DOI: 10.20472/EFC.2023.018.001

RUBA ALJARALLAH

Public Authority for Applied Education and Training , United Kingdom

IMPACT OF MINERAL RESOURCE RENT ON ECOLOGICAL FOOTPRINT IN GULF COUNTRIES

Abstract:

It is mostly the countries in the Gulf region that are blessed with natural resources that are faced with significant resource capital management challenges. As a result, these nations' capacity to utilize their blessed natural resources in the creation of goods that can be exported is reduced. Through the utilization of time-series data spanning the years 2000-2020, the research examined the main critical components that are responsible for causing damage to the ecosystem in five Gulf countries mainly, Saudi Arabia, UAE, Qatar, Kuwait, and Oman. The utilization of resource rents rather than resource value is a direct result of this phenomenon. According to the findings, mineral resource rents are the most significant determinants of the resource, which depletes mineral resources, in addition, economic activity and the renting out of resources also raise the ecological footprint. Industrialization also increases the ecological footprint in Gulf countries. According to the findings, it is vital to enact different resource regulations and policies that could be based on incentives to reduce the ecological footprints and the consumption of natural resources.

Keywords:

Ecological footprint, Resource rent, Developing countries, Regulation, Environment

JEL Classification: Q30, Q50, Q57

Introduction

It is a popular topic in environmental economics and among policymakers to address the obstacles in achieving sustainable development that is connected to excessive biodiversity loss, climate change, and carbon emission. The context of Gulf Countries (GC) cannot be neglected in ecological disasters due to the dependence of these countries' economies on fossil fuels and natural resources such as oil, and gas exports. These countries are responsible for carbon emissions by using abundant amounts of fossil fuels as compared to the world. The UAE, Saudi Arabia, and Iran were declared as the top 50 CO2 emitters in the world. It can be clearly seen in the published reports that Gulf countries are responsible for climate change, and they need to look at environment-friendly energy sources consumption (Raouf, 2008).

In recent years the concept of ecological footprint has been utilized for ecological degradation in environmental sustainability which majorly focused on greenhouse gas emissions (Sharif et al., 2020). The ecological footprint includes the demand for resources on six different surfaces: croplands, woodlands, grasslands, fishing regions, urbanized land, and carbon sequestration. When there is more resource demanded and wasted by a country or individuals than nature has provided and refilled it is directed to the ecological deficit. In developing countries, this ecological deficit is very high due to many reasons i.e. overpopulation, etc. In environmental economies, the introduction of an ecological footprint has increased the focus of discussion on the sustainability of economic development procedures. We can assess the effectiveness and viability of human activities in the long run by using the ecological footprint. It is a tool that measures how many environmental resources are utilized (Wackernagel & Rees, 1998). The tool of ecological footprint is widely used among various regions and countries for measuring environmental quality.

The ecological footprint measures an ecosystem's potential to renew in a biophysical amount while still being able to create consumer goods. Due to the concentration of enterprises in urban areas, it is not limited to measuring the quantity of pollution resulting from the consumption of natural resources; it also includes emissions from the consumption of energy substances (Ahmed et al., 2021). According to the findings of several empirical research, the over-exploitation of natural resource rents and consistent per capita income growth are the main factors contributing to the decline in environmental quality (Murakami et al., 2020).

The ecological imbalance in the Gulf Countries has a considerable impact on production and consumption activities. Environmental pollution, biodiversity loss, desertification, demolition debris, construction, and deforestation impede the sustainable development of GC. The issues

related to the environment are interlinked such as overgrazing cause desertification, wastage emits methane, etc. The increasing trend of urbanization and industrialization leads to environmental degradation in these countries. The refiners, oil spills, and brine wastewaters in GC have a serious threat to global warming (Sheppard, 2010). GC face considerable challenges in natural resource conservation due to their dependence on petrochemical industries, oil, and gas for this they mainly utilize fossil fuels which results in a rise in carbon dioxide emissions. These challenges also restrain these countries from carbon sinks, forests, and green areas which are supportive of natural resource conservation although they are abundant in various resources in the globalized world (Ansari, 2020).

The lack of international cooperation and help makes this issue worse, giving rise to the resource curse hypothesis (Frankel, 2010). In a country with a rise in ecological footprints, the decrease in sustainable production by industries, increasing resource prices, and policies related to trade liberalization, etc. all these things have a corrosive impact not only on the country's resource capital but also on the global agenda for resource conservation (Nahman et al., 2009). The introduction of structural changes by industrialization for modernization increases the use of fertile land for industrial purposes which results in the depletion of mineral resources and obstructs resource conservation efforts in GC. This ecological footprint issue has risen in GC and the existence of this issue for a longer duration gives unsustainable development which made natural resource conservation more difficult for upcoming generations (Barendse et al., 2016).

The long-term use of land for natural resource extraction and economic expansion in GC puts a threat to biodiversity loss. The resource damage function' must consider the economic issues associated with mineral depletion (Steen, 2006). The so-called design is used to gauge the depreciation of mineral resources, which is primarily affected by rising resource rents. Mineral resources are regularly depleted because of the rise in demand for them during the industrialization process. The mineral resources rent increased very rapidly in the last decade in emerging economies which result in mineral resource depletion as well as the fast grow of trade openness. The increase in trade also increases per capita income by realizing industrial value added (Yang et al., 2022).

Literature Review

The Gulf Cooperation Council (GCC) nations, which include Saudi Arabia, the United Arab Emirates, Kuwait, Bahrain, Qatar, and Oman, possess abundant natural resources such as minerals, gas, oil, and forests. Evidence showed that GCC countries contain 19.8% of the total

world's natural gas resources (BP, 2019). Due to their reliance on fossil fuels, the GCC countries experience a significant percentage of CO2 emissions. They rely on oil and gas income to fund their industrial and economic projects and to offer social services to their population (Ansari et al., 2020). In total, the GCC countries make up only 0.6% of the world's population yet are responsible for 2.4% of their greenhouse gas emissions (Bekhet et al., 2017). As the population of these countries grows their need for electricity, transportation, etc., also increases which requires the large production of fossil fuels to meet these needs. Most of the GCC countries produce 100% of their electricity from fuel, which has resulted in an increase in CO2 emissions from fuel combustion of 9781.4 million tons from 1971 to 2016 (El-Agouz, 2022). These countries are rich in natural resources results in the cheapest price of oil and petrol and higher per capita incomes, all of which have a negative impact on the environment since they encourage extravagant spending (Ansari et al., 2020).

In the world of energy consumers, GCC countries ranked high in the top 10 among all other countries in 2014. In 2019 World Bank declared Qatar as the highest energy consumer country, consuming 18562.7 kg of oil equivalent per capita. As the mechanism of renewable energy is missing in the GCC countries they only rely on fossil fuels for domestic energy consumption (El-Agouz, 2017). These countries are rapidly growing economies in the same way their demand for energy consumption and extraction also rising which causes environmental degradation through mining, agriculture, industrialization, and deforestation (Baloch et al., 2019). The expansion and use of natural resources raises wealth, but it also causes an inevitable rise in the ecological footprint and a decrease in biological capacity. Urbanization, industrialization, and technological advancement bring benefits to GDP, but at the same time the ruinous implementation of these practices cannot be denied. The ecological footprint rises with urbanization, industrialization, and technological advancement. Also, due to the excessive reliance on crude oil, these countries are susceptible to oil shocks (Yilanci et al., 2020; Ansari et al., 2020).

The long-term sustainable development goals emphasize environmental quality in order to achieve them. There are specific goals; SDG6, SDG13, SDG14, and SDG15; which holistically deal with environmental contamination. These goals play a vital role in informing the significance of environmental quality in sustainable development so the ecological literature introduced various ways to reduce the loss of environmental quality and the potential of nature to replenish natural resources. The discussion in recent years has centered on identifying the causes of pollution and the methods for decreasing it. It is a serious concern that our current generation is rapidly depleting natural resources while the future generations will suffer and face the ultimate

consequences of this depletion. The standard of living of future generations will be impacted by the shortage of basic needs which can only be fulfilled by natural resources i.e., water etc.

The discussion must be expanded to cover all other relevant areas of environmental quality, and a call to action from all actors in the economy must be included. Particularly these actors are industries and consumers. Additionally, the problems associated with environmental deterioration can be properly addressed by urging these actors to act responsibly in the current grave condition of climate change caused by ecological footprint.

The overutilization or exploitation of useful natural resources will lead to damage to the ecosystem. However, it can be overcome by using an efficient technical and allocative system in the extraction of resources. An efficient resource extraction system can double energy. It may also impact the stock intensity as it drops significantly due to changing stock composition. The higher the requirement to boost usable energy, the more desirable it is for supporting global income (Carmona et al. 2021). On the other hand, the implementation of an environmental tax can help in decreasing the high air pollution and harmful impact on the ecosystem. It also generates tax revenue and improves the quality of air by restricting industries to adopt green production technologies. These green technologies bring healthy and wealthy economic life with less environmental cost (Wang & Yu, 2021). The policies related to renewable energy and biomass energy significantly reduce resource consumption across the world in this way the hazards to ecosystems also minimize (Grause, 2021). The imbalance in resources is one of the main reasons for various socio-economic and environmental issues. This imbalance negatively impacts the green development goal. In the earlier research era, environmental quality was majorly determined by financial development, and very less attention was paid to mineral resources (Shen et al., 2021; Sharf & Mikhalchuk, 2021). In order to underwrite sustainable insurance services across the world, green financing, and mineral resource conservation, it is crucial to assess the mineral resources and money supply interaction. Strong regulatory institutions can enforce regulations that help to overcome the negative effect of the resource curse on economic and more broadly human development indicators (Bulte, 2006). The curse of natural resources can convert into a blessing for countries having high institutional quality (Aljarallah & Angus, 2018; Mehlum, 2006).

In recent studies, it has been discovered that when a country is rich in natural resources, it tends to experience higher levels of inequality. This is primarily due to the negative impact of natural resource abundance on the quality of institutions, which in turn hinders individuals' ability to improve their income potential. The immediate consequence of this institutional deterioration is

observed in the realm of human development, as noted by Aljarallah (2019) and Carmignani (2013). Moreover, Aljarallah (2020) highlighted that dependency on natural resources could hinder the development of human capital, which is the major factor for innovation. Additionally, Cockx & Francken (2016) have found that countries with abundant natural resources tend to allocate fewer funds toward education spending. As suggested by Aljarallah (2020) that due to a false sense of security, GCC households and governments are less willing to promote other important sectors, such as education and health, therefore, there will be fewer incentives to prioritize these sectors in budget planning. Furthermore, Caselli (2006) demonstrates that the presence of natural resources often leads to power struggles among different groups seeking control, thereby reducing the ruling group's incentive to invest in long-term development.

Globalization is a current topic of scholarly discussion that has a significant and multifaceted impact on the socioeconomic perspective of people around the world (Saud et al. 2020). Accordingly, globalization is described as a complicated phenomenon that involves interactions among states on a variety of social, cultural, technological, and environmental fronts (Rennen & Martens, 2003). As a result of the unprecedented cross-national, economic, social, and political interaction that is currently taking place in the world, environmental quality is being significantly impacted. The GCC nations are also more inclined to promote global integration. The GCC countries are advancing in terms of global integration (becoming more globalized), according to the KOF globalization index, which might have substantial environmental repercussions. With the increase in human demand on the ecosystem and a resulting rise in unsustainable ecological footprint, globalization has intensified its ecological impact (Hoekstra & Wiedmann, 2014). The literature focused on globalization has different interesting findings according to different contextual settings. Several studies related to how globalization affects the environment found that it has a negative impact on the environment (Yang et al. 2020; Yilanci & Gorus, 2020; Koçak & Ulucak, 2019), whereas few studies also found the opposite of the previous one that globalization has a positive impact on environmental quality (Etokakpan et al., 2020; Chishti et al., 2020).

Nowadays, Globalization is very crucial because the country cannot evolve in isolation. Hence, if GCC countries wanted to survive for a long time they need to diversify as it leads to greater financial development, which is a very important determinant of the economic environment and environmental quality. Globalization also introduced standards for operations and sustainable development goals which reduced the environmental degradation and misuse of natural resources. Economic growth and financial development should not be based on comprising

environmental degradation and ecological footprints, otherwise it will ultimately result in destruction, not in growth (Lu, 2018). GCC countries are struggling with their high energy consumption demand, global integration, and economic growth without compromising the environment quality. As a result, ecological footprint and environmental sustainability are serious concerns for GCC countries (Yang, 2021).

Research Method

The present study used the panel fixed effects technique to analyze the impact of mineral resource rent and urbanization on the ecological footprint in Gulf countries. The fixed effects model is well-behaved in a way that it captures the cross-country differences (Yu et al., 2022). For this purpose, this study used the dummy variable for each country because each country has a different level of energy consumption (Luzzati et al., 2009; Maletič et al., 2016). Thus, we can write the equation for the Fixed Effects model as

$$lnEF_{it} = \beta_i + \beta_1 lnRR_{it} + \beta_2 lnU_{it} + \beta_3 lnGPC_{it} + \beta_4 IND_{it} + \beta_5 Glob_{it} + EC + \mu_{it}$$

Where EF is ecological footprints, RR is resource rent, U is urbanization, GPC is GDP per capita, IND is industrialization, Glob is globalization and EC is energy consumption. The independent variables used in the analysis are reported in multiple studies and their channels are highlighted with renewable energy consumption such as Globalization (Alvi et al 2023, Zhu et al 2023, Salman 2023).

β_i serve the purpose of capturing the cross-country differences for all countries included in the sample, *ln* represents the variables in log form. However, it may always be true that the cross-country differences are captured through separate intercepts. For this case, we need to include an error term along with a common intercept. This approach is suggested by the proponents of the random effects model or the error correction model. It has the feature of identifying intercepts separately for each country, that is, the intercept is random with a fixed mean and a random component having mean zero and variance σ^2.

Data and Variable Description

Urbanization, GDP per capita, industrialization, resource rents and energy consumption are extracted from the World Bank Development Indicator. The ecological footprint data used in this study is taken from Global Footprint Network, Globalization data is taken from the KOF

globalization index, developed by Dreher, Axel (2006), and is utilized. The data is taken from 2000-2020.

Results and Discussion

Before moving to the estimation process, the panels are tested for cross-sectional independence. The null hypothesis of the cross-section independence test, Pesaran, 2003 points out that the panel is cross-sectionally independent. Hence, it is evident from the result in Table 1 that panel is cross-sectional independent because we failed to reject the null hypothesis. The key reason for cross-sectional independence is that the selected countries do not belong to a single economic block, and they have different economic relationships.

Table 1: Cross-Sectional Dependence Test

Test	Statistics	P-values
Pesaran CD	0.6414	0.3923

The cross-sectional dependence test is used to check the correlation or interdependence among observations in a cross-sectional or panel dataset. One of the most common diagnostic tests used to detect cross-sectional dependence is the Pesaran CD test. It relies on the assumption that if cross-sectional dependence is present, the residuals of a fixed effects regression model should exhibit spatial correlation. The test statistic is computed by regressing the residuals on the lagged residuals of neighboring units, and testing whether the coefficients on the lagged residuals are significantly different from zero. The null hypothesis of the Pesaran CD test is that there is no cross-sectional dependence among the panel data. If the test statistic exceeds the critical value, we reject the null hypothesis and conclude that there is evidence of cross-sectional dependence.

Table 1 shows that the p-value of the Pesaran CD test is 0.3923>0.05 so we fail to reject the null hypothesis that there is no cross-sectional dependence among our panel data. In the context of this study GCC countries may be similar in their variables being analyzed. It implies that the economic performance or behavior of one Gulf country may be related to or influenced by the economic performance or behavior of other Gulf countries. This cross-sectional dependence can arise due to various factors, such as shared economic policies, regional economic integration, common shocks or events affecting multiple countries, trade relationships, financial linkages, or cultural and social ties among the GCC countries. When analyzing GCC countries' data, detecting

and accounting for cross-sectional dependence is crucial to avoid biased or inefficient estimations. Ignoring cross-sectional dependence may lead to incorrect inferences or unreliable results.

Table 2: Unit root Test (Levin Lin Chu)

Variables	**Level**		**1st Differences**		**Order of integration**
	Intercept	Intercept and trend	Intercept	Intercept and trend	
Ecological footprint	-3.728 (0.010)	-4.549 (0.000)			I(0)
Globalization	-2.828 (0.0023)	-4.377 (0.000)			I(0)
Urbanization	-15.191 (0.000)	-15.060 (0.000)			I(0)
Resource rent	-3.742 (0.000)	-1.74812 (0.040)			I(0)
Industrialization	-4.834 (0.000)	-4.245 (0.000)			I(0)
Energy consumption	-0.282 (0.389)	0.146 (0.558)	-4.964 (0.000)	-3.686 (0.000)	I(1)
GDP per capita	-1.251 (0.383)	-0.806 (0.789)	-6.760 (0.000)	-9.979 (0.000)	I(1)

The Augmented Dickey-Fuller (ADF) test is a statistical test used to determine whether a time series variable has a unit root. A unit root implies that the variable is non-stationary, meaning it has a stochastic trend and does not exhibit a constant mean and variance over time. The ADF test takes lagged differences of the variable in the regression equation to account for potential

autocorrelation and serial dependence. By including these lagged differences, the ADF test can capture the presence of a unit root and provide more accurate results. The null hypothesis of the ADF test is that the variable is non-stationary. The alternative hypothesis is that the variable is stationary which means the absence of a unit root. If the computed test statistic is smaller (more negative) than the critical values, the null hypothesis of a unit root is rejected, suggesting that the variable is stationary. In this case, it indicates that the variable has a stable mean and variance over time and is not driven by a stochastic trend. On the other hand, if the computed test statistic is greater (less negative) than the critical values, there is insufficient evidence to reject the null hypothesis, implying that the variable has a unit root and is non-stationary. This is an appropriate modeling technique for transforming a time series by differencing to achieve stationarity.

Table 2 shows Augmented Dickey-Fuller (ADF) unit root test results, and the purpose of this test is to investigate the order of integration in the variables. The results revealed that Ecological footprint, Globalization, Urbanization, Resource Rent, and Industrialization have level static variables that are significant at a 5% confidence interval. The order of integration of Ecological footprint, Globalization, Urbanization, Resource Rent, and Industrialization is I(0) which means these variables move in a consistent way during a period. On the other hand, Energy consumption and GDP per capita have significant first differences. The order of integration of Energy consumption and GDP per capita are I(1) at a 5% confidence interval which means they are inconsistently moving in a period or have a wider dispersion in their series at different time intervals.

Table 3: Results of Fixed Effects Regression

Dependent Variable:	EF
Resource rent	0.351**
	(3.04)
Urbanization	0.427**
	(2.95)
Industrialization	0.461**
	(3.02)
Δ GDP per capita	0.113*
	(2.09)
Globalization	-0.253*
	(1.85)

Δ EC	0.0102
	(0.51)
Constant	-7.788***
	(-11.55)
N	105

Fixed effect regression also known as a fixed effects model or panel data model, is a statistical technique used in this study to estimate the relationship between Ecological footprint as a dependent variable and Mineral resource rent, Urbanization, Industrialization, GDP per capita, Globalization and Energy consumption as independent variables in the presence of individual-specific effect or unobserved heterogeneity. Fixed effect regression is used when the purpose of the study is to analyze panel data, which involves observations on the same individuals or entities over multiple time periods. In a fixed effects regression, the individual-specific effects are treated as fixed parameters that vary across individuals but remain constant over time. These effects capture unobserved factors that are specific to each individual but do not change over time, such as individual characteristics, abilities, or preferences. By controlling for these individual-specific effects, fixed effects regression helps to eliminate the potential bias caused by omitted variables that are time-invariant.

In this study, fixed effect estimation was applied to panel data from GCC countries (Saudi Arabia, UAE, Qatar, Kuwait, and Oman). When conducting fixed effects regression in the context of GCC countries, the analysis typically aims to control the unobserved heterogeneity across these countries while examining the relationships between variables of interest. It is important to note that fixed effects regression in GCC countries assumes that the individual-specific effects are constant over time within each country. This assumption implies that the relationships between the independent variables and the dependent variable are consistent within each country but may vary across countries. Therefore, the fixed effects model is particularly useful when analyzing panel data that covers multiple time periods for each Gulf country.

The fixed effect regression subtracts the country-specific effects from the model equation before estimating the regression coefficients. This is done by including a set of dummy variables, also known as fixed effects or Gulf country-specific intercepts, in the regression equation. These dummy variables take the value of 1 for observations belonging to a particular Gulf country and 0 otherwise. By including these fixed effects, the model effectively controls for any time-invariant

factors that may be driving the relationship between the independent variables and the dependent variable.

The fixed effects regression accounts for country-specific factors that may be influencing the outcomes, due to differences in institutions, cultural characteristics, or natural resource endowments of countries.

Table 3 shows that Mineral resource rent, Urbanization, and Industrialization are significant at a 5% confidence level. Moreover, GDP per capita and Globalization are significant at a 10% confidence level. While Energy consumption is non-significant in determining the relationship. Mineral resource rent, Urbanization, Industrialization, GDP per capita, and Globalization have a significant role in explaining the dependent variable ecological footprints.

Conclusion

This study has given the importance of mostly Gulf countries that are blessed with natural resources but are faced with significant resource capital management challenges. These nations' capacity to utilize their blessed natural resources in the creation of goods that can be exported is reduced. Through the utilization of time-series data spanning the years 2000-2020, the research conducted has examined the main critical components that are responsible for causing damage to the ecosystem in five GCC countries mainly, Saudi Arabia, UAE, Qatar, Kuwait, and Oman. The utilization of resource rents rather than resource value is a direct result of this phenomenon. According to the findings, mineral resource rents are the most significant determinants of the resource, which is depleting over time. In addition, economic activity, and the renting out of resources raise the ecological footprint. Industrialization also increases the ecological footprint in GCC countries. According to the findings of this research, it is vital to enact resource regulations that are based on incentives in order to reduce ecological footprints and the consumption of natural resources.

References

1. Ahmed, Z., Zhang, B., & Cary, M. (2021). Linking economic globalization, economic growth, financial development, and ecological footprint: Evidence from symmetric and asymmetric ARDL. *Ecological indicators*, *121*, 107060.
2. Aljarallah, R. (2019). Impact of natural resource rents and institutional quality on human capital: a case study of the United Arab Emirates. *Resources*, *8*(3), 152.
3. Aljarallah, R. A. (2020). Natural resource dependency, institutional quality and human capital development in Gulf Countries. *Heliyon*, *6*(7), e04290.
4. Aljarallah, R., & Angus, A. (2018). The Economical, political and social dimension of resource abdundance: A theoretical and empirical survey. *International Journal of Business and Management Studies*, *7*(2), 203-220.
5. Ansari, M. A., Ahmad, M. R., Siddique, S., & Mansoor, K. (2020). An environment Kuznets curve for ecological footprint: Evidence from GCC countries. *Carbon Management*, *11*(4), 355-368.
6. Baloch, M. A., Mahmood, N., & Zhang, J. W. (2019). Effect of natural resources, renewable energy and economic development on CO2 emissions in BRICS countries. *Science of the Total Environment*, *678*, 632-638.
7. Barendse, J., Roux, D., Currie, B., Wilson, N., & Fabricius, C. (2016). A broader view of stewardship to achieve conservation and sustainability goals in South Africa. *South African Journal of Science*, *112*(5-6), 1-15.
8. Bekhet, H. A., Matar, A., & Yasmin, T. (2017). CO2 emissions, energy consumption, economic growth, and financial development in GCC countries: Dynamic simultaneous equation models. *Renewable and sustainable energy reviews*, *70*, 117-132.
9. Bulte, E. H., Damania, R., & Deacon, R. T. (2005). Resource intensity, institutions, and development. *World development*, *33*(7), 1029-1044.
10. Carmignani, F. (2013). Development outcomes, resource abundance, and the transmission through inequality. *Resource and Energy Economics*, *35*(3), 412-428.
11. Carmona, L. G., Whiting, K., Wiedenhofer, D., Krausmann, F., & Sousa, T. (2021). Resource use and economic development: an exergy perspective on energy and material flows and stocks from 1900 to 2010. *Resources, Conservation and Recycling*, *165*, 105226.
12. Caselli, F. (2006). Power struggles and the natural resource curse.
13. Chishti, M. Z., Ullah, S., Ozturk, I., & Usman, A. (2020). Examining the asymmetric effects of globalization and tourism on pollution emissions in South Asia. *Environmental Science and Pollution Research*, *27*, 27721-27737.
14. Cockx, L., & Francken, N. (2016). Natural resources: a curse on education spending?. *Energy Policy*, *92*, 394-408.
15. El-Agouz, N. (2022, April). The Impact of Economic Growth on CO2 Emissions and Energy Consumption (In the Gulf Cooperation Council Countries). In *Sustainable Energy-Water-*

Environment Nexus in Deserts: Proceeding of the First International Conference on Sustainable Energy-Water-Environment Nexus in Desert Climates (pp. 553-563). Cham: Springer International Publishing.

16. Etokakpan, M. U., Adedoyin, F. F., Vedat, Y., & Bekun, F. V. (2020). Does globalization in Turkey induce increased energy consumption: insights into its environmental pros and cons. *Environmental Science and Pollution Research*, *27*, 26125-26140.
17. Frankel, J. A. (2010). *The natural resource curse: a survey* (No. w15836). National Bureau of Economic Research.
18. Grause, G. (2021). The price of resource consumption using the Ecopoint concept under consideration of regional differences. In *IOP Conference Series: Earth and Environmental Science* (Vol. 626, No. 1, p. 012005). IOP Publishing.
19. Hoekstra, A. Y., & Wiedmann, T. O. (2014). Humanity's unsustainable environmental footprint. *Science*, *344*(6188), 1114-1117.
20. Koçak, E., & Ulucak, Z. Ş. (2019). The effect of energy R&D expenditures on CO 2 emission reduction: estimation of the STIRPAT model for OECD countries. *Environmental Science and Pollution Research*, *26*, 14328-14338.
21. Lu, W. C. (2018). The impacts of information and communication technology, energy consumption, financial development, and economic growth on carbon dioxide emissions in 12 Asian countries. *Mitigation and Adaptation Strategies for Global Change*, *23*, 1351-1365.
22. Mehlum, H., Moene, K., & Torvik, R. (2006). Institutions and the resource curse. *The economic journal*, *116*(508), 1-20.
23. Murakami, S., Takasu, T., Islam, K., Yamasue, E., & Adachi, T. (2020). Ecological footprint and total material requirement as environmental indicators of mining activities: Case studies of copper mines. *Environmental and Sustainability Indicators*, *8*, 100082.
24. Nahman, A., Wise, R., & De Lange, W. (2009). Environmental and resource economics in South Africa: Status quo and lessons for developing countries. *South African Journal of Science*, *105*(9), 350-355.
25. Raouf, M. A. (2008). Climate change threats, opportunities, and the GCC countries. *The Middle East Institute Policy Brief*, *12*(5).
26. Rennen, W., & Martens, P. (2003). The globalisation timeline. *Integrated assessment*, *4*(3), 137-144.
27. Saud, S., Chen, S., & Haseeb, A. (2020). The role of financial development and globalization in the environment: accounting ecological footprint indicators for selected one-belt-one-road initiative countries. *Journal of Cleaner Production*, *250*, 119518.
28. Sharf, I. V., & Mikhalchuk, A. A. (2021). The effect of imbalance in resource management on regional social economic development. In *IOP Conference Series: Earth and Environmental Science* (Vol. 629, No. 1, p. 012010). IOP Publishing.

29. Sharif, A., Baris-Tuzemen, O., Uzuner, G., Ozturk, I., & Sinha, A. (2020). Revisiting the role of renewable and non-renewable energy consumption on Turkey's ecological footprint: Evidence from Quantile ARDL approach. *Sustainable Cities and Society*, *57*, 102138.
30. Shen, Y., Su, Z. W., Malik, M. Y., Umar, M., Khan, Z., & Khan, M. (2021). Does green investment, financial development and natural resources rent limit carbon emissions? A provincial panel analysis of China. *Science of the Total Environment*, *755*, 142538.
31. Sheppard, C., Al-Husiani, M., Al-Jamali, F., Al-Yamani, F., Baldwin, R., Bishop, J., ... & Zainal, K. (2010). The Gulf: a young sea in decline. *Marine Pollution Bulletin*, *60*(1), 13-38.
32. Steen, B. A. (2006). Abiotic resource depletion different perceptions of the problem with mineral deposits. *The International Journal of Life Cycle Assessment*, *11*, 49-54.
33. Wackernagel, M., & Rees, W. (1998). *Our ecological footprint: reducing human impact on the earth* (Vol. 9). New society publishers.
34. Wang, Y., & Yu, L. (2021). Can the current environmental tax rate promote green technology innovation?-Evidence from China's resource-based industries. *Journal of Cleaner Production*, *278*, 123443.
35. Yang, B., Jahanger, A., & Khan, M. A. (2020). Does the inflow of remittances and energy consumption increase CO 2 emissions in the era of globalization? A global perspective. *Air Quality, Atmosphere & Health*, *13*, 1313-1328.
36. Yang, B., Jahanger, A., Usman, M., & Khan, M. A. (2021). The dynamic linkage between globalization, financial development, energy utilization, and environmental sustainability in GCC countries. *Environmental Science and Pollution Research*, *28*, 16568-16588.
37. Yang, X., Anser, M. K., Yusop, Z., Abbas, S., Khan, M. A., & Zaman, K. (2022). Volatility in mineral resource pricing causes ecological footprints: A cloud on the horizon. *Resources Policy*, *77*, 102673.
38. Yilanci, V., & Gorus, M. S. (2020). Does economic globalization have predictive power for ecological footprint in MENA counties? A panel causality test with a Fourier function. *Environmental science and pollution research*, *27*(32), 40552-40562.
39. Yilanci, V., Bozoklu, S., & Gorus, M. S. (2020). Are BRICS countries pollution havens? Evidence from a bootstrap ARDL bounds testing approach with a Fourier function. *Sustainable Cities and Society*, *55*, 102035.