AgBioForum, 24(3): 1-7. ©2022 **AgBioForum**

The Role of Financial Credits, Economic Growth, and Sustainable Energy on the Environmental Condition in Iraq

Mona Abdel Sakban Fahd
University of Babylon, College of Administration and Economics, Iraq
Email: bus.sakban@student.uobabylon.edu.iq

Mahdi Khaleel Shadeed Al-Mamoori
University of Babylon, College of Administration and Economics, Iraq
Email: bus.mahdi.khaleel@uobabylon.edu.iq

Hussein Abbas Al-Shammari

University of Babylon, College of Administration and Economics, Iraq
Email: bus.hussein.abbas@uobabylon.edu.iq

Due to enormous commercial and financial operations that demand new literature and the experience of regulators, environmental degradation has become an important issue. Consequently, this study investigates the effect of financial credits, economic growth (EG), renewable energy (RE) output, and energy import on Iraq's environmental condition (carbon dioxide (CO_2) emissions. The paper also utilized a control variable, such as industrialization, to predict Iraq's environmental circumstances. From 1991 through 2020, secondary statistics were gathered from the World Development Indicators (WDI). Dynamic Auto-regressive Distributed Lags (DARDL) were used to examine the variables' relationship. Financial credits, economic growth, RE output, energy import, and industrialization were found to have a negative relationship with CO_2 emissions in Iraq. The research advises policymakers on preventing environmental deterioration through effective financial credits, economic growth, and renewable energy.

Key words: Financial credits, economic growth, renewable energy output, energy import, environmental condition, CO_2 emissions.

1. INTRODUCTION

In Iraq and other developing countries, bank credit is defined as money granted by financial institutions exclusively to private sector enterprises and households. It excludes government-provided finance. The average value of bank credit in Iraq between 1960 and 2020 was 7.97 percent, with a minimum of 1.27 percent in 2004 and a maximum of 14.07 percent in 1970. In 2020, the percentage was 13.07 percent. Based on information from 161 countries, the global average in 2020 is 58.11 percent. 1) Although there is a large body of literature on the concept of environmental conditions, particularly in developing countries, many of its aspects remain unexplored, particularly from an Iraqi perspective; therefore, the present investigation will focus on environmental conditions to highlight their significance to improve the world's environmental quality and conditions for the future. 2) Le T-H et al. (2020) and Kim et al. (2020) worked on the financial credits and CO_2 emission; however, the current study will also work on it with the addition of economic growth, RE output, energy import, and industrialization in Iraq with a new data set.

3) The model incorporating financial credits, economic growth, RE output, energy import, industrialization, and CO2 emissions in Iraq has not been validated in recent years. 4) Muhammad (2019) and Abbasi et al. (2021) worked on energy, EG, and CO_2 emission; however, the current study will also work on it, in addition to the addition of financial credits, RE output, energy import, and industrialization in Iraq with a new sample set. 5) Chen et al. (2019) and Sinha et al. (2018) worked on the relationship between RE output and environmental degradation. In contrast, using a new data set, the current study will examine the relationship between the addition of financial credits, economic growth, RE output, energy import, and industrialization. 6) Naimoğlu (2022) and Lin and Raza (2020) worked on energy imports and CO_2 emissions. However, the current study will also work on this relationship by adding other variables, such as financial credits, economic growth, RE output, and industrialization in Iraq, using a new data set. 7) Li et al. (2015) and Sinha et al. (2018) worked on industrialization and CO_2 emission. In contrast, using a new data sample, the current study will examine the relationship with adding variables such as financial credits, economic growth, RE output, and energy import in Iraq.

The significance of the present investigation is that 1) the present investigation will highlight the importance of the environment for the future of Iraq and the world, 2) the present investigation will add to the literature on environmental conditions in Iraq, and 3) the present investigation will also provide the support to ecologically related professionals to review and upgrade policies about the environment to create a safe future for the world.

2. LITERATURE REVIEW

Due to the growth in CO_2 emissions, global environmental degradation is accelerating at an alarming rate. To reduce its effects, the international community is concentrating on financial credits. According to the literature, there is a significant relationship between financial credits and CO_2 emission. Le T-H et al. (2020) examined if financial inclusion, including financial credits, affects CO_2 emissions in this environment. The research was conducted on 31 Asian economies. As a sample, the investigation employed the 10-year data set. The collected information spans the years 2004 through 2014. Using PC Analysis, the collected material was examined. The research indicated that the increase in CO_2 emissions in the

region appears to result from higher income, energy consumption, industry, urbanization, foreign direct investment, and financial inclusion. It seems that increased economic openness has reduced CO2 emissions. Kim et al. (2020) studied if financial credits through the finance curse affect CO2 emission. The investigation was conducted in developed and developing nations. The investigation utilized the 24-year data set as a sample. The collected data spans the years 1989 through 2013. The collected material was examined using the ARDL technique (Hamsal et al., 2021).

The analysis indicated a strong correlation between financial credits and CO_2 emissions. The nature of the relationship is favorable. The increase in financial credits results in increased investment in environmentally friendly projects and reduces CO_2 emissions. In addition, Khezri et al. (2021) examined whether there is a correlation between financial development, i.e., financial development, and CO2 emissions. The examination was conducted on the 31 economies of Asia and the Pacific. The investigation utilized the 18-year data set as a sample. The collected data spans the years 2000 through 2018. The collected sample was examined using the Spatial Durbin model. The analysis indicated that financial development, namely financial credits, had a substantial positive effect on CO_2 emissions in the selected economies.

Any nation's prosperity depends on its economic conditions. A nation with a healthy EG rate protects its future generation. Several factors affect or are affected by EG, and CO_2 emission is one of them. Muhammad (2019) explored whether there is a correlation between economic growth and CO_2 emissions in this environment. The examination was conducted on the economies of the Middle East and North Africa. The investigation utilized the 16-year data set as a sample. The collected information spans the years 2001 to 2017. The collected material was examined using the GMM technique. The results demonstrated a negative relationship between EG and CO_2 emission. An improvement in EG results in a reduction in CO_2 emissions. Abbasi et al. (2021) investigated the relationship between energy, industrial growth, urbanization, CO_2 emissions, and EG. The investigation took place in Pakistan. The investigation utilized the 50-year data set as a sample. The collected information spans the years 1972 to 2018. The collected material was examined using the ARDL method.

The analysis found that both industrial-added value and energy usage have a favorable effect on EG. Therefore, we conclude that CO_2 emissions positively impact Pakistan's economic development. In addition, Radmehr et al. (2021) examined the relationship between RE usage, CO_2 emissions, and EG. The examination focused on the economies of the European Union. The investigation utilized the 20-year data set as a sample. The collected information spans the years 1995 to 2014. GS2SLS was applied to the collected sample. Economic development and geographical correlation were found to have a stronger relationship than carbon dioxide (CO_2) emissions or renewable energy (RE) utilization. In addition, there is a reciprocal relationship between EG, carbon emissions, and the utilization of renewable energy.

Energy is necessary today, as every business and home activity depend on it. The huge quantity of energy products impacts the environment via CO_2 emissions. Chen et al. (2019) evaluated the relationship between RE production EG, foreign commerce, and CO_2 emission in this environment. In China, the investigation was conducted. As a sample, the investigation used the 34-year data set. The collected data spans the years 1980 through 2014. The collected material was analyzed using ARDL and other techniques. The results demonstrated the correlation between RE production and CO_2 emission. Particularly in China, the growth in RE output cuts CO_2 emissions. Likewise, Sinha et al. (2018) examined the relationship between RE generation and CO_2 emission. In India, the investigation was conducted. The investigation utilized the 44-year data set as a sample. The collected data spans the years 1971 through 2015. The collected material was examined using the ARDL technique. The study results indicate that the long-run elasticity of energy consumption is greater than the short-run elasticity, even though RE has been proven to have a significant negative impact on CO_2 emissions. de Souza Mendonça et al. (2020) examined the relationship between GDP, population, RE production, and CO_2 emission. The analysis was conducted on the world's 50 largest economies. The investigation utilized the 35-year data set as a sample. The collected data spans the years 1990 through 2015. The collected sample was analyzed using a historical regression model. 1) In the selected economies, CO_2 emissions increase by 0.27 percent for every 1 percent increase in GDP; 2) in all economies, CO_2 emissions increase by 1.67 percent for every 1 percent increase in population; and 3) the average reduction in CO_2 emissions caused by a 1 percent increase in RE's electrical matrix share is 0.13 percent.

Developing nations throughout the world import energy to meet their energy needs. This energy import is also related to several additional concerns, such as environmental degradation and EG. In this regard, Naimoğlu (2022) examined the relationship between energy imports and CO_2 emissions. The analysis was conducted on the world's top 10 energy-importing economies. As an example, the investigation utilized the thirty-year data set. The collected data spans the years 1990 through 2019. The collected material was examined using the ARDL technique. The analysis found that the EKC theories apply to these economies.

Moreover, the usage of nuclear energy and the pricing of energy reduces CO_2 emissions. However, energy imports result in increased CO_2 emissions. Lin and Xu (2020) also examined the relationship between energy security and CO_2 emissions. The investigation took place in Pakistan. As a sample, the investigation used the 28-year data set. The collected data spans the years 2012 through 2040. The

collected sample was analyzed using the MARKAL framework. The analysis indicated that while total RE will increase, the availability of primary energy would decrease only somewhat. The transportation industry and other sectors would consume the most fuel, increasing CO_2 emissions that may be offset by using renewable energy sources. In addition, Rehman et al. (2021) examined the relationship between industrialization, energy imports, economic development, and CO_2 emission. The investigation took place in Pakistan. The investigation utilized the 50-year data set as a sample. The collected data spans the years 1971 through 2019. The collected material was examined using the ARDL technique. The investigation's findings demonstrated that industrialization had a favorable effect on CO_2 emissions. The shifting EG has a detrimental impact on CO_2 emissions.

There are various factors for the global increase in CO2 emissions. A quick development in industrialization is one of the key drivers. In this context, Li et al. (2015) investigate whether urbanization, industrialization, and CO2 emissions are related. The research was conducted on 73 economies. The investigation utilized the 40-year data set as a sample. The collected information spans the years 1971 through 2010. The collected material was examined using the STIRPAT technique. The analysis results demonstrated that industrialization and CO_2 emissions are significantly related. A rise in CO_2 emissions also accompanies increased industrialization.

Similarly, Sinha et al. (2018) demonstrated the connection between industrialization and CO_2 emission. Investigations were conducted in Bangladesh. The investigation utilized the 35-year data set as a sample. The collected information spans the years 1975 through 2010. The collected material was examined using the ARDL technique. The results demonstrated that industrialization increases CO_2 emissions, particularly in Bangladesh. In addition, Mentel et al. (2022) examined the connection between industrialization and CO_2 emission. The investigation was conducted on the 44 sub-Saharan African economies. The investigation utilized the 15-year data set as a sample. The collected data spans the years 2000 through 2015. The collected sample was examined using a GMM estimator. According to the investigation findings, industrialization increases CO_2 emissions in selected economies, leading to environmental damage.

3. RESEARCH METHODS

The article examines the impact of financial credits, EG, RE output, energy import, and industrialization on CO_2 emissions in Iraq. The research used the secondary data extracted from the WDI from 1991 to 2020. The study equation is given as under:

$$CO2E_t = \alpha_0 + \beta_1 FC_t + \beta_2 EG_t + \beta_3 REO_{it} + \beta_4 EI_t + \beta_5 IND_t + e_t \quad \textbf{(1)}$$

Where;

CO2E	=	Carbon Dioxide Emissions
t	=	Time Period
FC	=	Financial Credits
EG	=	Economic Growth
REO	=	Renewable Energy Output
EI	=	Energy Import
IND	=	Industrialization

The primary variable of the study was the environmental state as measured by CO_2 emissions (metric tons per capita). In addition, the study employed three predictors, including financial credits measured with domestic credit provided by the financial sector (percentage of GDP), EG measured with GDP growth (annual percentage), and sustainable energy measured with RE output (percentage of total output) and energy import (percentage of energy use). The article also utilized the control variable, such as industrialization as measured by Industry value added (percent of GDP). These measurable constructions are listed in Table 1.

Table 1: Variables with Measurements

S#	Variables	Measurement	Sources
01	Environmental Condition	CO2 emissions (metric tons per capita)	WDI
02	Financial Credits	Domestic credit provided by the financial sector (% of GDP)	WDI
03	Economic Growth	GDP growth (annual percentage)	WDI
04	Sustainable Energy	RE output (% of total output)	WDI
		Energy import (% of energy use)	WDI
05	Industrialization	Industry value added (% of GDP)	WDI

The study employed descriptive statistics to examine the details of the variables, including minimum values, total observations, maximum values, average values, and standard deviations. In addition, the correlation matrix was used to examine the correlation between predictors. In addition, the unit root was verified using the Phillips–Perron (PP) and Augmented Dickey–Fuller (ADF) tests. The equation is as follows:

$$d(Y_t) = \alpha_0 + \beta t + YY_{t-1} + d(Y_t(-1)) + \varepsilon_t \quad \textbf{(2)}$$

In addition, the research applied the (Westerlund et al., 2008) approach to examine the co-integration among variables. The equations are given below:

$$LM_{\varphi}(i) = T\hat{\varphi}_i\,(\hat{r}_i/\hat{\sigma}_i) \quad \textbf{(3)}$$

$$LM_{\tau}(i) = \hat{\varphi}_i/SE(\hat{\varphi}_i) \quad \textbf{(4)}$$

The equations show $\hat{\boldsymbol{\varphi}}_{\boldsymbol{i}}$ that represents the estimate beside standard error, r^2_i that represents the long-run measured variance, $\boldsymbol{\varphi i}\ \boldsymbol{(L)} = \mathbf{1} - \sum \boldsymbol{\varphi_{ij}} \boldsymbol{L^j}$ represents the scalar polynomial with L lag length, and ρ_i represents the factor loading parameters vector.

In addition, the ARDL model, which offers the short- and long-run correlation between variables, was utilized in this

study. It is the optimal method for determining the link between variables when neither I(0) nor I(1) have a unit root (Zaidi et al., 2018). In addition, it controls the impact of autocorrelation and heteroscedasticity on estimations (Nazir et al., 2018). The equation is given as follows:

$$\Delta CO2E_t = \alpha_0 + \sum\delta_1\Delta CO2E_{t-1} + \sum\delta_2\Delta FC_{t-1} + \sum\delta_3\Delta EG_{t-1} + \sum\delta_4\Delta REO_{t-1} + \sum\delta_5\Delta EI_{t-1} + \sum\delta_6\Delta IND_{t-1} + \varphi_1 CO2E_{t-1} + \varphi_2 FC_{t-1} + \varphi_3 EG_{t-1} + \varphi_4 REO_{t-1} + \varphi_5 EI_{t-1} + \varphi_6 IND_{t-1} + \varepsilon_t \quad (5)$$

The research also employed the DARDL to examine the relationship between factors. This strategy is created by Jordan et al. (2018). This strategy addresses all the drawbacks of the standard ARDL paradigm. The equation is given as follows:

$$\Delta CO2E_t = \alpha_0 + \sum\delta_1\Delta CO2E_{t-1} + \sum\delta_2\Delta FC_t + \sum\delta_3\Delta FC_{t-1} + \sum\delta_4\Delta EG_t + \sum\delta_5\Delta EG_{t-1} + \sum\delta_6\Delta REO_t + \sum\delta_7\Delta REO_{t-1} + \sum\delta_8\Delta EI_t + \sum\delta_9\Delta EI_{t-1} + \sum\delta_{10}\Delta IND_t + \sum\delta_{11}\Delta IND_{t-1} + \varepsilon_t \quad (6)$$

4. FINDINGS OUTCOMES

The study employed descriptive statistics to examine the details of the variables, including minimum values, total observations, maximum values, average values, and standard deviations. The results revealed that the average value of CO_2E was 11,219 metric tons per capita, while the average value of FC was 31,201 percent, and EG was 9,010 percent. In addition, the results indicated that the average value of REO was 54.091%, the average value of EI was 5.902%, and the average value of IND was 44.720%. Table 2 displays these results.

Table 2: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
CO2E	30	11.219	0.732	7.121	14.320
FC	30	31.201	1.201	28.102	39.133
EG	30	9.010	2.493	7.201	13.298
REO	30	54.091	3.731	51.029	61.256
EI	30	5.902	0.860	1.401	9.257
IND	30	44.720	2.776	37.892	47.676

In addition, the correlation matrix was used to examine the correlation between predictors. According to the findings of this study, the financial credits, EG, RE output, energy import, and industrialization are negatively correlated with CO_2 emissions in Iraq. Table 3 displays these results.

Table 3: Matrix of Correlations

Variables	CO2E	FC	EG	REO	EI	IND
CO2E	1.000					
FC	-0.673	1.000				
EG	-0.616	0.382	1.000			
REO	-0.321	0.733	0.783	1.000		
EI	-0.736	0.482	0.438	0.330	1.000	
IND	-0.322	0.734	0.543	0.493	0.544	1.000

In addition, the paper utilized the PP and ADF tests to validate the unit root. CO2E, FC, EG, and IND were shown to be stationary at level, while REO and EI were stationary at first difference. Table 4 displays these results.

Table 4: Unit Root Test

	ADF		PP	
Series	Level	First difference	Level	First difference
CO2E	-2.011***	------	-2.721***	------
FC	-3.012***	------	-3.331***	------
EG	-2.421***	-----	-2.782***	------
REO	------	-5.102***	------	-5.902***
EI	------	-5.423***	------	-5.910***
IND	-3.631***	------	-3.781***	------

In addition, the technique (Westerlund et al., 2008) was utilized to analyze the co-integration of variables. The results indicated that p-values are less than 0.05 and t-values are more significant than 1.96, meeting the standard criterion. These results suggest that co-integration exists. Table 5 displays these results.

Table 5: Co-integration Test

Model	No Shift		Mean Shift		Regime Shift	
	Test Stat	p-value	Test Stat	p-value	Test Stat	p-value
LM_τ	-3.021	0.000	-4.392	0.000	-5.771	0.000
LM_φ	-3.328	0.000	-4.901	0.000	-5.891	0.000

The research also employed the DARDL to examine the relationship between factors. According to the findings of this study, the financial credits, EG, RE output, energy import, and industrialization are negatively correlated with CO_2 emissions in Iraq. These connections are shown in Table 6.

Table 6: Dynamic ARDL Model

Variable	Coefficient	t-Statistic	Prob.
CO2E	4.021***	5.782	0.000
FC_{t-1}	-3.782***	-6.019	0.000
FC	-3.102**	-3.102	0.043
EG_{t-1}	-4.392***	-3.223	0.004
EG	-3.201***	-4.301	0.002
REO_{t-1}	-0.676***	-5.888	0.000
REO	-1.291**	-2.338	0.032
EI_{t-1}	-2.191***	-4.102	0.000
EI	-0.887***	-5.201	0.000
IND_{t-1}	-2.102***	-2.133	0.009
IND	-0.891**	-3.291	0.002
Cons	-2.192**	-4.201	0.000
R square = 56.201			Stimulation = 5000

5. DISCUSSIONS

The results demonstrated a negative correlation between financial credits and CO_2 emissions. These results are consistent with Le T-H et al. (2020), who found that using diverse materials, such as plastic, metals, chemicals, etc., in various economic sectors generates smoke, fumes, or harmful wastes. These compounds produce CO_2 emissions. The availability of financial credits helps businesses to switch to eco-friendly products and halts CO_2 emissions. These results are also consistent with the findings of Lv et al. (2021), who found that even though economic actions create hazardous gases from waste, financial credits enable businesses to adopt effective environmental management and lower CO_2 emissions. The results demonstrated a negative correlation between EG and CO_2 emissions. The results are consistent with Adedoyin et al. (2020)'s assertion that, even though the increasing frequency of economic practices causes waste and CO_2 emissions, EG promotes innovative economic strategies that lead to a decrease in waste and, consequently, waste emissions. These conclusions are consistent with Lin and Raza (2020)'s research. This prior study suggests that when a nation outperforms its competitors on the global market, it has a greater capacity to utilize eco-friendly technical resources and, consequently, regulate CO_2 emissions, which may be detrimental to the natural environment.

The results demonstrated a negative correlation between RE output and CO_2 emissions. These results are consistent with the research of Radmehr et al. (2021), which investigates the effectiveness of RE technology in reducing CO_2 emissions. According to the study, mining for energy resources and nuclear energy reactions release greenhouse gases contributing to climate change. The alternate solution, the RE output, maintains the lowest CO_2 emission economic practices. These results are also consistent with the findings of Razmjoo et al. (2021), who found that in countries with abundant renewable energy production, the demand for fossil fuels derived from mining and nuclear energy declines.

Consequently, there is a significant drop in CO_2 emissions. The results demonstrated a negative relationship between energy imports and CO_2 emissions. These results are consistent with the findings of Zhang et al. (2019), who hypothesize that importing foreign RE technologies stimulates domestic enterprises to shift to renewable energy to continue operations. The energy shift reduces carbon dioxide emissions. These results are also consistent with Zhang et al. (2019)'s research, which demonstrates that importing energy-efficient technology and RE sources reduces reliance on non-RE-based economic practices. Consequently, there are fewer CO_2 emissions.

The results demonstrated a negative relationship between industrialization and CO_2 emissions. According to Jin et al. (2021)'s research, the industrial revolution brings about changes in technology applicable to economic operations. The eco-friendly economic technologies produce identical results with fewer CO_2 emissions. These results are consistent with Appiah et al. (2021)'s assertion that industrialization promotes innovative organizational practices. The innovativeness enhances the efficiency of the business and decreases the likelihood of CO_2 emissions.

6. IMPLICATIONS

As a result of the present study's substantial contribution to literature, scholars might utilize it as a guide for future literary endeavors. The study investigates the environmental effects of financial credits, EG, RE output, and energy import, as well as controlling factors such as industrialization. In this study, CO_2 emissions have been used as a proxy for environmental conditions. In addition, the writers begin analyzing environmental circumstances in Iraq as a result of financial credits, EG, RE output, and energy imports.

The present research also has numerous empirical implications. The research instructs environmental authorities and economics on how to decrease CO_2 emissions. The study suggests that to reduce CO_2 emissions, and policymakers must boost financial credit inside the economy. It suggests that governments and economists should focus on raising EG to reduce CO_2 emissions. The research assists policymakers in formulating measures to prevent environmental deterioration via appropriate financial credits, EG, and renewable energy sources. There is a directive for policymakers mandating that they increase RE output. It

would reduce carbon dioxide emissions. It is also urged that the importation of renewable, clean, and economical energy should be encouraged, and CO_2 emissions should be minimized. In addition, the study indicates that governments must effectively control industrialization to reduce CO_2 emissions and improve environmental quality.

7. CONCLUSION

The study aimed to determine the contribution of financial credits, EG, RE output, energy import, and industrialization to environmental improvement. Iraqi empirical data on financial credits, EG, RE output, energy import, industrialization, and CO_2 emissions were gathered by questionnaire surveys. The results demonstrated a negative relationship between CO_2 emissions and financial credits, EG, RE output, energy import, and industrialization. The results indicated that the availability of financial credits improves the financial situation of businesses and increases their capacity to battle CO_2 emissions and exercise environmental responsibility. The results showed that when a country is destined to have a higher EG, it engages in inventive development and reduces its CO_2 emissions. The results suggested that countries proficient in producing considerable quantities of RE can mitigate CO_2 emissions. The study found that a country's ability to import energy enhances its use of clean energy and its CO_2 mitigation efforts. In addition, the study suggested that efforts for growing industrialization within the country's borders promote economic growth and help reduce CO_2 emissions.

8. LIMITATIONS

The role of financial credits, EG, RE output, and energy import in environmental conditions has lately been examined. Numerous aspects can be utilized to improve environmental circumstances, and researchers are expected to investigate them. Second, only CO_2 emission has been discussed as a proxy for environmental conditions in this study. Greenhouse gases are superior indicators of environmental quality. Therefore, future authors must study greenhouse gases rather than CO_2 emissions to quantify environmental quality more accurately.

REFERENCES

Abbasi, K. R., Shahbaz, M., Jiao, Z., & Tufail, M. (2021). How energy consumption, industrial growth, urbanization, and CO2 emissions affect economic growth in Pakistan? A novel dynamic ARDL simulations approach. *Energy*, *221*, 119793. doi: https://doi.org/10.1016/j.energy.2021.119793

Adedoyin, F. F., Gumede, M. I., Bekun, F. V., Etokakpan, M. U., & Balsalobre-Lorente, D. (2020). Modelling coal rent, economic growth and CO2 emissions: does regulatory quality matter in BRICS economies? *Science of the Total Environment*, *710*, 136284. doi: https://doi.org/10.1016/j.scitotenv.2019.136284

Appiah, M., Li, F., & Korankye, B. (2021). Modeling the linkages among CO 2 emission, energy consumption, and industrialization in sub-Saharan African (SSA) countries. *Environmental Science and Pollution Research*, *28*, 38506-38521. doi: https://doi.org/10.1007/s11356-021-12412-z

Chen, Y., Wang, Z., & Zhong, Z. (2019). CO2 emissions, economic growth, renewable and non-renewable energy production and foreign trade in China. *Renewable Energy*, *131*, 208-216. doi: https://doi.org/10.1016/j.renene.2018.07.047

de Souza Mendonça, A. K., Barni, G. d. A. C., Moro, M. F., Bornia, A. C., Kupek, E., & Fernandes, L. (2020). Hierarchical modeling of the 50 largest economies to verify the impact of GDP, population and renewable energy generation in CO2 emissions. *Sustainable Production and Consumption*, *22*, 58-67. doi: https://doi.org/10.1016/j.spc.2020.02.001

Hamsal, M., Ichsan, M., Utomo, A. R., Fahira, A. A., & Wetik, R. E. (2021). The relationship analysis between knowledge & skills, organizational drivers, and perceived success in implementation of agile project management: Case study of PT XYZ. *International Journal of Operations and Quantitative Management*, *27*(2), 111-126. doi: https://doi.org/10.1016/10.46970/2021.27.2.2

Jin, S., Hao, Z., Zhang, K., Yan, Z., & Chen, J. (2021). Advances and challenges for the electrochemical reduction of CO2 to CO: from fundamentals to industrialization. *Angewandte Chemie*, *133*(38), 20795-20816. doi: https://doi.org/10.1002/ange.202101818

Jordan, S., & Philips, A. Q. (2018). Cointegration testing and dynamic simulations of autoregressive distributed lag models. *The Stata Journal*, *18*(4), 902-923. Retrieved from https://journals.sagepub.com/doi/pdf/10.1177/1536867X1801800409

Khezri, M., Karimi, M. S., Khan, Y., & Abbas, S. (2021). The spillover of financial development on CO2 emission: a spatial econometric analysis of Asia-Pacific countries. *Renewable and Sustainable Energy Reviews*, *145*, 111110. doi: https://doi.org/10.1016/j.rser.2021.111110

Kim, D.-H., Wu, Y.-C., & Lin, S.-C. (2020). Carbon dioxide emissions and the finance curse. *Energy Economics*, *88*, 104788. doi: https://doi.org/10.1016/j.eneco.2020.104788

Le T-H, L. H.-C., & Taghizadeh-Hesary, F. (2020). Does financial inclusion impact CO 2 emissions. *Evidence from Asia. Finance Res. Lett*, *34*, 101451. doi: https://doi.org/10.1016/j.frl.2020.101451

Li, K., & Lin, B. (2015). Impacts of urbanization and industrialization on energy consumption/CO2 emissions: does the level of development matter? *Renewable and Sustainable Energy Reviews*, *52*, 1107-1122. doi: https://doi.org/10.1016/j.rser.2015.07.185

Lin, B., & Raza, M. Y. (2020). Analysis of energy security indicators and CO2 emissions. A case from a

developing economy. *Energy*, *200*, 117575. doi: https://doi.org/10.1016/j.energy.2020.117575

Lin, B., & Xu, B. (2020). How does fossil energy abundance affect China's economic growth and CO2 emissions? *Science of the Total Environment*, *719*, 137503. doi: https://doi.org/10.1016/j.scitotenv.2020.137503

Lv, Z., & Li, S. (2021). How financial development affects CO2 emissions: a spatial econometric analysis. *Journal of Environmental Management*, *277*, 111397. doi: https://doi.org/10.1016/j.jenvman.2020.111397

Mentel, U., Wolanin, E., Eshov, M., & Salahodjaev, R. (2022). Industrialization and CO2 emissions in Sub-Saharan Africa: the mitigating role of renewable electricity. *Energies*, *15*(3), 946. doi: https://doi.org/10.3390/en15030946

Muhammad, B. (2019). Energy consumption, CO2 emissions and economic growth in developed, emerging and Middle East and North Africa countries. *Energy*, *179*, 232-245. doi: https://doi.org/10.1016/j.energy.2019.03.126

Naimoğlu, M. (2022). The impact of nuclear energy use, energy prices and energy imports on CO2 emissions: Evidence from energy importer emerging economies which use nuclear energy. *Journal of Cleaner Production*, *373*, 133937. doi: https://doi.org/10.1016/j.jclepro.2022.133937

Nazir, M. I., Nazir, M. R., Hashmi, S. H., & Ali, Z. (2018). Environmental Kuznets Curve hypothesis for Pakistan: Empirical evidence form ARDL bound testing and causality approach. *International Journal of Green Energy*, *15*(14-15), 947-957. doi: https://doi.org/10.1080/15435075.2018.1529590

Radmehr, R., Henneberry, S. R., & Shayanmehr, S. (2021). Renewable energy consumption, CO2 emissions, and economic growth nexus: a simultaneity spatial modeling analysis of EU countries. *Structural Change and Economic Dynamics*, *57*, 13-27. doi: https://doi.org/10.1016/j.strueco.2021.01.006

Razmjoo, A., Kaigutha, L. G., Rad, M. V., Marzband, M., Davarpanah, A., & Denai, M. (2021). A Technical analysis investigating energy sustainability utilizing reliable renewable energy sources to reduce CO2 emissions in a high potential area. *Renewable Energy*, *164*, 46-57. doi: https://doi.org/10.1016/j.renene.2020.09.042

Rehman, A., Ma, H., & Ozturk, I. (2021). Do industrialization, energy importations, and economic progress influence carbon emission in Pakistan. *Environmental Science and Pollution Research*, *28*, 45840-45852. doi: https://doi.org/10.1007/s11356-021-13916-4

Sinha, A., & Shahbaz, M. (2018). Estimation of environmental Kuznets curve for CO2 emission: role of renewable energy generation in India. *Renewable Energy*, *119*, 703-711. doi: https://doi.org/10.1016/j.renene.2017.12.058

Westerlund, J., & Edgerton, D. L. (2008). A simple test for cointegration in dependent panels with structural breaks. *Oxford Bulletin of Economics and statistics*, *70*(5), 665-704. doi: https://doi.org/10.1111/j.1468-0084.2008.00513.x

Zaidi, S., & Saidi, K. (2018). Environmental pollution, health expenditure and economic growth in the Sub-Saharan Africa countries: Panel ARDL approach. *Sustainable Cities and Society*, *41*, 833-840. doi: https://doi.org/10.1016/j.scs.2018.04.034

Zhang, Z., Xi, L., Bin, S., et al. (2019). Energy, CO2 emissions, and value added flows embodied in the international trade of the BRICS group: A comprehensive assessment. *Renewable and Sustainable Energy Reviews*, *116*, 109432. doi: https://doi.org/10.1016/j.rser.2019.109432