from industries, and renewable energy consumption which contribute to environmental quality in terms of CO2 emission. This study attempts, therefore, to fill the gap by analyzing how economic growth, renewable energy consumption, internationalization, urbanization and value-added products from industries impact on environmental quality in Myanmar.

Research Method

The data used in this study were time series data to analyze the environmental quality of Myanmar. The secondary data were collected from World Bank Indicators as an authentic source for data collection. The study used annual data during the period between 1990-1991 and 2020-2021. The data were analyzed by using Stata for generating results. Both descriptive and inferential statistics are used to analyze the data. The study used particular variables such as CO_2 emission per capita as explained variable measuring in terms of metric tons per capita as a measure for environmental quality. This is confirmed that the main greenhouse gas responsible for global warming is CO_2 emission (Huiming Zhu, Lijun Duan, Yawei Guo, Keming Yub (n.a); Emine Kılavuz1 and ˙Ibrahim Dogan (2020). Fodha and Zaghdoud (2010) used CO_2 as environmental factor and economic factor (GDP). Economic growth, also known as per capita income, and increases production. The increase in production also increases the demand for energy (Emine Kılavuz1 and ˙Ibrahim Dogan 2020, p.478). In this study, the economic growth as GDP per capita at current dollars, renewable energy consumption in terms of share of renewable energy in total final energy consumption, net inflow of foreign direct investment in terms of % of GDP, urbanization measured by urban population (in terms of % of total population) which captures both the impact of urbanization and that of rising population (Dung B.X. Le. 2018) and value-added products from industries (VAI) in terms of share of total value added are explanatory variables. These data facilitate to predict future consequences depending on the result.

As a research Model, the following function assesses the environmental quality of Myanmar in terms of CO_2 emissions per capita.

$$CO_2 = f\,(GDPP, REC, FDI, UBP, VAI) \qquad (1)$$

In Equation.1, CO_2 stands for carbon dioxide emission per capita measured in metric tons. GDP is per capita GDP in term of current dollars, used as a proxy of economic growth. REC stands for renewable energy consumption in terms of share of renewable energy in total final energy consumption. FDI stands for net inflow of foreign direct investment measured in percentage of GDP. UBP is urban population as % of total population, and VAI is value-added in industry (% of total GDP). All the variables are transformed into first differencing form to avoid non-stationary in the data in this model prior to empirical analysis. The empirical model is as follow.

$$CO_{2t} = \beta 0 + \beta_{1t}\,GDPP + \beta_{2t}\,REC + \beta_{3t}\,FDI + \beta_{4t}\,UBP + \beta_{5t}\,VAI + \varepsilon_t \qquad (2)$$

where

CO_2 = CO_2 emission per capita
GDPP = GDP per capita at current dollars
REC = Renewable energy consumption
FDI = Net inflow of Foreign Direct Investment
UBP = Urban population
VAI = Value-added products from industries

In Equation. 2, ‘t’ represents the quantity of time, and ‘ε’ is the error term. Further, β_1, β_2, β_3, β_4, and β_5, are the coefficients of economic growth, renewable energy consumption, net

inflow of foreign direct investment, urban population, and value-added products from industries respectively.

Findings and Discussion

Descriptive Statistics of Selected Variables

Table 1. explores the descriptive statistics of the data prior to examining the time series data to observe the distribution and variability of the variables. It summarized the time series data over the time frame of (1990-1991 to 2020-2021) for Myanmar. Myanmar has international connection with the rest of the world due to inflow of FDI, and industries related activities and other economic related sectors. It is obvious that CO_2 emission, GDP per capita, renewable energy consumption, net inflow of foreign direct investment, urban population, and value-added products from industries in Myanmar are on the average 0.2543419, 536.1142, 79.47774, 4.463448, 28.00352 and 27.27968 respectively. It can be observed that the maximum of 0.6409 MT of CO_2 emissions per capita is documented in Myanmar. GDP per capita ranges from $50.7829 to $1477.453 with a mean value of $536.1142. Regarding renewable energy use, the maximum is 91.12% and the minimum is 59.75%. In the case of Net inflow of FDI, Myanmar recorded a maximum of 11.1388% and a minimum of 2.2185%. Furthermore, it can be seen that a maximum of 31.141 % urban population is observed and a maximum of 30.01% is observed in the case of value-added products from industries. The details about the variables in terms of descriptive statistics are provided in Table1.

Table 1. Descriptive Statistics of Selected Variables

	Observation	Mean	Std.Dev.	Minimum	Maximum
CO_2 emission per capita	31	.2543419	.1635782	.0987	0.6409
GDP per capita	31	536.1142	513.2746	50.7829	1477.453
Renewable energy consumption	31	79.47774	9.348475	59.75	91.12
Net inflow of FDI (% of GDP)	31	4.463448	2.191451	2.2185	11.1388
Urban population (% of total)	31	28.00352	1.735442	25.243	31.141
value-added in industry (% of GDP)	31	27.27968	1.331559	24.02	30.01

Unit Root Test

Prior to performing the regression analysis, it is crucial to study the stationary level in the variables. The augmented Dickey-Fuller (ADF) test for unit roots was conducted for all the time series used for the study. Table 2 shows the result of Unit Root Test.

Table 2. Unit Root Test at Level

Variables	ADF test	Test Statistics	Critical Value 5%	Decision
CO_2	Trend and intercept	-0.516	-3.58	At level, non-stationary
GDPP	Constant	-1.397	-3.58	At level, non-stationary
REC	Trend and intercept	-0.975	-3.58	At level, non-stationary
FDI	Trend and intercept	-3.133	-3.58	At level, non-stationary
UBP	Trend and intercept	16.389	-3.58	Stationary at level
VAI	Trend and intercept	-2.301	-3.58	At level, non-stationary

Note: According to Table (2) ADF unit-root test, there is stationary at the level and it is statistically significant at the 5% level.

Table (2) displays the outcome of unit root tests using the ADF Unit Root Test at the level. In Table (2), the outcome of the ADF test demonstrates that all the data series except UBP are nonstationary at this level.

Table 3. Results of ADF Unit Root Test at stationary I (1)

Variables	ADF test	Test Statistics	Critical Value 5% or 10%	Decision
CO_2	Trend and intercept	-4.580	-3.58	Stationary at I (1)
GDPP	Constant	-2.614	-2.611	Stationary at I (1)
REC	Trend and intercept	-4.832	-3.58	Stationary at I (1)
FDI	Trend and intercept	-7.176	-3.58	Stationary at I (1)
UBP	Trend and intercept	16.389	-3.58	Stationary at level
VAI	Trend and intercept	-6.069	-3.58	Stationary at I (1)

Note: The null hypothesis of nonstationary is achieved at the 5%, and 10% significant level.

Table (3) denotes that all the data series are stationary at first differencing. The result of the ADF test on the first difference strongly supports that all data series are stationary after the first difference at the 5% and 10% significant levels. The ADF results show that all the variable series are integrated in order of first difference.

Results of Multiple Regression with First Difference

According to the empirical model, the regression results are as follows.

$$CO_{2t} = -.1038618 - .0000752\ GDPP - .015429\ REC + .0021448\ FDI + .0039241\ UBP + .0077716\ VAI$$

The regression result is presented in Table (4) by using multiple regression with first differencing to examine the impacts of the economic growth in terms of GDP per capita, renewable energy consumption, net inflow of foreign direct investment, urban population, and value added in industry on environmental quality in terms of CO_2 emission per capita. The result confirmed that explanatory variables have a significant effect on CO_2 emission. The overall model is significant Prob. (F-statistics) 0.0000. The results of Adj R-squared reflect that CO_2 emission per capita are highly dependent on GDP per capita, renewable energy consumption, net inflow of FDI, urban population, and Value added in industry respectively. The high R^2 reveals the good explanatory power of the model. The interrelationship in the explanatory variable is called multicollinearity (Muhammad Suhrab et al., 2022). It occurred when two or more explanatory variables formed a dependency or relation. Its occurrence affects the significance/strength of a regression. The value of VIF in the study is less than 10 which validates that there is no multicollinearity. This is because there is a strong relationship between CO_2 emission per capita and GDP per capita, renewable energy consumption, net inflow of FDI, urban population, and Value added in industry.

Table 4. Results of Multiple Regression with First difference

CO_2	Coef.	Std. Err	t	P>|t|	(95% Conf. Interval)		VIF
GDPP	-.0000752**	.0000341	-2.20	0.037	-.0001456	-4.78e-06	1.23
REC	-.015429***	.0010548	-14.63	0.000	-.0176061	-.013252	1.23
FDI	.0021448*	.0012234	1.75	0.092	-.0003802	.0046699	1.08
UBP	.0039241**	.0016183	2.42	0.023	.0005841	.0072642	1.33
VAI	.0077716**	.002936	2.65	0.014	.001712	.0138312	1.19
_cons	-.1038618**	.0446411	-2.33	0.029	-.1959965	-.0117271	
F (5, 24)							60.17
Prob > F							0.0000
R-squared							0.9261
Adj R-squared							0.9107

*** 1% significant level, ** 5% significant level, * 10% significant level

Discussion

It is found that GDP per capita, urban population and value added in industry (% of GDP) significantly affected on CO_2 emission at 5% level. The renewable energy consumption significantly affected on CO_2 emission at 1% level, and net inflow of foreign direct investment significantly affected on CO_2 emission at 10% level.

The GDP per capita is found to be negative and significantly affected on CO_2 emission per capita at 5% level, indicating that a one-unit increase in GDP per capita leads to a decrease in CO_2 emission per capita of 0.0000752 unit on average when other things are held constant. The result shows that an increase in GDP per capita improves the environmental quality in Myanmar as a result of decreasing CO_2 emission per capita. One possible reason is that Myanmar has begun structural change, indicating that the share of industry decreased while the share of service sector has already increased. It may be the fact that Myanmar shifts increasingly from pollution-intensive industry to non-pollution-intensive service sectors. Another possible reason is that an increase in environmental awareness and regulations drives the economy towards reducing energy intensity. This result also confirms the finding of Soytas et al. (2007); Emine Kılavuz and ˙Ibrahim Dogan. (2021); Dinda (2004) and Atici (2012). This result goes in line with the study of Emine Kılavuz and ˙Ibrahim Dogan (2021) who stated that income and environmental degradation are inversely related, implying that when income increases, environmental degradation begins to increase at first and then declines after incomes surpass a certain level according to environmental Kuznets curve hypothesis. This result also goes in line with the work by Dinda (2004) who found that in the early stages of economic growth, the quality of environment becomes worse. However, an increase in economic growth improves the quality of environment in the latter stages. It is in line with the finding of Atici (2012) that an increase in per capita income leads to a decrease in CO_2 emission. It can be said that economic growth in Myanmar plays a crucial role in improving the environmental quality through decreasing CO_2 emission per capita.

The renewable energy consumption is negatively significant with CO_2 emission at 1% level, suggesting that a one-unit increase in renewable energy consumption tends to a decrease in CO_2 emission per capita of 0.015429 unit on average when other things are held constant. This illustrates that an improvement in renewable energy consumption has a significant impact on the improvement of environmental quality in Myanmar due to a decrease in CO_2 emission per capita. This indicates that renewable energy consumption plays a critical role in reducing the CO_2 emission per capita in Myanmar. This result goes in line with the study of Kirikkaleli and Adebayo (2020) for the global context, Kirikkaleli and Adebayo (2021) for India, Orhan et al. (2021) for India, Samia Zahra, and Ramez Abubakr Badeeb (2022) for five OECD countries. In order to reduce the CO_2 emission per capita, renewable energy consumption becomes an important mechanism for Myanmar. It goes in line with the study of Hassan Radoine, Salwa Bajja, Jerome Chenal and Zahoor Ahmed. (2022), in which renewable energy consumption produces negligible amount of CO_2 emission and lower carbon footprint, for instance, solar energy produces only 0.2 pounds of CO_2 energy per kilowatt-hour (CO_2E/kWh) compared to coal (3.6 pounds of CO_2E/kWh) or the burning of natural gas (2 pounds of CO_2E/kWh). According to the result, increased renewable energy consumption improved the environmental quality in Myanmar.

The result also found that net inflow of foreign direct investment shows a positive and significant relationship with CO_2 emission per capita at 10% level, indicating that an increase in net inflow of FDI may worsen the environmental quality due to increase in CO_2 emission per capita. The empirical result shows that a one-unit increase in net inflow of FDI leads to an increase in CO_2 emissions per capita of 0.0021448 unit on average when other things are held constant, implying that most FDI might invest in polluting sectors in Myanmar. This confirms that most of the FDI in Myanmar are attentive in extraction of natural resource sectors such as mining, oil and gas. This results in extensive adverse impact on environment (The Myanmar Centre for Responsible Businesses 2015). This reminds Myanmar to prevent from becoming a pollution haven in the future. More attention needs to be paid on Multinational companies to use more advanced environmentally friendly technologies and can disseminate cleaner technology that will be less harmful to the environment. This study goes in line with the studies of (Huiming Zhu, Lijun Duan, Yawei Guo, Keming Yub (n.a) for ASEAN-5; Merican et al. (2007) for ASEAN-5; and Dung (2018) for 24 Asia-Pacific economies. They also found that FDI increases CO_2 emissions in Philippines, Thailand, and Malaysia, and inflow of FDI may also provide to develop innovation in the production technique which may be indirectly passed on to domestic firms through backwards or forward linages. The study suggests that Myanmar needs to pay more attention on environmental problems to improve its environmental quality, and environmental regulations need to be restricted. In such a way that, an increase in net inflow of FDI may improve environmental quality of Myanmar by reducing CO_2 emission and prevent from becoming a pollution haven in the future.

The urban population is found to be positive and affected by CO_2 emission per capita at 5% level. According to the result, a one-unit increase in urban population tends to an increase in CO_2 emission per capita of 0.0039241 unit on average, indicating that an increase in urban population positively affects the CO_2 emission per capita. One possible reason is that an increase

in urban population leads to an increase in energy consumption which causes an increase in CO_2 emission per capita. This study goes in line with the finding of Cole and Neumayer 2004 and Urszula Gierałtowska et al. (2022).

The coefficient of value-added in industry is positive and statistically significant at 5% level. This suggests that a one-unit increase in value-added in industry tends to an increase in CO_2 emission per capita of 0.0077716 unit on average when other things being constant. This is very common since manufacturing industries contribute to CO_2 emission even around the globe. The positive effect of value-added in industry on CO_2 emission in Myanmar indicates that it contributes positively to CO_2 emission. Increased CO_2 emission in value-added products from industries may depend on the use of material inputs, product design, production technology and use of energy respectively. On the other hand, expansion in manufacturing industries requires large amount of energy consumption and material inputs and thus lead to increased production and contribute to economic growth along with an increase in CO_2 emission in an economy. This result confirms with findings of Hocaoglu and Karanfil, (2011), Harun et al. (2013), Rahman and Kashem (2018), Rauf et al., (2018), Khan et al. (2021a) for the United States, Khan et al. (2021b) for thirty-eight IEA countries, and Arvind Goswami et al. (2023).

Conclusion

The study examines the effect of economic growth, renewable energy consumption, net inflow of foreign direct investment, urbanization, and value added in industry on environmental quality in terms of CO_2 emission per capita in Myanmar. The result found that GDP per capita and renewable energy consumption had significant effect on improvement in environmental quality in Myanmar whereas net inflow of foreign direct investment, urbanization and value-added products from industries are significant effect on deterioration in environmental quality in Myanmar. It is found that an increase in consumption of renewable energy would improve the environmental quality in Myanmar. As a developing country, Myanmar needs to pay more attention to inflow of FDI that focuses on non-carbon intensive industries which tend to transform their industries towards green economy in the long run. This will be the best way to fight against the environmental deterioration arising from economic growth. Myanmar, therefore, needs to enhance the consumption of renewable energy to improve environmental quality without compromising economic growth and thereby leading to green growth, green economy and achieve SDGs: SDG 1 (no poverty), SDG 2 (zero hunger), SDG 7 (affordable and clean energy), SDG 8 (decent work and economic growth), SDG 9 (industry, innovation, and infrastructure), SDG 10 (reduced inequalities), SDG 11 (sustainable cities and communities) and SDG 13 (climate action).

The result offers policy implications to improve environmental quality through reduction in CO_2 emission per capita in Myanmar. Myanmar should pay more attention to attain green economy through transforming from carbon intensive industries to non-carbon intensive industries. In the manufacturing sector, product should be created in an environmentally sensible way and in the most energy efficient manner. It should apply command and control strategies such as setting rules and regulation for a use of inputs, product design, and technological design for manufacturing industries including local and FDI to mitigate CO_2 emission per capita; as well

as incentive-based strategy such as imposing taxation on polluted industries, and/or subsidies on non-carbon intensive industries as well as to introduce clean technologies. The focus should be on innovation-driven sustainable industrialization in Myanmar. To achieve sustainability, effective environmental and energy policies need to be focused to improve environmental quality through reduction in CO_2 emission without compromising economic growth and thereby leading towards green growth, green economy and achieve SDGs.

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