Institutiones Administrationis – Journal of Administrative Sciences
DOI:10.54201/iajas.v3i2.59

Studying the Role of Quality of Governance, Renewable Energy and External Monetary Assistance and Their Repercussions on the Ecological Footprint in the Context of Djibouti

Evidence from ARDL, Impulse Response and Variance Decomposition

Kadir Aden*

* University of Djibouti, Faculty of Law, Economics, and Management, Department of Law and Politics, Djibouti City, Djibouti. E-mail: kadir.dirir4@gmail.com

Abstract

In accord with the aim of achieving global sustainable development, the current article provides empirical evidence on the role of quality of governance, renewable energy consumption and official development assistance (ODA) in providing a successful outcome on ecological footprints. According to the ARDL model, renewable energy decreases the ecological footprint, and among the variables selected to represent quality of governance, only controlling corruption mitigates the ecological footprint, whereas regulatory quality, rule of law and ODA increase the ecological footprint. This is likely, as the current Djiboutian environmental legislation fails to accommodate the ecological issue, and because other underdeveloped sectors absorb the cumulative ODA, thus leaving for small sums to be allocated to environmental activities. Furthermore, the finding of the impulse response and the variance decomposition project was that all the variables have a collective ad-hoc shock on the ecological footprint by restraining the level of the human imprint on ecology; however, it takes significant time to transpire.

Keywords

governance quality, ecological footprint, environmental management, ODA, renewable energy, Djibouti

1 Introduction

Despite the efforts of developing economies to address environmental deterioration, some countries contend that the primary offenders, namely *advanced economies*, should take the initiative to reduce environmental harm. This accusatory trend, of which and who is subjected

to environmental degradation *of culprit status* has, been addressed as an accusatory innuendo, made even by some world leaders (Charfeddine et al., 2018). Certainly, when we contemplate the cumulative effect of environmental degradation, lower-middle-income countries have a scant share of responsibility to uphold. Nevertheless, it is absurd to ignore the fact that, in the twenty-first century, it is not actually terrorism or recession that is the largest threat to humans, but rather climate change and global warming that menaces human survival, in the contest of witnessing rising sea levels, desertification and failing agriculture, therefore, there are further calls for a global cooperation network, regardless of the status of the countries belonging to it.

Several causes have been ascribed to the escalation of global climate change, including the use of energy, which produces CO_2 emissions (*the primary greenhouse gas in terms of quantity)*. According to Intergovernmental Panel on Climate Change's (IPCC) 2007 estimate, CO_2 emissions make up 76.7% of all greenhouse gas emissions to date. As companies are expanding and economies are becoming more open, the influence of CO_2 emissions is severe. From a collective perception, it is reasonable to assume that this trade liberalization and economic boom in many underdeveloped countries can be regarded as a miracle, as it inspires and produces greater amounts of human capital development (Solomon et al., 2007).

Ironically, this positive capital transformation of developed countries from developing nations has put considerable pressure on nature and undermined nature's capacity, due to the rising demand for supply and trade agreements. For instance, despite a 25% increase in global biocapacity over the past 50 years, the ecological footprint (EF) has grown by 190% during the same time period[1]. Owing to this discrepancy between the ecological footprint and biocapacity, the globe is perilously experiencing catastrophic weather events, and rising temperatures in numerous locations. Indeed, the lack of biocapacity and human-induced increasing demands on the environment have prevented carbon emissions from being absorbed. As a result of this condition, there has been a decrease in biocapacity activities, due to which, both a disruption in the biological life cycle and a rise in natural catastrophes have materialized.

Scholars contend that the variable ecological footprint is rather persuasive, as it incorporates many environmental factors (Al-Mulali & Ozturk, 2016; Baabou et al., 2017). For example, the ecological footprint is estimated by taking into consideration how much land and water are required to generate the resources that are used by people, communities, or even countries. This includes the water and land needed to grow food, produce clothes and other necessities, as well as the energy and resources needed for travel, communication, and other tasks. The ecological footprint also considers the amount of water and land required to sustain the waste produced by human activity, including carbon dioxide emissions from the burning of fossil fuels. Similarly, the so-called ecological footprint may be used to evaluate how sustainable human activity is and to spot places where environmental effects might be minimized. The efficacy of sustainability projects may be assessed, and decisions concerning resource usage and management can be made knowledgably, by monitoring changes in the ecological footprint over time (Destek et al., 2018).

With regard to this, the Djiboutian government has made several efforts to address ecological issues; first, the development of protected areas is one notable example of the Republic of Djibouti's attempts to lessen its ecological impact. The *Day Forest National Park* was created by the government in 2,000 to preserve the distinctive ecosystems of the nation and to safeguard endangered animals. Almost 140 different bird species may be seen in the park, along with

[1] Footprint Data Foundation, York University Ecological Footprint Initiative, and Global Footprint Network: National Footprint and Biocapacity Accounts, 2022 edition. Available online at https://data.footprintnetwork.org

numerous different antelope species. The *Ghoubbet Reserve*, which was created in 2006 to safeguard the nation's marine biodiversity, including a number of shark and ray species, is another example. The country is also promoting the use of renewable energy sources as a means of reducing its environmental impact (UNEP-WCMC, 2023).

The nation's first wind farm was put into operation in 2020, and it is anticipated that 35% of the population could receive renewable energy from it, however, when the current project will be fully implemented is debatable (Kohen, 2021). In 2022, a large amount of financing for environmental initiatives was also provided to the Republic of Djibouti by foreign organizations. For instance, the Global Environment Facility and the U.S. authorized $20 million to assist sustainable land management in Djibouti, which would help to reduce soil erosion and enhance food security (The World Bank, 2022). The Green Climate Fund has also authorized money for initiatives supporting the preservation of biodiversity, the protection of coastlines, and the promotion of renewable energy throughout the nation, and recently, in 2022, the Minister of the Environment's department in collaboration with the Ministry of Higher Education officially launched the Regional Research Observatory for the Environment and Climate (RROEC).[2]

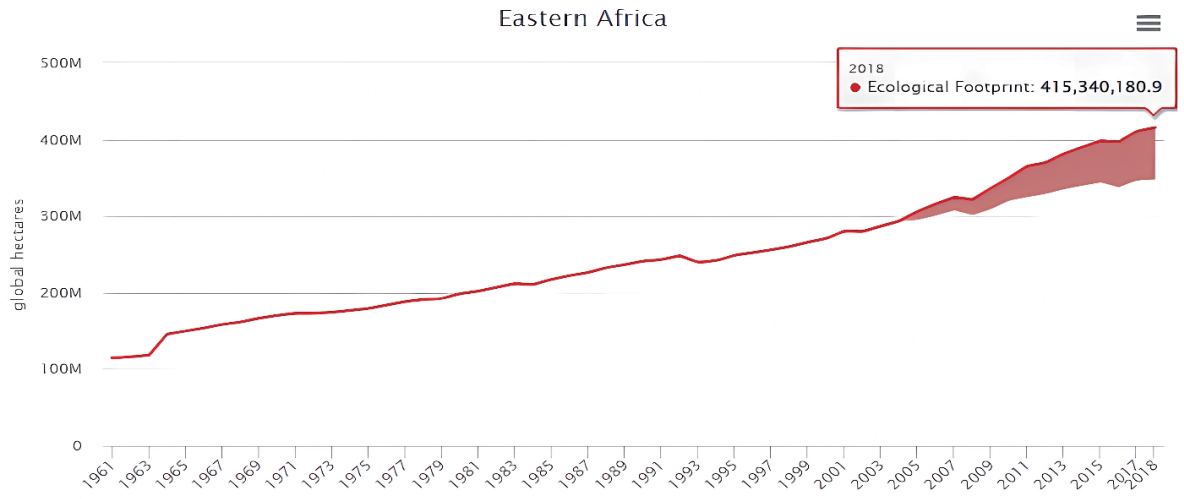


Figure 1. Ecological footprints in East Africa regions
Source: Global ecological footprint network

However according to the world ecological footprint; the East African countries, despite the efforts of ecological mitigation, are facing a greater calamity. The level of ecological footprints increased to 415 million in the whole region; this number is alarming compared to the early 2000s, when it was below 300 million; see *Figure 1***.** Certainly, population expansion and climate change have worsened the situation. The Republic of Djibouti also hosts significant numbers of migrants and asylum-seekers from the region. Noting from *figure 2,* both resource depletion and poor policy frameworks have impeded environmental performance. According

[2] At a conference lasting 3 days (23 to 25 October 2022) organized by the Ministry of Higher Education and Research. The event brought together scientists, NGOs, researchers, and decision-makers from around the world to discuss the fight against climate change in Africa. According to the minister's speech, the aim of the conference was to realize the Government's desire to integrate the effects of climate change into public environmental policies and identify national and regional focal points, in which the structure will be responsible for providing climate data to better counter the consequences of climate change.

to the graph, the remained biocapacity for the country is estimated to be 684,733, lower than the ecological footprint (2 million) and it is predicted, given the current state of its biocapacity deficit, the country could reach a certain threshold at which the total biocapacity area available for the population will further shrink relative to its ecological footprint.

Considering the above points, the given research provides an empirical study on how governance qualities (*by selecting regulatory qualities, rule of law, and control of corruption as representative of the quality of Djiboutian policy-makers)*, renewable energy consumption, and official development provide assistance to mitigate ecological footprints in the republic of Djibouti. The research contributes to the literature, (i) by employing the ecological footprint variable as a representative of the environment instead of CO_2 or other environmental proxy variables – which in most cases cannot fully assess the whole environmental performance in a uniform manner; this factor is oriented more toward environmental policy. (ii) Second, we juxtapose the role of Djiboutian governance qualities by fully focusing on the quality of national regulation, the level of upholding the rule of law, and the extent of controlling the rate of corruption with ecological issues. (iii) Unlike previous studies, we include official development assistance in our study – considering Djibouti's lower-middle income status. Previous scholars, have excessively focused on foreign direct investment (FDI) with a relative exploration of the link between ODA and ecological footprint.

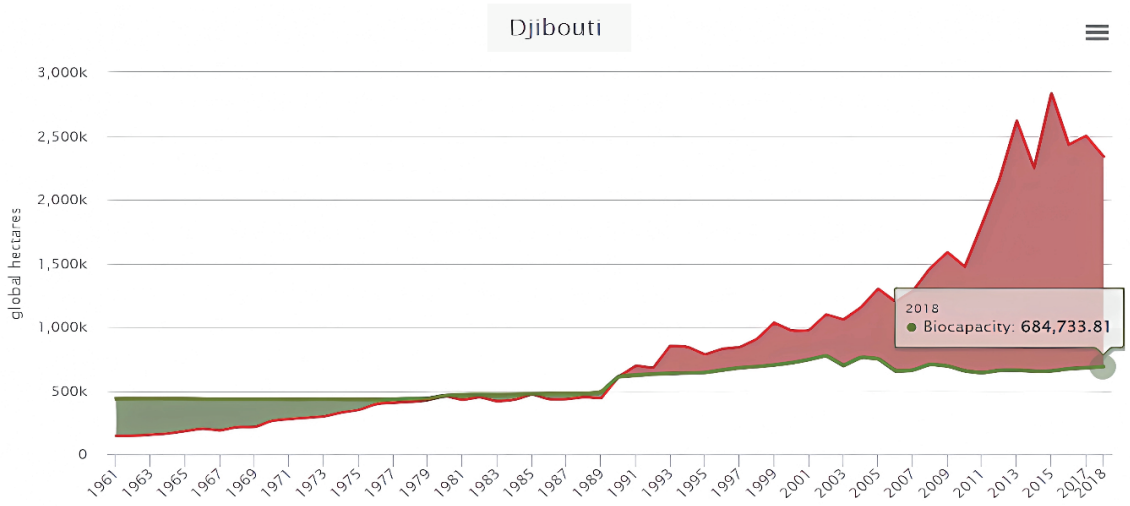


Figure 2. The red line presents ecological footprints, whereas the green trend represents the biocapacity
Source: Global ecological footprint network

To address the following aims, we use an autoregressive distributed lag (ARDL) to examine the long-run and the short-run between the selected variables. followed by a Toda-Yamamoto test to check the effect of the variables on each other. Finally, both an impulse response function (IRF) and variance decomposition tests will be conducted to analyze the future shock of the independent factors on the ecological footprint. The paper is divided as follows: firs, an overview of the literature papers, followed by a methodology section and the econometric models used. Then, in section 4, I will provide both the results and the discussion, whereas policy recommendations in accordance with the findings will be provided in section 5, finally, the conclusion and remarks will be included in section 6.

2 Literature Review

The effect of climate change on environmental quality is a major priority on the world agenda. The concept of sustainable development, which is based on three pillars of environmental, sociological, and economic sustainability, has grown in importance over the past two decades (Ulucak & Khan, 2020), and, when we look closely, most of these above-mentioned pillars are directed more toward ecological sustainability (Ozcan et al., 2018).

2.1 The relationship between renewable energy consumption and ecological footprint in African states

Many scholars on environmental governance juxtaposed energy and environmental quality. Those scholars who exclusively focused on the African continent selected diverse states, such as Sub-Saharan African states (Nathaniel & Bekun, 2021; Kohler, 2013), Kenya's environmental sector (Ozturk et al., 2016) and Tunisia (Farhani et al., 2014). Although those studies were interested in how energy consumption (Natural energy) impacts CO_2 emissions, according to their findings, non-renewable energy consumption in these parts of the globe is the main cause of environmental degradation. However, their empirical focus was limited to CO_2 emissions, which could not account for the whole environmental impact for several reasons. (I) CO_2 emissions are restricted to certain sectors with a high intensity of carbon dioxide emissions; it could be either a *manufacturing company* or *the transportation sector* as a whole. (II) compared to developed nations, African nations emit relatively small quantities of CO_2, for which only huge oil-exporting countries can be taken into account; as such, it is worth examining environmental deterioration from an ecological footprint perspective, considering how it incorporates a broader scope of environmental degradation, in contrast to other proxy variables used by previous studies.

Nketiah et al. (2022) conducted a study on how the use of renewable energy, biocapacity, and tourism may either increase or decrease the ecological footprint (ECF) in West African nations. The study discovered favorable correlations between real income, tourism, renewable resources and human capital. Alternatively, the ad-hoc impact of non-renewable energy, such as coal consumption (which *is the main energy resource of South Africa in particular*) on natural resources in African soil has been addressed by Udi et al. (2020); indeed, by confirming previous studies' findings, the authors suggested that this excessive natural resource exploitation without considering the implementation of green framework to compensate for coal addiction has slowed Africa's transition to renewable energy. However, the author ignores the reality that South Africa is an emerging country with GDP growth estimated at 4.9 in 2022 percent, as a result, overshadowing the efforts toward a green transition.

It is worth noting, that energy demand is met from two main streams, either from non-renewable energy, which involves fossil and nuclear fuel; or renewable energy, such as solar, hydraulics, wind, hydrogen, and biomass. In fact, energy demands have been increasing in recent years in proportion with population expansion in advanced nations, and in this context of population expansion in developed nations with respect to their economic growth, their energy demand is estimated to increase by 90% by 2035 (Uddin et al., 2019). Ironically, expanse of economic growth comes with an increase in energy consumption as other rich sectors start to materialize, however, a less direful scenario can be noted from this case, for instance, emerging countries with abundant natural resources will receive an increase in energy demand from advanced nations, but if these emerging nations adjust their energy portfolio by turning to green

energies, underdeveloped countries vulnerable to market energy transformation (including Djibouti) will be the most affected by such a policy outcome.

2.2 Contextualizing the standpoint of quality of governance with ecological footprints

The substantial role of institutions in ecological footprint mitigation is fragmentary in the literature, one side of the scholars identify an unreliable effect of legislation within state contextualization, (Karşılı & Erkut, 2022; Mehmood et al., 2022). On the other side, academicians counter-argue with such findings by providing the reverse outcome, by contending the ineffectiveness of so-called regulation (Oteng-Abayie et al., 2022; Makhdum et al., 2022; Charfeddine & Mrabet, 2017). This respective discrepancy can only be conceived from a country-level analysis, in which the recently adopted legislation by the state can be considered relevant for evaluation with minimal collective generalisation.

Even so, due to market profitability and the given state's level of foreign direct inflows, the nature of these environmental regulations could be disintegrated in a biased context. When a market is highly profitable, there is a tendency for businesses to prioritize economic interests over environmental concerns. In such conditions, there might be pressure to relax or alter environmental regulations to favor economic growth. Furthermore, states receiving substantial FDI may be inclined to make regulatory concessions to attract and retain foreign investors, potentially including relaxed environmental standards. This situation could lead to a disintegration of environmental regulations, where they are fragmented or weakened to accommodate the interests of powerful industries and foreign investors, creating a biased context that prioritizes economic gains over environmental protection, potentially at the expense of sustainability and public welfare.

For instance, the fact of adopting stringent regulations to achieve ecological footprint repercussions is more likely to encompass advanced nation systems that strive to introduce green market competition; however, emerging nations and underdeveloped countries are apathetic to such transformation; for them economic growth overshadows this sustainable transition, while the greater emphasis on stricter laws for the national environment is overlooked for the sole purpose of attracting foreign companies who are seeking markets driven by the slightest sustainability agenda.

A more formal comparative example between developed nations and emerging countries can be addressed from trade and human capital development with an emphasis on governing institutions. Countries with lower trade intensities may prioritize environmentally damaging economic activity to cover any economic gaps that may result from reduced trade volumes. However, in nations with larger trade intensities, priorities may shift toward ecologically-friendly behaviors, and potentially undoing the environmental degradation caused by trade (Addai et al., 2022). Additionally, lower-income nations are more prone to develop into pollution hotspots – since increased trade activity in these nations is thought to have detrimental consequences on environmental performance. However, as the economy expands and people's living standards rise, nations are better able to offset the costs associated with enhancing environmental health and, in retrospect, can afford to make the necessary compromises to stop the depletion of the ecosystem's vitality, which would enhance environmental performance.

This ecological depletion caused by indirect state involvement can be observed blatantly in trade agreements. The effect of trade liberalization with a high level of corruption in the institutional framework have been found to trigger environmental degradation (Tobin et al., 2018). However, theoretically, some academics hint that if energy is employed and used judiciously, pollution may be kept to bare minimum levels (Pita et al., 2020).

The asymmetric effect of policies on trade, and particularly on companies competing in the same market, is viewed from another dimension by environmental economists. Their theory predicts that excessively stringent environmental legislation will boost *compliance intentions*, and shift the whole transportation sector in a low abatement cost direction (Dechezleprêtre & Sato, 2017). This is particularly troubling for global pollution, since it implies that, in addition to the economic effects on domestic businesses, abatement efforts will be somewhat negated and rising emissions will be shifted to other emerging countries due to *company migration*. Although, despite the reality of corporate resistance in the face of stringent regulation aimed at sustainable development, and in most cases, supported by neo-institutionalist and institutional theorists, in which they suggest that the after-effects of these regulations could be a panacea for environmental degradation (Addai et al., 2022).

It is evident that a nation with strong institutions has a solid foundation for future economic growth. Institutional disparities are mostly to blame for variations and stagnated economies in regional growth. A framework for institutional quality and the evaluation of this qualitative topic has been developed in recent works on institutional economics (Zhang et al., 2022). A strong institutional foundation accelerates growth by encouraging economic activity, such as enhancing productivity and effectively allocating resources. The freedom of choice is supported within this institutional contextualization; likewise, economic development possibilities are made easier by preserving property rights, cutting transaction costs, and discouraging rent-seeking behavior (Li, 2021).

The interconnection between institutions' characteristics and the environment had also been noted by Epo & Nochi Faha (2020), where the authors studied how income growth, natural resources and institutional quality shape 44 African countries' GDP trajectory. Certainly, these authors were focused more on economic expansion than ecological context; nevertheless, however, we are engaged in examining the role of institutional qualities in projecting positive outcomes. Turning back to their study, the findings demonstrated that real income and natural resources vary according to institutional qualities, further validating the dependency between their variables studied.

These institutional quality thresholds might be obsolete if not already achieved by advanced states, yet the paradigm of institutional betterment to accommodate societal scope remains widely studied and addressed, considering the relative level of advancement in African states. Al-Mulal & Ozturk (2015) decided to view institutional factors in ecological footprint mitigation by using the political stability variable as a proxy. The results of the Pedroni cointegration test revealed that ecological footprints are reduced with a stable political system in place.

One might argue how much such an effect could transpire. The study by Al-Mulal & Ozturk (2015) concentrated on the Middle East and northern African countries (MENA), which has had several political upheavals and conflicts over time, which can have a direct impact on the environment. As an illustration, during the 1991 Iraqi-Kuwaiti conflict, Iraqi forces torched Kuwaiti oil reserves, causing a half-ton of air pollution, smog, and acid rain. Dams and wastewater treatment facilities were also destroyed as a result of the conflict. Other battles, including those in Afghanistan, Iraq against the United States, and the Israeli-Lebanon war, caused significant damage to the region's air, water, and land; in turn, leading to a number of environmental issues. Therefore, indicators of political instability may thus be one of the key causes of the MENA region's environmental deterioration.

According to (Dasgupta & Mäler, 1995) environmental preservation and civil and political rights are closely related. Strictly speaking, political and civil rights play a significant role in safeguarding the environment's resource base, at least when compared to totalitarian nations

where such liberties are absent. In support of this claim, Dolšak & Dunn (2006) propose that political transparency will enhance environmental quality. Nevertheless, mixed findings are found in empirical investigations. Some researchers indicate that institutional elements have a favorable impact on environmental deterioration, while others hint that they may have little impact or even impair environmental quality. Torras & Boyce (1998), for instance, looked at the connection between seven environmental quality indices and political institutional elements: they demonstrate how democracy enhances the environment, especially in developing nations. However, in a recent study by (Hassan et al., 2020) on the extent of institutions in correcting environmental pollution in Pakistan. Reiterating Hassan's conclusion – due to corruption in the national Pakistani governments, public institutions use more fossil energy and produce more CO_2 emissions with less commitment to environmentally-friendly policies and, at this pace, achieving green sustainable development in Pakistan is a mirage unless a renewable energy policy is rapidly implemented.

The influence of corruption on environmental quality has been mentioned in the literature, as the latter concept operates indirectly through its impact on income levels. Corruption within a society can hinder economic development and equitable income distribution. When corruption is rampant, it often diverts public resources and investments away from essential environmental initiatives and sustainability projects. This not only limits the funds available for environmental protection but also perpetuates income disparities, as corrupt practices can favor certain interest groups and exacerbate poverty. Hence, reduced economic growth and unequal income distribution can lead to diminished resources for environmental conservation efforts, ultimately impacting the overall quality of the environment as environmental protection and conservation take a back seat to economic and political interests.

Within the literature, there exist three distinct perspectives regarding the relationship between corruption and economic growth. The first viewpoint, commonly referred to as the 'grease the wheels' (GTW) hypothesis, posits that corruption has a stimulating effect on economic growth, as supported by various scholars such as Lui (1985), Acemoglu and Verdier (1998), Rock and Bonnett (2004), and Huntington (2006). According to the GTW hypothesis, corruption may assist entrepreneurs in circumventing inefficient administrative processes and protracted bureaucratic procedures that impede investment, therefore enhancing economic efficiency (Chang and Hao, 2017).

The second perspective, often termed the 'sand in the wheels' (STW) hypothesis, posits that an escalation in corruption exerts a dampening effect on economic growth. This viewpoint finds support in the work of scholars such as Rose-Ackerman and Palifka (2016), and Glaeser and Saks (2006). According to the STW hypothesis, corruption diminishes economic growth by diverting public expenditure away from productive sectors and into less fruitful domains. This diversion misguides market incentives, fosters increased inequality of opportunity, elevates transaction costs, and introduces uncertainty into decision-making processes.

A more recent perspective, often referred to as the third opinion, posits a complex relationship between corruption and economic growth characterised by an inverted U-shaped pattern. This viewpoint has been elucidated by scholars like Méndez and Sepúlveda (2006), Aidt (2009), Swaleheen (2011), and Zhou and Peng (2012). According to this perspective, corruption may have a positive effect on economic growth in countries with less effective institutional structures. However, for nations with stronger and more robust institutions, corruption tends to hinder economic growth. Consequently, the existing body of research lacks a unified theoretical consensus on the precise impact of corruption on economic growth. This lack of consensus further complicates efforts to establish the indirect influence of corruption on environmental degradation definitively.

2.3 How does official development assistance (ODA) affect ecological footprints?

In 2009, ODA completely modified its aid assistance due to emerging climate change issues. The ODA members proposed a package of monetary climate mitigation while pursuing the old objective of the organization's "economic development" (Michaelowa & Michaelowa, 2007). In the same year, the Organization for Economic Co-operation and Development (OECD) incorporated a climate adaptation framework into their development cooperation. Although, the membership of ODA communities is growing, with considerable numbers of countries transitioning from recipient to donor status, only a few papers have examined how ODA contributes to ecological footprint mitigation.

Momita et al. (2019) pointed out that foreign aid generally poses a barrier to economic expansion. This gloomy reasoning is that an increase in ODA inflow will generate greater dependency on external aid, whereas, in the same case, official development assistance is used by some authorities to pay external personal debts, thus failing to allocate the received sum to their desired sectors. Although, as ODA and macroeconomic factors that determine states' growth are related, we are expected to regard economic growth before investigating the environment, since scholars contend that economic growth should be achieved alongside sustained financial institutions in order to finance climate activities.

Pragmatically, on one side, when countries reach a positive threshold of economic growth with the assistance of external monetary assistance, the urgency of shifting toward the environment becomes probable, as several public sectors become minimally reliant on foreign aid (the recipient case); on the other side, as countries experience an increase in national growth with relatively healthy balanced export levels by creating a desired market for their products (donor case), we witness an ODA spillover in underdeveloped countries, in the sense of acquainting a decent sum of ODA accumulation, which in turn, will lead this extra monetary assistances to be allocated for environmental purposes; however, the occurrence of such an outcome of *favorable allocation* remains questionable, especially in highly corrupt countries.

Furthermore, Lee et al. (2020) have used panel data to study the effect of ODA on environmental quality (CO_2), with a focus on South Korea from 1993 to 2017. The authors used a modified impact, population, affluence, and technology (IPAT) model and a simultaneous equation, respectively. The findings suggested that the ODA has a direct impact on CO_2 emissions in the recipient countries, in which a small significant effect was recorded from ODA to CO_2 reduction. In a similar vein, Daly et al. (2022) studied how pouring financial aid into different underdeveloped sectors around the globe could assist in sustainable development but, to the authors' surprise, the data revealed that official development assistance and public debts cause the environmental process to stagnate rather than providing substantial environmental protection.

3 Methodology of the study

This research evaluates the causal effect and the relationship between governance factors, official development assistance and renewable energy consumption on the ecological footprint. The current research focuses exclusively on the Republic of Djibouti from the period of 1998 to 2018. Considering the availability of the data provided by the global ecological footprint, which is limited to 2018, the research therefore selects a period of twenty years. Researchers

often incorporate the ecological footprint metric into their studies based on data availability, aligning it with other factors in terms of temporal congruence, ensuring that the timeframes of these variables are synchronized with the 'Ecological footprint' dependent variable (Ponce et al. 2023; Kibria, 2023; Uzar & Eyuboglu, 2023). The comprehensive variable (Main variable) used to measure the global ecological footprint stands for the level of ecological footprint that human actions have on the environment (Al-Mulali & Ozturk 2016; Kihombo et al., 2021).

On the other side, our independent variables are regulatory quality, control of corruption, and rule of law; those factors were employed as a proxy for quality of governance. The selection of regulatory quality, control of corruption, and rule of law as independent variables in our study is underpinned by their robust conceptual grounding as proxies for quality of governance. These factors have gained prominence in the academic literature for their capacity to encapsulate critical dimensions of the effectiveness of governance. Regulatory quality reflects the government's ability to formulate and implement sound policies and regulations; the control of corruption index denotes the transparency emphasis and avoiding the prevalence of corruption within a society, while the rule of law assesses the extent to which legal frameworks are upheld and enforced. Together, these indicators offer a comprehensive overview of governance quality, making them well-suited choices for our analytical framework.

The data on governance factors were pooled from the world governance indicators under the World Bank development umbrella. In addition, the study includes two control variables (I) official development assistance (ODA). Observe Table 1. Considering that the article focuses on a lower-middle income country with relatively non-existent foreign direct investment; consequently, opting for more of a variable measuring the monetary assistance will be relatively adequate rather than private monetary spill-over such as FDI. Generally, official ODA factors are often considered more suitable for sustainability evaluation in lower-middle-income countries than FDI inflows due to their inherent focus on developmental and humanitarian goals. ODA, typically provided by donor countries and international organizations, is designed to promote socio-economic development, poverty reduction, and environmental sustainability in recipient nations. In contrast, FDI primarily serves the interests of foreign investors and may prioritize profit generation, potentially leading to resource extraction and environmental degradation in host countries. (II) Renewable energy consumption was employed alongside other independent factors, since it provides robustness to the model and has been used as a potential determinant of environmental betterment. Its inclusion reflects a commitment to quantifying the sustainability of human activities by accounting for energy sources that have significantly lower ecological footprints than fossil fuels. By incorporating renewable energy consumption into the assessment, it acknowledges the importance of transitioning towards cleaner and more environmentally friendly energy systems, thereby providing a more accurate picture of humanity's ecological impact (Nathaniel & Khan, 2020).

Abbreviation	Name	Sources	Variable explained
Log ECFP	Ecological Footprint	Global Ecological Footprint Network (GFN)	It measures human impact on ecological resources per person
RQ	Regulatory Quality	World Governance Indicators (WGI)	captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote state development.
Log RENP	Renewable energy consumption	World Governance Indicators (WGI)	This indicator includes energy consumption from all renewable resources: hydro, solid biofuels, wind, solar, liquid biofuels, biogas, geothermal, marine and waste
RL	Rule of Law	World Governance Indicators (WGI)	captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
CC	Control of Corruption	World Governance Indicators (WGI)	Captures the perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.
Log of ODA	Net official development assistance and official aid received (current US$)	World Development Indicators (WDI)	Monetary aid assistance spillover for development and economic growth

Table 1. Variable explanations and their respective sources
Sources: Compiled by the author

3.1 Explaining the method used

The current study employs four econometric techniques: first we start with an ARDL model, then a causality test and finally we run an impulse response and variance decomposition.

3.1.1 The ARDL technique

The primary model under consideration for this study is the Autoregressive Distributed Lag (ARDL) model; generally, this is a powerful econometric tool utilized for several critical purposes in empirical economic research. Its advantages lie in its ability to address various aspects of time series data analysis, offering a comprehensive framework for examining both short-term and long-term relationships among economic variables. One primary advantage of the ARDL model is its applicability in situations where the variables involved may exhibit non-stationary behavior, a common characteristic in economic and financial data. By accommodating non-stationarity through differencing or transformations, the ARDL model permits the investigation of cointegration relationships, which reveal the existence of stable, long-run equilibrium associations between variables. The ARDL model also allows for the examination of short-run dynamics by including lagged values of variables, thereby capturing the speed of adjustment towards equilibrium following shocks or changes in the system.

The utilization of the ARDL model typically entails several procedural stages. Initially, we must establish the suitable differencing orders for each variable to ensure stationarity. Subsequently, the model's structural configuration is ascertained, encompassing the determination of lag lengths for both autoregressive and distributed lag components. Model estimation is then carried out, typically employing methods such as ordinary least squares (OLS) or other relevant techniques. Following this, we undertake diagnostic examinations to assess the model's goodness of fit, including scrutinizing residual autocorrelation, heteroscedasticity, and serial correlation. Ultimately, the analysis encompasses the interpretation of both long-term and short-term relationships, often facilitated by significance tests on coefficients and informed by economic theory.

3.1.2 Toda-Yamamoto (TY) Causality test

The Toda-Yamamoto causality test serves as a specialized econometric method for examining causality within non-recursive or feedback contexts. It becomes essential when multiple variables are believed to exert simultaneous, mutually reinforcing influences, surpassing the capabilities of conventional Granger causality testing. This test is particularly relevant for investigating bidirectional or concurrent causal relationships, allowing for a more comprehensive exploration of complicated causal structures. In macroeconomic analysis, where variables correlate, it uncovers feedback loops and simultaneous causal links, elucidating how one variable's changes can both impact and be impacted by others.

3.1.3 Impulse response function

Impulse response analysis and variance decomposition serve as pivotal tools in the domain of time series econometrics for comprehending the dynamic behaviors and interconnectedness among economic variables. The process of conducting impulse response analysis comprises several fundamental steps. Initially, we estimate a suitable time series model, frequently opting for a Vector Autoregressive (VAR) model, grounded in empirical data. Subsequently, specific variables of interest are designated for shock identification. These chosen variables are subjected to structural shocks, conventionally set at a unitary magnitude impulse, while holding other variables constant.

3.1.4 Variance decomposition analysis

Conversely, variance decomposition represents another invaluable technique employed to dissect the origins of variability within a VAR system. This method entails the partitioning of the forecast error variance of each variable into components arising from its own historical innovations and those originating from other variables within the system. To perform this, we estimate the VAR model and compute forecast error variances for each variable. These variances are then attributed to the shocks originating from individual variables, shedding light on the relative significance of each variable's innovations in elucidating the overall variance within the system. This method thus offers a structured approach for comprehending the influence of endogenous shocks on the variability of economic variables within a multivariate framework. The amalgamation of impulse response analysis and variance decomposition furnishes a holistic comprehension of the dynamic interplay and contributions of economic variables in response to shocks. Consequently, this aids in facilitating more discerning economic analysis and policy decision-making processes.

4 Adopted econometric model for the study

First, a thorough explanation of the function that will serve as the foundation for this study in light of the suggested variables will follow. For instance, we start with a more basic regression that incorporates all the variables.

$$ECFP_t = \beta_0 + \beta_1 lnRENP_t + \beta_2 RQ_{t+} \beta_3 RL_t + \beta_4 lnODA_t + \beta_5 CC_t + \varepsilon it \quad 1$$

Where (In) represents the natural algorithm of renewable energy and official development assistance. Logarithms are more useful to address exponential equations and to balance the data. For instance, if the data is greater than one hundred (100), we use a natural algorithm to explore the properties; as result, it will make the interpretation of the standard deviation and coefficient of the applied model easier and prevent discrepancy while simultaneously creating a balanced threshold with other variables. denotes for , whereas equals the study's period (1998, …, 2018). On the other side, the is a parameter that measures the spatial changes, or how the constant fluctuates over time. and shows the residual term at time . Finally, lnRenp= renewable energy consumption; RQ= Regulatory qualities; RL= rule of law; lnODA= official development assistance; and CC= control of corruption, *equation 1*.

4.1 Step-I-unit root test

Due to the fact that the majority of time series data are non-stationary, it is necessary to look first at the unit root problem. The study employed an auto-regressive model (AR) to explore the stationary series.

$$\kappa_t = \theta\, \kappa_{t-1} + \epsilon_t \qquad 2$$

In accordance with above equation, there are three conceivable applications of this paradigm, which are as follows: the variable could be stationary at level (I), at first difference (II), or the series if non-stationary (II). In cases of failing to demonstrate the presence of stationarity, whether it is at level of at first difference, the variable should be discarded. Following these possible scenarios, the study opts for the Dickey–Fuller (ADF) unit root test to the integral order of the variables (Zahra et al., 2022). This particular test (ADF) includes the optimal lag selection of each of the factors. The optimal lag was fixed to 2 lags, whereas Akaike information criteria (AIC) is utilized as potential determinant of the optimal lag length. The following econometric method is used in this paper, observer *equation 2*.

$$\Delta\kappa_t = \beta_0 + \theta\kappa_{t-1} + \sum_{i=1}^{n} \delta_i \Delta\kappa_{t-1} + \epsilon_t \qquad 3$$

$$\Delta\kappa_t = \beta_0 + \beta_1 t + \theta\kappa_{t-1} + \sum_{i=1}^{n} \delta_i \Delta\kappa_{t-1} + \epsilon_t$$

($\kappa t - 1$) which is an axiom of the AR; is the intercept term, denotes the coefficient of trend variables, is utilized for the error term at time t in the model. The assumption for the ADF test implies that the data have a unit root problem, whereas the second hypothesis considers that the data are unit root problem-free; *equation 3*.

4.2 Step-2 ARDL approach

The Autoregressive Distributed Lag Model allows to the relationship between certain selected variables to be tested and to determine the extent of this relationship, whether it falls under the short or the long run (Pesaran et al., 2001).As the objective of this study is to examine both the relationships and the effect, an ARDL test will be the prime model to help us assess the short-run and long-run relationship between the explanatory (Renewable energy consumption, Official development assistance, regulatory quality, control of corruption and rule of law) variables and the dependent variable (Ecological footprint). Although, it is worth noting, that the short-run and long run are calculated differently. While the short run model takes the following mathematically form:

$$ECFP_t = \propto_0 + \sum_{i=1}^{P} \phi_{1i} \Delta\, ECFP_{t-i} + \sum_{i=1}^{S} a_{2i} \Delta\, InRENP_{t-i} + \sum_{i=1}^{T} a_{3i} \Delta\, RQ_{t-i} + \sum_{i=1}^{U} a_{4i} \Delta\, RL_{t-i} + \sum_{i=1}^{V} a_{5i} \Delta\, InODA_{t-i} + \sum_{i=1}^{W} a_{6i} \Delta\, CC_{t-i} + \varepsilon_t \quad (4)$$

Equation 4 shows short-run effects with denoting the short-run parameters, while Δ demonstrates the differences for stationarity, whereas, in the equation shows the residual term with zero mean and constant variance.

Although extending the model to a long-run should only be decided after taking into account the wald F-statistics. A null hypothesis indicates the absence of cointegration between the variables, therefore limiting the study only to the short-run, while the alternative hypothesis suggests the presence of cointegration by observing the F-statistics; in doing so, we observe whether the F-statistic is greater than the upper bound (Narayan, 2004). The long-run takes the following equation.

$$ECFP_t = \propto_0 + \sum_{i=1}^{P} \phi_{1i} \Delta\, ECFP_{t-i} + \sum_{i=1}^{S} a_{2i} \Delta\, InRENP_{t-i} + \sum_{i=1}^{T} a_{3i} \Delta\, RQ_{t-i} + \sum_{i=1}^{U} a_{4i} \Delta\, RL_{t-i} + \sum_{i=1}^{V} a_{5i} \Delta\, InODA_{t-i} + \sum_{i=1}^{W} a_{6i} \Delta\, CC_{t-i} + \lambda ECT_{t-1} + \varepsilon_t \quad (5)$$

where *ECTt* – 1 shows the error correction term and the model's adjustment parameter, *equation 5.*

4.3 Step-III: Causality Test

The ARDL approach allowed for the observation of the relationship between the chosen variables. However, a conclusion regarding the relationship between these variables that is based solely on correlation coefficients cannot be drawn (Barrowman, 2014). As a result, a discussion regarding evaluating less significant correlations develops among economists; hence the Toda-Yamamoto technique is one of the credible methods for checking whether one event affects another to occur, how much of the second event can be accounted for by its own past (lag) values, and how substantially the prior values of the first event contribute to the explanation (Toda & Yamamoto, 1995). The test's findings either establish causation, (I) indicating that one event is caused by another event, (II) or they show that there is no causal relationship at all, or showcase the presence of (III) two-way causality. Below is the *equation 6*:

$$\mathrm{ECFP}_t = o_1 + \sum_{i=1}^{1} \beta_1 \,\mathrm{ECFP}_{t-i} + \sum_{i=1}^{1} \beta_2 \ln RENP_{t-i} + \sum_{i=1}^{1} \beta_3 \,\mathrm{RQ}_{t-i} + \sum_{i=1}^{1} \beta_4 \,\mathrm{RL}_{t-i} + \sum_{i=1}^{1} \beta_5 \ln \mathrm{ODA}_{t-i} + \sum_{i=1}^{1} \beta_6 \,\mathrm{CC}_{t-i} + \varepsilon \quad 6$$

4.4 Step-IV: Impulse Response Function (IRF) and Variance Decomposition Analysis (VDA)

The Toda-Yamamoto causality test is more accurate than correlation analysis when analyzing governance variables, but it only evaluates precedence and information content, although it fails to provide an explanation for complicated types of causation. Since governance variables frequently change in tandem with one another, it is normal for their correlation to fluctuate. Hence, to further boost the accuracy of the study, a variance decomposition and impulse response are employed. More formally, VDA assesses the relationship between variables across time; it evaluates how much of the variance in each variable's forecasting error can be accounted for by external shocks. Meanwhile, IRF assesses the extent to which a predictor affects a dependent variable (Stock & Watson, 1993). In general, both models are useful to forecast future effects, therefore a period of twenty years was selected, starting from 2023 to 2043.

$$\mathrm{IRF}_t = \sum (\mathrm{j} = 0)\text{^}\infty A\_J^* \varepsilon_{t-j} \quad 7$$

At time t, the IRF represents the reaction of variable y to a shock in variable x. is the element of the impulse response function that represents the effect of a shock in x on y periods after the shock. Recall that IRF is a response of one variable (x) to the shock of another variable (y) in a multivariate time series, equation 7.

$$\mathrm{VD}_{kt} = \sum (\mathrm{j} = 0)\text{^}\infty (B_j\,(K,K) * \sigma^{2(k,t-j)]} / \sigma\text{^}2_{(y,t)} \quad 8$$

VD_k(t) is the variance of the forecast error of y due to the shocks in variable *k* at time *t. B_j (k,k)* is the *j th* element of the variance decomposition matrix, which represents the proportion of the forecast error variance of y due to the shocks in variable k j periods before the forecast. *σ^2_(k,t –j)* is the variance of the shock in variable k j periods before time *t. σ^2_(y,t)* is the variance of the forecast error of y at time , *equation 8*.

5 Results and Discussion

Table 2 shows the descriptive statistics of the candidate's variables. Ecological footprint ranges from 0.703 to 1.913, with an average of 1.148 projecting an increase of ecological footprint (ECFP) in the recent years. This can also be assessed by the standard deviation of 0.397, higher than the other selected variables. Alternatively, governance quality factors are leaning toward negativity. On average regulatory quality, rule of law and control of corruption in the Djiboutian bureaucratic system are relatively 0.712, -0.862 and -0.588 respectively, implying that the country's poor governance performance still remains the same, if not somehow increasing toward a higher negative value which would likely lead to stalemate as regards addressing ecological issues. On the other side, the level of aid poured in the country by public entities and ODA countries had been increasing to 8.120, although, the efficiency of such an allocation remains questionable. Similarly, renewable energy consumption shows a low value; at maximum,

Djiboutian residents consume energy generated by renewables at 0.340, which further calls for the development of renewable energy sectors to mitigate the ecological footprint.

variable	Mean	Median	Maximum	Minimum	Standard. Deviation
ECFP	1.148488	1.033974	1.913756	0.703297	0.397493
lnRENP	0.314915	0.3252	0.3404	0.2413	0.028348
RQ	–0.71234	–0.72657	–0.45631	–0.8937	0.108251
RL	–0.86230	–0.88297	–0.65668	–1.02716	0.097435
lnODA	8.052143	8.120673	8.267993	7.773786	0.166853
CC	–0.58855	–0.6366	–0.30324	–0.8592	0.141708

Table 2. Descriptive statistics of the selected variables
Sources: Compiled by the author

To confirm that the data complies with the ARDL model, we consult the results of unit root tests. Our time series data are tested for a unit root to see whether it exists. The data is deemed non-stationary if it has a unit root. In order to examine data stationarity, we either employ the Philps-Perron test or the augmented Dickey-Fuller (ADF) analysis, according to scholars, checking the unit root before proceeding with a time series dataset, one of the available unit root test methods should be performed as it prevents creating a fictitious or misleading regression (Dickey & Fuller, 1979). According to Table 3, all the selected factors are non-stationary at this level but became stationary at first difference, suggesting they are integrated at (1). This integration demonstrates that our study meets the requirements for using the auto-regressive distributed lag approach to evaluate the effects of renewable energy consumption, regulatory qualities, rule of law, official development assistance, and control of corruption on the ecological footprint in the Republic of Djibouti.

Variable	Level		First difference		Stationarity
	Constant	Trend	Constant	Trend	Decision
ECFP	–1.316	–1.838	–2.467**	–2.646	At first difference I(1)
lnRENP	–0.651	–1.806	–2.164**	–2.008	At first difference I(1)
RQ	–0.526	–1.785	–3.318***	–3.057	At first difference I(1)
RL	–0.158	–1.712	–-3.535***	–3.453**	At first difference I(1)
lnODA	1.215	–2.382	–3.526***	–3.870***	At first difference I(1)
CC	–0.672	–1.428	–3.062***	–3.164*	At first difference I(1)
1%, 5% and 10% represented as ***, ** and *					

Table 3. The unit root test
Sources: Compiled by the author

Table 4 reports the outcomes of a bound test. This test is used to identify a co-integration connection among the variables by observing the F-statistic value. With a 1% significance level, the F-statistical value of 5.870 is larger than both the upper and lower bounds of 4.68 and 3.41. There is therefore

evidence of a long-term co-integration connection. However, if the F-statistic was less than the top and lower boundaries, we would have presumed the existence of no co-integration. If, otherwise, the F-statistic was between the top and lower boundaries, the results would have been considered equivocal and indecisive, although such a scenario is quite rare but likely here.

Test statistics	Value	
F statistics	5.870	
Significance level (Critical)		
Significance level	I (0) Lower Bound	I (1) Upper Bound
10%	2.26	3.35
5%	2.67	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Table 4. The long-term criteria decision results
Sources: Compiled by the author

Furthermore, we calculated the model's diagnostic, and all of the residuals exhibit no autocorrelation (0.637) and are distributed consistently (0.6145). The Ramsey test result shows that the present model has no misspecification errors (0.782), and the model also predicts no problems with heteroskedasticity; as a result, and the ARDL bounds test generates accurate and consistent estimates (Ramsey, 1969). To ensure that there are no diagnostic problems, we observe the value; more formally the value should not be less than 0.05; Table 5.

Breusch–Godfrey Serial Correlation LM Test:				
F-statistic	0.465700	Prob. F (2,28)	0.6378	No serial correlation exits
Observation × R-squared	0.825581	Prob. Chi-Square (2)	0.5956	
Heteroskedasticity Test: Harvey				
F-statistic	0.547595	Prob. F (2,28)	0.4688	
Observation × R-squared	0.690475	Prob. Chi-Square (2)	0.4422	The model is Homoskedastic
Jarque–Bera test				
Test	0.8739	Chi (2)	0.6145	Estimated residuals are normal
Ramsey RESET test				
F-statistic	0.010	Prob > F	0.7823	The model has no misspecification

Table 5. The diagnostic result of the model
Sources: Compiled by the author

The lowest part of the table contains the Error Correction Model (ECM) coefficient, which indicates the short-term effects of variables. The residual term is statistically significant but has a negative value at a 1% level of significance. According to the table's ECM coefficient (1.958), a short-run

disequilibrium may be converted into a long-run equilibrium at a rate of roughly 195.8% in a year. The model additionally passes each and every one of the required diagnostic tests. Table 6.

The probability values in Table 6 depict that renewable energy consumption (RENP) has a negative short-run (-7.76) and long-run (-4.96) relationship with ecological footprints (EFP). This negative value implies that an increase in Djiboutian residents' consumption of energies generated by green technology and renewables would eventually lead to a 5% decrease in the ecological footprint in the short run, whereas a decrease of about 1% is observed in the long run elasticity. Empirically speaking, the current result is in line with previous studies (Nketiah et al. 2022; Baloch et al. 2019; Doğan et al. 2021). These studies suggest that the consumption of renewable energies promotes environmental quality, and thus urge the promotion and use of renewable energy resources in order to achieve sustainable growth. Technically, it is easy to suggest that renewable energies are particularly useful in controlling ecosystem degradation. However, the above promising points might only be subjected to OECD and emerging countries.

On our current status, given Djibouti's financial strength, switching to clean energy sources might not be simple, but raising awareness, offering relief to the population (through subsidies, flexible interest rates, taxes breaks, etc.), and incentivizing businesses to switch to cleaner production while taxing those that use dirtier methods of production could all be positive steps in the right direction. The country also needs to adopt an energy portfolio that encourages a flow pattern of green energy consumption generated by environmentally friendlier tools (such as solar, wind, hydropower, and geothermal power).

Alternatively, Djiboutian regulatory qualities and the level of adherence to the rule of law, positively affect ecological footprints. The general interpretation would be that, with an increase in both rule of law and regulatory quality in the long run, we are more likely to witness ecological degradation (1.891-2.082), as both factors tend to manifest certain detrimental effects on the Djiboutian ecological sector; Table 6. A critical issue in this sense is the difference in the environmental regulations of different countries. It is also important to note that environmental legislation cannot always have the desired effect. For instance, it is possible that it is implemented inefficiently, and as a result, any potential advantages are overwhelmed by this inefficiency (Makhdum et al., 2022). It is also necessary to quantify environmental stringency accurately in order to create a control group that accurately represents what would occur in the absence of a policy or in the case of a policy that is less stringent in order to assess the effects of a particular regulation. One should mention that if a policy is rolled out gradually over time or in a randomly selected subset of regions, variations in the strictness of environmental regulations may appear in the within-country analysis. For example, the employment of collective national environment legislation across the country will not accommodate the demand of other regions within the national territory, consequently creating a discrepancy when taking public sectorial development into account.

Similarly, the cost burden of environmental policies has often been found to be very small or non-existent in some cases. One of the primary causes of failing to meet environmental goals is the weakening or non-implementation of environmental legislation due to corruption (Balsalobre-Lorente et al., 2019).

The current finding of Djiboutian environmental legislation failing to introduce a solid package of ecological footprint reduction can also be viewed from an internal administrative dimension rather than the common ground of bureaucratic ineffectiveness, in which, mostly, the implementation of ambitious environmental policies can have an adverse (negative) effect on unemployment, particularly in polluting energy-intensive sectors. More formally, the effects tend to cluster on a select minority of basic manufacturing industries epitomized by high energy-intensive production systems, a constrained ability to completely pass through emission control (regardless of whether due to regulation or international competition), and maybe even

an inability to innovate and attract investment capacity to advance new production processes. Additionally, Sustainable development growth necessitates little or no harmful emissions and is dependent on the state's institutions and economic activity. As a result, elements such as low corruption in the public sector, quality of institutions, flexible laws, and economic forces (e.g., agricultural activities, trade openness, and foreign aid) must play a substantial and significant part in the sustainability process. Although, Greaker (2003) proposes the theory of the "race to the bottom"; it claims that state authorities intentionally weaken environmental norms in order to entice more international investors and boost economic growth in their own countries.

However, this theory collapses for the current study, as East African nations do not have reason to lower regulations directed toward the environment to create external investment spill-over, therefore further sustaining both above-mentioned arguments of regulatory inefficiency and unemployment surge. However, this does not entail the practice of withdrawing institutional law due to the absence of subjection to national regulation betterment by the international and regional community, but adopting a more realistic approach – which provides clean industries and promotes competition which also increases economic growth but at a little expense of environmental depletion. Overall, the finding is in line with studies such as (Hassan et al., 2020; Oteng-Abayie et al., 2022; Makhdum et al., 2022); Table 6.

Dependent Variable: (ECFP)				
Optimal lags: (1 2 2 1 2 2)				
Short run relationship				
	Coef.	Std.Err	t	P>t
Δ lnRENP t	–7.761113	3.061034	–2.54	0.085**
Δ lnRENP t-1	7.304639	1.940656	2.48	0.089**
ΔRQ t	2.449052	1.129173	2.17	0.119
ΔRQ t-1	0.7948385	0.6379184	1.25	0.301
ΔRL t	4.761984	1.70703	2.79	0.068**
ΔlnODA t	–0.2576444	0.7770557	–0.33	0.762
ΔlnODA t-1	1.254258	0.6712099	1.87	0.158
ΔCC t	3.665073	1.390796	–2.64	0.078**
ΔCC t-1	–3274309	0.3133126	–1.05	0.373
Ecm (− 1)	–1.958652	0.2009045	–6.75	0.001
Long Run Estimates				
Variables	Coefficient	Std. Error	t-Statistic	Prob.
lnRENP	–4.963856	1.342234	–3.70	0.034*
RQ	1.891657	0.3015058	6.27	0.008***
RL	2.082199	0.550417	3.78	0.032*
lnODA	0.8859638	0.2782082	3.18	0.047*
CC	–1.540602	0.3713176	–4.15	0.025*
_cons	–4.997744	2.851488	–0.64	0.570
"The asterisks *, **, and *** showed that the coefficient is significant at 1% 5% and 10% respectively". Note that in the ARDL logs, the first log (1) is for the dependent variable (PEP)				

Table 6. Autoregressive distributed lag (ARDL) test
Source: Author's findings

Furthermore, the study contradicts the common belief of official development assistance (ODA) in contributing to a green economy by reducing harmful factors in the environment (Michaelowa

& Michaelowa, 2007). The result of (ODA) displays a positive coefficient in the long run (0.88); meanwhile, an insignificant effect can be discerned in the short-run (-0.25, 1.25), Table 6.

These findings contend that as monetary aid increases in the Republic of Djibouti, the plausible scenario of ecological depletion is likely. Let us analyze these, then, from two grounds; (I) It makes sense to suggest that one of the key barriers to the growth of a stronger collaboration between donors and recipient nations in the pursuit of environmental protection and the accomplishment of Millennium Development Goals (MDGs) is a lack of effective assistances. Hence, the international community may find itself in some sort of a usual "low-level equilibrium" as a result of the uncertainty around the efficient use that may be made of monetary assistance. Likewise, due to the perceived slowness of success in comparison to previous assistance and the proof of aid misuse in some specific cases, donor nations have experienced considerable "aid weariness" with regard to combating climate change, therefore, aid volumes in most African countries – particularly East Africa – had consequently fallen as a result of poor aid allocation. It is also worth noting that ODA efficacy also seems to have decreased as donors try to assert more control over the assistance they are giving, regardless of how recipient nations approach the money they received. (II) Furthermore, it appears that neither contributor is very committed to preserving the climate. Their respective aid continues to be focused on reducing poverty, meeting basic necessities, promoting education and developing rural areas.

Additionally, governance and control of corruption play a crucial role in lowering environmental pollution, as the findings suggest; greater control of corruption reduces the ecological footprint by (3.665) in the short run and (–1.540) in the long run, respectively. Since control of corruption (CC) is an institutional indicator that lowers environmental deterioration from carbon and nitrous emissions, it could seem logical that eliminating corruption is the key to compelling investors and businesses to adhere to the rules. The study confirms the results of (Amuakwa-Mensah & Adom, 2017), Table 6. In fact, citizens would respond favorably to government policies: if it makes transparent policies for the welfare of the population, which will raise awareness in the environmental sector, the government would then be better equipped to implement effective environmental policies as a result of this awareness, Table 6.

Similar trends may be observed in terms of resource mismatch and ecological efficiency: the more corruption, the more resource mismatch materializes. Whereas a positive relationship scenario between the degree of resource discrepancy, corruption, and ecological efficiency could intensify corruption and not only will directly lead to ecological decline, but also causes an ecological efficiency backdrop by intensifying the resource mismatch. For example, Amuakwa-Mensah and Adom (2017) discovered that the lack of enforcement is fueled by foresters' misconduct and results in significant habitat loss. The author links corruption with the environment through regulation, in which non-compliance with environmental legislation has its origins in the corruption of the political system, and the best indicator of systemic corruption in a country's political system is non-compliance with environmental regulations. Likewise, in a report published by Freedom House on the top 10 countries as the worst democratic performances[3], Syria, South Sudan, Eritrea, Turkmenistan, North Korea, Equatorial Guinea, Saudi Arabia, Somalia, Sudan and Tajikistan, where three countries are from the East of Africa, further validating the consensus of high corruption plaguing the region. Indeed, corruption cannot be completely eliminated and is very difficult to do. Therefore, a more practical approach is to accept some corruption, as long as it stays below a particular threshold.

Moreover, the presence of corruption has adverse effects on the equity, effectiveness, and efficiency expected from regulatory measures in the field of energy research, and development,

[3] Freedom house: Expanding Freedom and Democracy (See; https://freedomhouse.org/)

as highlighted by Balsalobre-Lorente et al. (2019). Corruption can also result in the excessive exploitation of natural resources throughout the extraction, distribution, and management processes. This, in turn, triggers ecosystem and wildlife degradation, which in part fosters the illegal trade of endangered and near-extinct species and diverts allocated environmental policy funds for personal gain (Lisciandra & Migliardo 2017; Sekrafi & Sghaier, 2018). In this context, Harring (2013) argued that corruption diminishes patriotism, leading to a decrease in economic efforts aimed at environmental protection.

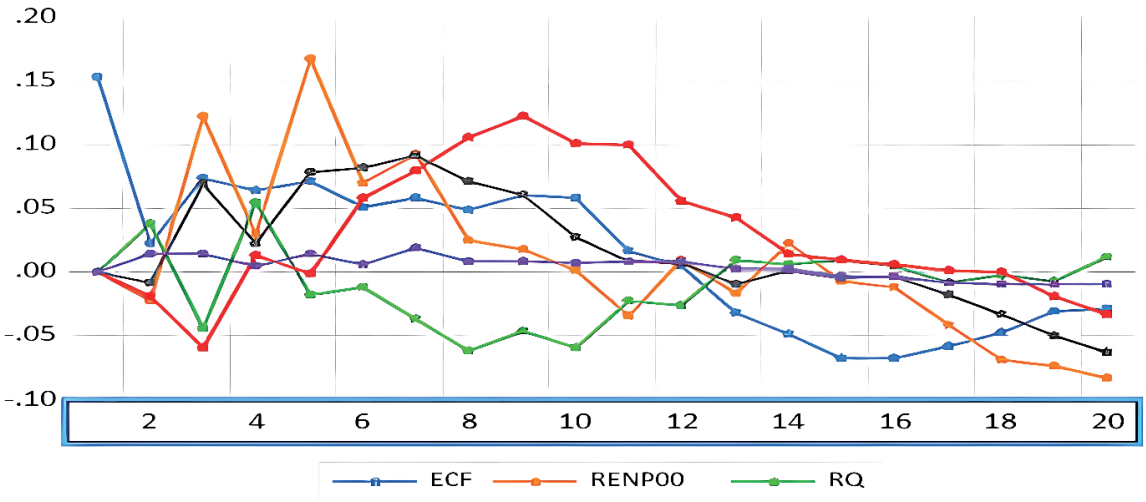
The evaluation of the environmental effects of corruption can be framed within the theoretical construct of the pollution haven hypothesis (PHH). In nations characterized by elevated levels of corruption, the inappropriate exploitation of environmental resources for personal gain tends to proliferate, thereby exerting a detrimental impact on environmental standards. Consequently, corruption serves as a catalyst for the influx of polluting enterprises, often in the guise of FDI, capitalizing on lax environmental regulations (Akhbari & Nejati, 2019).

In this part of the study, I estimated both the IRF and the variance decomposition (VRA). In order to determine how a particular variable – particularly the dependent variable – reacts to changes made to other variables or factors, the impulse response function and the variance test are used. Based on Cholesky's analysis of IRF, the results of the impulse response can be observed, Table 7.

Impulse Responses						
Period	ECFP	lnRENP	RQ	RL	lnODA	CC
1	0.15292	0	0	0	0	0
2	0.02246	–0.0223	0.03775	–0.019	–0.0081	0.01485
3	0.07417	0.12255	–0.0441	–0.0594	0.06912	0.01402
4	0.06384	0.02984	0.05416	0.01363	0.02263	0.00462
5	0.07158	0.16707	–0.0175	–0.0009	0.07871	0.0144
6	0.05074	0.07074	–0.0121	0.05784	0.08216	0.00666
7	0.05834	0.09255	–0.0365	0.07943	0.09205	0.01869
8	0.04902	0.02469	–0.0619	0.10555	0.07111	0.00834
9	0.06097	0.01831	–0.0457	0.12258	0.06074	0.00879
10	0.05789	0.00082	–0.059	0.10107	0.02691	0.00769
11	–0.0173	–0.0346	–0.0227	0.09924	0.00834	0.00797
12	–0.0053	0.00976	–0.0259	0.05596	0.00766	0.008
13	–0.0319	–0.0161	0.00959	0.04299	–0.0089	0.00244
14	–0.0486	0.02287	0.00664	0.01443	0.00191	0.00309
15	–0.0673	–0.0069	0.00996	0.00929	–0.0041	–0.003
16	–0.0674	–0.0117	–0.0054	–0.0056	–0.0038	–0.0037
17	–0.0584	–0.0418	–0.0077	–0.0013	–0.0178	–0.0083
18	–0.0466	–0.0681	–0.0027	–0.0002	–0.0336	–0.0094
19	–0.0309	–0.0739	–0.0064	–0.0185	–0.0498	–0.0096
20	–0.0284	–0.0827	–0.0024	–0.033	–0.0632	–0.0095
Cholesky One S.D. (d.f. adjusted) Cholesky ordering: ECFP						

Table 7. The impulse response function results
Sources: Compiled by the author

When conducting the IRF test, we have the possibility to select a specific period, therefore in this case a period of *20 years* is applied, starting from late 2022 to 2042. Observe the first *five years* of the IRF response, at the first ecological footprint, affects itself, which makes other independent factors (renewable energy consumption, regulatory quality, rule of law, and control of corruption) have zero impact on the dependent variable (ecological footprint) whereas, a negative shock starts to materialize among variables; five years for regulatory quality, after ten years for renewable energy and official development and finally after sixteen years for both the rule of law and control of corruption. This negative value demonstrates how, as institutional qualities ameliorate, adopting renewable energy as the primary source of energy generation and external monetary aid spill-over in the Djiboutian national territories reduces the amount of the ecological footprint.



ECF: Ecological footprint; RENP00: Renewable energy consumption, RQ: Regulatory Quality, Rl: Rule of law, LOODA3: Official development assistance, CC: Control of corruption

Figure 3. The effect of independent variables on ecological footprints
Source: Compiled by the author

Figure 3 provides a better view in which the combined factors infuse a collective reduction, although it is interesting that through the years, control of corruption remains low; indeed, higher transparency contributes to environmental betterment, but the effect remains the same, in which it keeps leaning toward negativity compared to other factors which impose a higher shock on the ecological footprint. It is worth noting that the current results of the IRF can be considered relevant unless future reforms have been proposed by the Djiboutian authorities—as can be noticed from the IRF and VRA, the materialization of such a shock requires a period and a specific threshold of time to pass in order to transpire completely.

Interestingly, the above results have also been supported by the Toda-Yamamoto test, in which all the variables have a future significant effect on the ecological footprint. Toda-Yamamoto is most suitable when the variables are stationary at either level or 1st level, rather than a Granger causality, so the study adopts the Toda-Yamamoto test in relevance of the absence of a mixture of stationary tests. According to the results, both renewable energy consumption and control of corruption have a higher considerable effect on the ecological footprint with an elasticity of 9.23 and 8.67, respectively, Table 8.

Variables			t-statistics	Significance level	Decision
Renewable energy consumption	→	Ecological Footprint	9.2396	0.0023	Supported
Regulatory quality	→		5.6295	0.0176	Supported
Rule of law	→		5.3658	0.0205	Supported
Official development assistance	→		3.2303	0.0622	Supported
Control of corruption	→		8.6769	0.0032	Supported

Table 8. Toda-Yamamoto causality test
Source: Compiled by the author

Meanwhile, the variance decomposition predicts that two of the explanatory variables have a noteworthy burden on the ecological footprint. It appears that both renewable energy consumption, and an increase in rule of law adherences among civil servants have a substantial shock on the ecological footprint, which is expected to climb from 1.88% and 1.33% in late 2022 and early 2023 to 27% and 23% by 2042. Additionally, regulatory quality and official development assistance have a decent fair share of the reduction in the ecological footprint by 6% and 15% after twenty years, respectively. This illustrates the need to develop more sustainable legislation while taking into account the aftermath of such regulation, and fastening the introductory mission of transparent budgetary allocation, considering how certain official development assistance is poorly allotted, Table 9.

Variance Decomposition						
Period	**ECFP**	**lnRENP**	**RQ**	**RL**	**lnODA**	**CC**
1	100	0	0	0	0	0
2	90.28325	1.887493	5.386499	1.363756	0.245888	0.833119
3	51.17444	27.02228	5.865872	6.778406	8.432864	0.726128
4	50.6673	24.84442	9.541644	6.174971	8.108013	0.663651
5	36.47519	41.89546	6.24489	3.855875	10.91837	0.61021
6	33.28742	39.88979	5.461095	6.003738	14.80004	0.557917
7	29.30273	38.06497	5.314781	9.029774	17.60451	0.683242
8	26.80868	33.39143	6.800722	14.19787	18.16846	0.632837
9	25.32626	29.39908	6.996621	19.93711	17.74831	0.592618
10	24.79187	26.99426	8.021446	22.99264	16.62853	0.571252
11	23.6285	26.10734	7.827449	26.07605	15.79155	0.569111
12	23.23169	25.69626	7.979292	26.9628	15.54335	0.586611
13	24.0128	25.44779	7.907128	27.36677	15.36037	0.580955
14	24.0135	25.33192	7.821855	27.09475	15.16064	0.577322
15	25.39295	24.85625	7.70942	26.60047	14.87122	0.569695
16	26.72365	24.43787	7.574094	26.10628	14.59381	0.564299
17	27.47329	24.58444	7.430991	25.53477	14.39786	0.578647

Variance Decomposition						
Period	**ECFP**	**lnRENP**	**RQ**	**RL**	**lnODA**	**CC**
18	27.46109	25.59397	7.207205	24.75649	14.38671	0.594532
19	26.86928	26.71562	6.974732	24.0327	14.79951	0.608162
20	25.93134	27.89659	6.712109	23.32355	15.52431	0.612102
Cholesky One S.D. (d.f. adjusted) Cholesky ordering: ECFP LNRENP RQ RL LNODA CC						

Table 9. Variance decomposition analysis
Sources: Compiled by the author

6 Policy recommendation

6.1 Consolidating ecological footprint mitigation via the amelioration of institutional quality and the curtailment of corruption

The ongoing discussion among policy analysts centers on the growing concerns of ecological degradation and escalating energy demands, with a particular focus on the role of an effective governance structure in achieving Sustainable Development Goals. Research conducted in various South Asian countries by Asif, Sabir and Qayyum (2023) highlights that corruption and political instability have a notable and a positive influence on both carbon and ecological footprints in both the short and long term, with the exception of corruption, which has a short-term negative impact on carbon footprint. As the role of sustainable government is among an amalgam of core elements that assists ecological footprint mitigation, generally this governance indicator incorporates corruption and political stability.

However, it is unlikely that both factors could yield the same significant effect on ecological footprint, depending on the studied nation and the political architecture of the country. A reasonable example could be sought from the study by Sun, Gao, Raza and Khan (2023): some of the selected BRICS countries (Brazil, Russia, India, China and South Africa) showed that controlling the level of corruption and increasing government effectiveness might significantly affect the ecological footprint of all countries excluding India and China. In the case of political stability, all economies portrayed that political stability fosters energy efficiency and reduces the ecological footprint; nevertheless, China exhibited insignificant influence on the political stability-ecological footprint nexus. Also, regulatory quality helped in improving energy efficiency in all countries. However, the association of regulatory quality with the ecological footprint revealed that regulatory quality does not Granger-cause the ecological footprint in China; but the effect is significant in other countries. Perhaps this raises the question of whether, pragmatically, corruption contributes to the sustainability or it is a pure abstract concept in the environmental sense. This view holds that the concept of corruption could be divided into sub-categories in an environmental contextualization, such as effective budgetary allocation for environmental amelioration activities, transparency, citizen-governmental co-creation, the emphasis on principles of participation for sustainability causes. Nevertheless, the level of development within a country framework cannot be overlooked, as the rapid development obfuscates the prominent effect of corruption on the ecological footprint, since it is compensated by providing a strong economic mechanism for citizens; as a result, altering ecological concerns to a threshold below the quintessential level among officials' agendas.

Apart from the context of corruption, institutions assume a cardinal and indispensable role in the endeavor of mitigating ecological footprints. A proficient institutional framework can exert a manifold impact, both in direct and indirect ways—on the ecological health of a region and the economic prosperity of nations. The complex relationship between institutions and the environment can be elucidated by dissecting various institutional facets, including government efficacy, democratic responsibility, anti-corruption measures, the maintenance of legal and societal order, and the caliber of bureaucratic administration, as expounded upon by Uzar (2020a). Similarly, the stability of a government, the high quality of its bureaucratic machinery, and the exclusion of military involvement in political affairs collectively enhance the effectiveness of governmental policies. Augmented policy efficiency, in turn, facilitates the autonomous and productive formulation of environmental policies. To illustrate further, any institutional shortcomings have the potential to amplify the influence of lobbying within the policymaking arena. Specifically, the influences exerted by sectors, associated with high levels of pollution and conventional energy corporations, on a government can erode the robustness of environmental policy frameworks (Cadoret and Padovano 2016).

An additional facet within the spectrum of institutional dimensions can be found in domain of legal frameworks, hence, a robust legal system wields substantial influence over the regulation of economic and social spheres, primarily by upholding property rights, enhancing legislative frameworks, and efficiently enforcing contractual agreements (Mishkin, 2009). Under this fact, a potent legal system assumes a dual role in averting environmental impacts, firstly by guaranteeing the accurate implementation of environmental laws, and secondly, by compelling corporations to adhere rigorously to environmental standards (Welsch, 2004). Conversely, enterprises that fail to conform to these stringent protocols face the prospect of suspension of their operations and the imposition of punitive measures. The rule of law may aid in supporting sustainable development and safeguarding the environment for future generations by encouraging environmental legislation and enforcement, public involvement and responsibility, and investment in renewable energy – as investors are more prone to trust the regulatory and legal frameworks controlling renewable energy projects and are more likely to be prepared to invest in them when there is a strong rule of law. This can facilitate the switch, moving faster to more environmentally friendly energy sources.

It can thus be seen that democratic accountability is very important in terms of environmental policies. The institutionalization of democracy allows free discussion of universal issues such as human rights, justice, inequalities, and the environment (Uzar, 2020b). In such a democratic conjuncture, people can easily learn about government policies and provide feedback to their governments on relevant policies. An accountable relationship between government and society can increase social pressure on governments and prevent environmental policies that have negative effects (Payne, 1995).

6.2 Implementing practical adaptive measures for ecological footprint (an inspiration from different countries)

The government should possess the capacity to furnish microfinancing and financial assistance to bolster the resilience of agricultural sectors and small enterprises in the face of climate change. Taking a cue from China’s forward-thinking approach, the Beijing government has strategically employed financial incentives, manifesting in the provision of subsidies aimed at facilitating the construction of water reservoirs and storage infrastructure tailored to the needs of farmers (Li et al. 2018). This visionary initiative has yielded demonstrable results by effectively

mitigating the vulnerability of farmers to the perils of drought. Likewise, as elucidated by Ryan and Elsner (2016), the implementation of sand dams, categorized as a form of rainwater harvesting infrastructure, demonstrated its efficacy in expediting the recovery of vegetation following drought episodes in Kenya. As expected, ecosystem-based adaptation strategies and policies emerged as the prevailing approach in addressing a spectrum of environmental challenges, encompassing activities such as *erosion control, environmental revitalization and preservation, adaptive management, and the stewardship of fisheries resources*. This stands as a source of inspiration for governmental endeavors akin to Djibouti, particularly in addressing the pressing challenges posed by desertification.

It is no surprise that such as structural adaptations (encompassing a range of initiatives such as the expansion of water reservoirs, installation of solar-powered water pumps, creation of a plant nursery, and construction of emergency shelters) have proved effective in ameliorating environmental repercussions – since a similar mechanism had been adopted in Pakistan as it increased food security for 50 village households, increased access to safe drinking water, reduced women's workloads, and decreased the number of lives lost during a cyclone.

Likewise, it is advisable to consider a comprehensive measure geared towards risk mitigation, encompassing strategic investments in information and communication technologies, the establishment of collaborative knowledge-sharing platforms, and the deployment of early warning systems. Eakin et al. (2015) provided a demonstration of the effectiveness of an early warning system implemented in Chile. This system, far from being a singularly focused tool, not only served as an alert mechanism for potato growers regarding potential pest infestations and disease outbreaks but in its role in substantially diminishing the threat posed by potato blight.

The responsibility for safeguarding the environment extends beyond the government's purview and involves various stakeholders. For instance, there exists an efficient mechanism aimed at embracing eco-friendly practices, encompassing both environmental protection hardware (EPH) and environmental protection software (EPS). Vázquez-Brust et al. (2022) have delved into the integration of corporate entities and businesses into sustainable endeavors in Brazil, facilitated by the concept of green human resource management (GHRM). Interestingly, the model has unveiled that heightened pressure from environmentally conscious stakeholders fosters the adoption of both categories of eco-friendly practices, with GHRM playing a partially mediating role in this dynamic relationship.

Djiboutian leaders should duly contemplate the incorporation of cooperative development practices, as they hold significant potential for enhancing social dynamics. A pertinent case study in Bolivia exemplifies the transformative influence of local agricultural cooperatives. These cooperatives extended invaluable support to farmers by granting access to both informational and tangible resources, facilitating their transition from monocultural agricultural practices to agroforestry, with a specific focus on cultivating cocoa trees (Jacobi et al., 2015). This adaptive shift not only engendered more favorable working conditions, including the provision of shaded environments and reduced exposure to chemical fertilizers and pesticides but also stimulated heightened levels of self-organization among the two communities.

Furthermore, the spectrum of policy recommendations extends to encompass the enhancement of institutional dynamics, mechanisms for conflict resolution, the augmentation of local engagement and self-governance, and the transformation of governmental structures. The activities falling within this category are predicated upon fostering collaborative endeavors, uniting individuals hailing from diverse institutional and cultural backgrounds. This collaborative ethos manifests through initiatives such as the development of accessible decision

support tools, the establishment of a far-reaching information-sharing network bridging various organizations, and the implementation of community-centered strategies for the management of natural resources. A noteworthy example can be found in St. Vincent and the Grenadines. Here, a concerted effort was orchestrated to fortify a network comprising a consortium of institutions and community organizers. This revolved around securing funding and facilitating the construction of a solar-powered desalination facility. The overarching goal was to bolster the availability of freshwater resources at the local level, thereby fortifying the region's prospects for enduring water security, Jaja et al. (2017).

It is also relatively safe to assume that the country needs to adopt "a circular economy" a system that is restorative or regenerative by intention and design. A system that replaces the "end-of-life" concept with restoration, by shifting toward the use of renewable energy, that eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through sustainable activities. However, the argument of the lower-middle income concept (Djibouti) and the country has maintained infancy in environmental endeavors highlighted embracing such a bold economic framework, but with a decent portion of official development assistance, establishing a system for waste disposal and adopting multilateral agreements based on environmental cooperation could compensate for such a lack. An interesting case is Vietnam's context. Since 2015, Vietnam has been considered the 4th highest ranked country in the world in terms of the amount of plastic waste released into the ocean (Jambeck et al., 2015). It is estimated that the amount of plastic waste discharged into the sea from Vietnam reaches about 0.28–0.73 million tons per year, equivalent to 6% of the total amount of plastic waste discharged into the sea worldwide. Meanwhile, the recycling of waste in Vietnam, especially plastic waste, has not been effective. It was traditionally regarded as a low-tech activity carried out mostly by trade villages scattered around the country.[4] As a result, of the 1.8 million tons of plastic waste generated annually in Vietnam, only 27% is recycled (Dang et al., 2021).

Recently, the issue of plastic waste has received special attention by the Vietnamese Government. On 4 December 2019, the Prime Minister issued the National Action Plan for the Management of Marine Plastic Litter (hereinafter referred to Plan) by 2030.[5] The Plan's overall objective is to implement international commitments of Vietnam effectively to address plastic pollution with the focus being the prevention of plastic pollution from land-based sources and maritime activities. According to the Plan, Vietnam aims to reduce plastic waste in the ocean by 75%. The country wants to have 100% of lost and discarded fishing gear collected and to end the practice of the direct disposal of fishing gear into the sea. It also plans to have 100% of the country's coastal tourism sites and service facilities not using single-use plastic and 100% of its marine protected areas to be plastic waste-free.

6.3 Enhancing the legal environmental framework and opting for a co-creation, collaborative Government-citizen approach

Djibouti's adoption of international conventions and treaties are transparent in their incorporation in the national environmental legislation.[6] These numerous conventions have been used as a

[4] Vietnam Business Council for Sustainable Development, 'Vietnam Plastic Industry Report' (n 5).

[5] National Action Plan for Management Plan of Marine Plastic Litter by 2030, Document no 1746/QDTTg, adopted on 4 December 2019 by the Prime Minister.

[6] Several noteworthy elements have been integrated into Djibouti's national environmental legislation, signifi-

solid inspiration and references and even more to the extent of copying and pasting, in order to generate national environmental laws. Nevertheless, this can only be perceived positively, as it positions the country as a part of the international community. For instance, the Convention on Biological Diversity states "Each Contracting Party, to the extent possible and appropriate: (a) Establish a system of protected areas or areas where special measures must be taken to conserve biological diversity; (b) Develop, where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures must be taken to conserve biological diversity; (c) Regulate or manage biological resources of importance to conservation of biological diversity inside and outside protected areas to ensure their conservation and sustainable use; (d) Promote the protection of ecosystems and natural habitats, as well as the maintenance of viable populations of species in their natural environment; (e) Promote sustainable and environmentally sound development in areas adjacent to protected areas with a view to strengthening their protection".[7] The convention is inherently geared towards the establishment of nature reserves within wetlands, primarily aimed at safeguarding animal conservation habitats and preserving the delicate ecosystems that support water-birds. Additionally, the convention extends its focus to maritime conservation efforts, with a particular emphasis on curbing illicit fishing activities, while concurrently promoting ecotourism initiatives.[8] Despite existing national laws protecting marine life in Djibouti, illegal harvesting for meat and ornamental carapace collection is still widespread and other anthropogenic threats, such as entanglement in fishing gear, cause additional mortality (Boldrocchi et al., 2021). Hence, considering the minimal regulatory oversight in this region, and the threats that undermine marine turtle conservation, population monitoring programs should be carried out.

However, the absence of national drafted law in accordance with the country's culture, economy and environmental spectrum puts skepticism on the national environmental law in the extent of its applicability since the so-called Djiboutian environmental law is a mere mirror to international conventions and French environmental law due to both countries' historical relations, which indirectly further leave some roots for its past colonialism.

---

cantly contributing to the formulation of the present-day legal framework in Djibouti:

The United Nations Framework Convention on Climate Change; the Convention on Biological Diversity; the Convention to Combat Desertification; the Vienna Convention for the Protection of the Ozone Layer, the Montreal Protocol, and amendments to the Montreal Protocol; the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; the Kyoto Protocol to the United Nations Framework Convention on Climate Change; the Cartagena Protocol on Biosafety to the Convention on Biological Diversity; the Convention on Wetlands / Ramsar Convention; the Stockholm Convention on Persistent Organic Pollutants; the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.

[7] Since the concept of ecological footprint covers a wider array than simple environmental protection even extending to animal protection since they indirectly and directly become affected by human prints.

[8] The area is home to several endangered and poorly known species, such as the whale shark, Rhincodon typus (Rowat et al. 2007; Boldrocchi et al. 2020), and the Indian Ocean humpback dolphin, Sousa plumbea (Braulik et al. 2018). The Djibouti marine ecosystem also hosts several threated marine turtle species, including the green, Chelonia mydas; hawksbill, Eretmochelys imbricata; and loggerhead Caretta, although no research currently takes place on any these species, given the lack of knowledge on marine turtle biodiversity in Djibouti, and the wider Gulf of Aden (see; Regional action plan for the conservation of marine turtles and their habitats in the Red Sea and Gulf of Aden. Jeddah: PERSGA; 2004).

Likewise, in essence, Djibouti finds itself confronted with the imperative to assess the evolution of its national water legislation. This need arises from the nation's challenging arid climatic conditions, with half of its population grappling with acute water scarcity, while the remaining half faces the ominous threat of desertification. Evidently, Djibouti's water resources are reaching ecological thresholds, marked by the protracted deterioration of ecosystems and their interconnected counterparts. This decline is exacerbated by the persistently inadequate rainfall patterns in the region. Although there is a well-established acknowledgment of the pressing necessity for immediate actions to counteract the environmental deterioration of water resources, the implementation of these measures is intertwined with a web of human priorities. In Djibouti, there is a more obvious assumption of public responsibility for ensuring sustainable water by the national government but it is only supported in national environmental legislation, in contrast to other countries (comparatively, the South African government had gone beyond the prism of incorporating water law in the legislation but also into constitutional framework) (Reed & de Wit, 2003). This responsibility, however, is challenged by the imperative to confront pervasive disparities in the equitable allocation and accessibility of water resources within the nation. The enforcement of water laws and environmental preservation measures must navigate within the broader scope of government obligations, coupled with the constraints posed by the government's restricted financial resources allocated to these endeavors. The Djiboutian government's efficacy in fulfilling its obligations regarding water management should be assessed in the context of its capacity to address a comprehensive spectrum of societal, cultural, and economic reform.

The two most interesting articles in the Djiboutian environmental law can be seen in article 2[9] and article 3[10] that are based on several *fundamental principles.* The principles are as follows * *Principle of participation*: the preservation of the environment constitutes a supreme interest of the nation, engaging the collective responsibility of all citizens and requiring the participation of all in the development of environmental policy * *Principle of integration*: protection and good environmental management are an integral part of the national economic, social and cultural development policy; * *Planning principle*: the establishment of a necessary balance between the requirements of national development and those of environmental protection when developing sectoral development plans and the integration of the concept of sustainable development when the development and execution of these plans, and finally, **The polluter-pays principle*.

Both planning and integration principles are endogenous, as they require simple internal competent authorities, whereas the principle of participation is rather exogenous and often more complex and harder to achieve than the former principles. It depends outside the state's internal competency in the sense that the outcome and the results could be sporadic. The participation factor is based on a co-creation mechanism that involves citizens and authorities responsible for the environment while considering the threshold of transparency within this participation. Indeed, the augmentation of public participation holds significant potential for enhancing the framework of environmental democracy. This potential lies in its capacity to facilitate the integration of valuable environmental insights and interests into the processes of formulating

[9] Art 2: This law sets the objectives of the national environmental protection and management policy on the basis of fundamental principles intended to manage and protect the environment against all forms of degradation or deterioration of environmental resources with a view to ensuring sustainable development.

[10] Art 3: Management and protection of the environment for sustainable development are based on the following fundamental principles:

environmental law, thereby fostering a delicate equilibrium between economic imperatives and environmental considerations. Moreover, this augmentation serves to bolster the efficacy of public engagement in the rigorous enforcement and implementation of legal statutes within the environmental domain.

So, the essential question arises: *how can a country lacking a well-established democratic foundation establish a mechanism for public participation in its legislative processes?* It is worth noting that the Ministry of Environmental and Urbanization, in partnership with the Ministry of Higher Education, has been organizing climate change seminars and conferences with the participation of some incumbent experts in the East African region. However, the idea of comprehensive involvement in ecological initiatives is noticeably absent among the citizens of Djibouti, largely due to a lack of consistent interaction with governmental authorities.

Even in the absence of a democratic prism, a nation can attain elevated levels of public participation, as exemplified by the Chinese government. China, as a case in point, has established a noteworthy precedent.[11] In the past, public involvement in legislative matters followed a single-stage disclosure and comment process, which has now become a regular practice. The transformation commenced with the revision of the Environmental Protection Law in 2012, ushering in a novel mechanism characterized by a two-stage disclosure and comment procedure.

The second question that emerges is *how might the promotion of public involvement in the formulation of environmental legislation contribute to the advancement of environmental democracy, and how could Djibouti leverage this emphasis on co-creation and collaboration to its advantage?* One significant advantage of increased public participation in Djibouti's environmental law-making is that it brings valuable technical expertise to the country's legislative processes. This helps to ease the tension caused by the limited availability of skilled professionals and resources in the realm of environmental policy. Djibouti faces pressing environmental challenges, and the involvement of experts can contribute to the development of comprehensive and high-quality legislation needed to address these issues effectively. Another valuable outcome of increased public participation in environmental law-making is the emphasis it places on incorporating environmental concerns into the legislative process. This broader involvement can empower the Department of Environment to strike a balance more effectively between Djibouti's economic and environmental interests within its environmental legislation. Yet another compelling argument for bolstering public involvement lies in the implementation and administration of environmental laws. To ensure effective public participation in environmental decision-making, a robust institutional framework is crucial. However, achieving this becomes improbable if public engagement is lacking from the outset during the law-making process. Laws can serve as vital safeguards for the public's right to participate in pivotal policymaking decisions by specifying key procedural elements such as stages, scope, and approaches for policy implementation. These considerations hold particular relevance in Djibouti, a country with a limited tradition of involving the public in government decision-making processes.

[11] The Legislation Law of 2015 of the People's Republic of China (adopted on 15 March 2000, effective on 1 July 2000, amended on 15 March 2015) art 37 ('For a bill on the agenda of a session of the Standing Committee, the draft law and an explanation of the drafting and amendment thereof, among others, shall, after the end of the session of the Standing Committee, be released to the public to solicit opinions, unless a decision not to release the same is made at the Chairmen's Meeting. The period during which public opinions are solicited on the same shall not be less than 30 days. Information on the solicitation of opinions shall be released to the public.')

Admittedly, Djibouti had occasionally worked on a parcel of citizen participation campaigns and initiatives However, the intangible impact of these legal advancements has left much to be desired, falling short of expectations; more prevalent practices of non-participation or tokenism still remain. In general, the public faces constraints on how they can engage in the decision-making process. They often have limited access to information, influence over decisions, and opportunities to seek judicial review and remedies. When there's a lack of effective legal channels for expressing concerns about environmentally detrimental projects, it can lead to increased street protests by citizens and heightened pressure from environmental groups on the government (Aden, 2023). One pivotal reason for this systemic failure lies in the inadequacy and lack of comprehensiveness in the legal provisions governing public participation. For instance, when it comes to decision-making processes for construction projects, there is no legal entitlement for the public to participate actively, with requirements limited to the submission of Department of the Environment report forms or registration forms, offering little assurance of meaningful public engagement. Moreover, the involvement of experts in these processes poses challenges, as they may not consistently advocate for the broader public interest due to potential financial support from specific interest groups or government authorities, leading to advocacy for private or non-environmental concerns. Consequently, some companies have exploited this legal gap by conducting seminars exclusively with experts, thus fulfilling the legal requirements without involving the wider public, ultimately undermining the spirit of true public participation in environmental decision-making.

The literature on the principle of polluter pays (PPP) encompasses economic and legal aspects. Its historical origins can be traced to Plato[12] and its contemporary foundation lies in Pigou's economic theory, emphasizing the internalization of external costs. Failure to account for these costs distorts the market, leading to inefficient economic decisions (Pigou, 1951).[13] In environmental contexts, this principle necessitates that polluters bear the external costs of their pollution. Over time, the international regime has expanded the scope of this principle, yet it continues to resist alterations related to the allocation of liability, defining limits, and determining compensation for instances of pure environmental harm. Even the Council on Guiding Principles concerning international aspects of environmental recommends to the OECD the implementation of the polluter-pays principle (De Sadeleer, 2020). However, the comprehensive implementation of the aforementioned principle by the Djiboutian government raises questions, given the prevalent prioritization of economic interests over ecological endeavors. Therefore, there is a great necessity for Djiboutian legislators to consider the impartial implementation of such a principle within a framework that protects the environment in order to be compatible with the general disposition of Djiboutian environmental law.[14]

---

[12] *Laws* 485e. "If anyone intentionally spoils the water of another […] let him not only pay damages but purify the stream or cistern which contains the water". Jowett's translation.

[13] The Pigovian theory (1951) was subsequently criticised, not least by Ronald Coase (1960).

[14] General disposition statement: The environment of Djibouti is a national heritage, an integral part of world heritage. Its preservation therefore constitutes a primary interest at the local, national, regional and international to guarantee the needs of current and future generations. The purpose of this law is to establish the basic rules and fundamental principles of national policy in the field of environmental protection and management with a view to ensuring sustainable development, in accordance with multilateral environmental agreements. Every citizen has the right to a healthy environment under the conditions defined by this law. This right is accompanied by an obligation to preserve and protect the environment.

Conclusion

In accordance with United Nations sustainable development goals (SDG7, SDG11, SDG13)[15] the current research explores how governance qualities, official development assistance, and renewable energy consumption mitigate the ecological footprint in the Djiboutian context. Three variables, namely regulatory qualities, the level of upholding the rule of law and control of corruption was selected to represent Djiboutian governance qualities. According to the ARDL model only (i) control of corruption and (ii) renewable energy provides a repercussion effect framework on the ecological footprint, hence, the mitigation of the ecological footprint can be achieved by gathering precise data on a variety of topics and making it available to the public. The administrative authorities must also set an example by implementing ecologically friendly procedures within their own operations. This covers everything from lowering energy use in public buildings to encouraging sustainable mobility alternatives for workers. These programs will not only help the government agencies to leave a smaller environmental imprint, but they will also set a strong example for the general population. Indeed, it is also cardinal to encourage investment in renewable energy; for this, the country needs to provide a supportive legislative and regulatory framework. Another approach is to encourage public-private partnerships (PPPs) for the growth of renewable energy sources. In order to reduce uncertainties and risks, policymakers can also provide clear and comprehensible regulatory frameworks and offer incentives. Additionally, Djibouti may make use of international finance frameworks to encourage investments in renewable energy. Alternatively, from an internal standpoint, the country has the chance to create financing methods, such as community-led investment models, social impact bonds, and crowdsourcing, to obtain funding from more diverse sources and promote inclusive and sustainable development.

Whereas the rule of law, regulatory qualities and official development assistance seldom decrease the level of ecological print, as a result; Djiboutian policy-makers must reach a threshold that accommodates both national legislation and ecological footprints. To do this, ecological footprint goals can be included in national law. For instance, the quantity of greenhouse gas emissions, waste creation, or resource consumption that can be incurred by certain economic activities, could be restricted by legislation. Furthermore, monitoring and enforcing the adherence to objectives for reducing ecological footprints is crucial to ensuring that legislation is successful. At the same time the government should encourage citizen participation, public education campaigns, public meetings, and other means of outreach should be used to persuade people to support environmental preservation and hold the authorities accountable. On a similar scenario as the national status (lower-middle income) remains unchanged, even in the upcoming years it is unlikely for the Djiboutian government to consider allocating a higher budget for the environment. However, it is recommended for the Djiboutian government to seek specific ODA programs that align with the current national climate challenges and sustainable development, once identified the consistency of both projects (ecological issues and ODA package), a consecutive monitoring approach should be adopted alongside, yet this would require greater transparency and a concise portfolio by the recipient. Finally, the impulse response and the variance decompositions showcased how the selected variables have a prominent burden on ecological footprints by repercussion from the extension of so-called environmental degradation. However, alarmingly such negative shocks start to materialize after ten years.

[15] https://sdgs.un.org/goals

Nonetheless, there are some drawbacks in the current article. First, the research only looks at a particular lower-middle-income country with its own special environmental situation and resources. As such, it is important to compare it with countries that are similar in these aspects. It is also crucial to pick a specific area, such as transportation, public administration efficacy, financial inclusion, and environmental literacy vis-à-vis compliance with environmental laws. Future research endeavors could also contemplate the adoption of alternative econometric models to delve deeper into the realms of governance sustainability and ecological footprint.

References

Acemoglu, D., & Verdier, T. (1998). Property rights, corruption and the allocation of talent: a general equilibrium approach. *The economic journal*, 108(450), 1381–1403. https://doi.org/10.1111/1468-0297.00347

Addai, K., Serener, B., & Kirikkaleli, D. (2022). Environmental Sustainability and Regulatory Quality in Emerging Economies: Empirical Evidence from Eastern European Region. *Journal of the Knowledge Economy*, 1–37. https://doi.org/10.1007/s13132-022-01000-2

Aden, K. (2023). How Can Governmental Incentives Inspire Youth to Be More Engaged in Environmental Protection? An Analysis of Factors Affecting Djiboutian Young People's Engagement Toward the Environment. *Public Governance, Administration and Finances Law Review*, 7(2), 109–137. https://doi.org/10.53116/pgaflr.2022.2.5

Aidt, T. S. (2009). Corruption, institutions, and economic development. *Oxford review of economic policy*, 25(2), 271–291. https://doi.org/10.1093/oxrep/grp012

Akhbari, R., & Nejati, M. (2019). The effect of corruption on carbon emissions in developed and developing countries: empirical investigation of a claim. *Heliyon*, 5(9), e02516. https://doi.org/10.1016/j.heliyon.2019.e02516

Al-Mulali, U., & Ozturk, I. (2015). The effect of energy consumption, urbanization, trade openness, industrial output, and the political stability on the environmental degradation in the MENA (Middle East and North African) region. *Energy*, 84, 382–389. https://doi.org/10.1016/j.energy.2015.03.004

Al-Mulali, U., & Ozturk, I. (2016). The investigation of environmental Kuznets curve hypothesis in the advanced economies: the role of energy prices. *Renewable and Sustainable Energy Reviews*, 54, 1622–1631. https://doi.org/10.1016/j.rser.2015.10.131

Amuakwa-Mensah, F., & Adom, P. K. (2017). Quality of institution and the FEG (forest, energy intensity, and globalization)-environment relationships in sub-Saharan Africa. *Environmental Science and Pollution Research*, 24, 17455–17473. https://doi.org/10.1007/s11356-017-9300-2

Asif, K., Sabir, S., & Qayyum, U. (2023). Corruption, Political Instability, and Environmental Degradation in South Asia: a Comparative Analysis of Carbon Footprint and Ecological Footprint. *Journal of the Knowledge Economy*, 1–25. https://doi.org/10.1007/s13132-023-01133-y

Baabou, W., Grunewald, N., Ouellet-Plamondon, C., Gressot, M., & Galli, A. (2017). The Ecological Footprint of Mediterranean cities: Awareness creation and policy implications. *Environmental Science & Policy*, 69, 94–104. https://doi.org/10.1016/j.envsci.2016.12.013

Baloch, M. A., Mahmood, N., & Zhang, J. W. (2019). Effect of natural resources, renewable energy and economic development on CO_2 emissions in BRICS countries. *Science of the Total Environment*, 678, 632–638. https://doi.org/10.1016/j.scitotenv.2019.05.028

Barrowman, N. (2014). Correlation, causation, and confusion. *The New Atlantis*, 43, 23–44. Online: https://www.jstor.org/stable/43551404

Balsalobre-Lorente, D., Shahbaz, M., Chiappetta Jabbour, C. J., & Driha, O. M. (2019). The role of energy innovation and corruption in carbon emissions: Evidence based on the EKC hypothesis. In M. Shahbaz, & D. Balsalobre (Eds.), *Energy and environmental strategies in the era of globalization* (pp. 271–304). https://doi.org/10.1007/978-3-030-06001-5_11

Boldrocchi, G., Omar, M., Azzola, A., & Bettinetti, R. (2020). The ecology of the whale shark in Djibouti. *Aquatic Ecology*, 54, 535–551. https://doi.org/10.1007/s10452-020-09758-w

Boldrocchi, G., Schmidt, J. V., & Robinson, D. P. (2021). First documented record of the leatherback turtle (Dermochelys coriacea) from Djibouti waters. *Marine Biodiversity Records*, 14(1), 3. https://doi.org/10.1186/s41200-021-00200-0

Braulik, G. T., Findlay, K., Cerchio, S., Baldwin, R., & Perrin, W. (2018). *Sousa plumbea, Indian Ocean Humpback Dolphin.* The IUCN Red List of Threatened Species. http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T82031633A82031644.en

Cadoret, I., & Padovano, F. (2016). The political drivers of renewable energies policies. *Energy Economics*, 56, 261–269. https://doi.org/10.1016/j.eneco.2016.03.003

Chang, C. P., & Hao, Y. (2017). Environmental performance, corruption and economic growth: global evidence using a new data set. *Applied economics*, 49(5), 498–514. https://doi.org/10.1080/00036846.2016.1200186

Charfeddine, L., & Mrabet, Z. (2017). The impact of economic development and social-political factors on ecological footprint: A panel data analysis for 15 MENA countries. *Renewable and sustainable energy reviews*, 76, 138–154. https://doi.org/10.1016/j.rser.2017.03.031

Charfeddine, L., Al-Malk, A. Y., & Al Korbi, K. (2018). Is it possible to improve environmental quality without reducing economic growth: Evidence from the Qatar economy. *Renewable and sustainable energy reviews*, 82(1), 25–39. https://doi.org/10.1016/j.rser.2017.09.001

Coase, R. H. (1960). The problem of social cost. *The journal of Law and Economics*, 3, 1–44. https://doi.org/10.1086/466560

Daly, S., Benali, N., & Yagoub, M. (2022). Financing Sustainable Development, Which Factors Can Interfere? Empirical Evidence from Developing Countries. *Sustainability*, 14(15), 9463 https://doi.org/10.3390/su14159463

Dang, V. H., Gam, P. T., & Xuan Son, N. T. (2021). Vietnam's regulations to prevent pollution from plastic waste: a review based on the circular economy approach. *Journal of Environmental Law*, 33(1), 137–166. https://doi.org/10.1093/jel/eqaa028

De Sadeleer, N. (2020). Environmental principles: from political slogans to legal rules. Oxford University Press. https://doi.org/10.1093/oso/9780198844358.001.0001

Dasgupta, P., & Mäler, K. G. (1995). Poverty, institutions, and the environmental resource-base. *Handbook of development economics*, 3(A), 2371–2463 https://doi.org/10.1016/S1573-4471(05)80011-7

Dechezleprêtre, A., & Sato, M. (2017). The impacts of environmental regulations on competitiveness. *Review of environmental economics and policy*, 11(2), 183–206. https://doi.org/10.1093/reep/rex013

Destek, M. A., Ulucak, R., & Dogan, E. (2018). Analyzing the environmental Kuznets curve for the EU countries: the role of ecological footprint. *Environmental Science and Pollution Research*, 25, 29387–293960. https://doi.org/10.1007/s11356-018-2911-4

Dickey, D., & Fuller, W. A. (1979). Distribution of the estimators for time series regressions with a unit root. *Journal of the American Statistical Association*, 74(366), 427–431 https://doi.org/10.1080/01621459.1979.10482531

Doğan, B., Driha, O. M., Balsalobre Lorente, D., & Shahzad, U. (2021). The mitigating effects of economic complexity and renewable energy on carbon emissions in developed countries. *Sustainable Development*, 29(1), 1–12. https://doi.org/10.1002/sd.2125

Dolšak, N., & Dunn, M. (2006). Investments in global warming mitigation: The case of "activities implemented jointly. *Policy Sciences*, 39, 233–248. https://doi.org/10.1007/s11077-006-9020-9

Eakin, H., Wightman, P. M., Hsu, D., Gil Ramón, V. R., Fuentes-Contreras, E., Cox, M. P., Hyman, T-A. N., Pacas, C., Borraz, F., González-Brambila, C., Ponce de León Barido, D. & Kammen, D. M. (2015). Information and communication technologies and climate change adaptation in Latin America and the Caribbean: A framework for action. *Climate and Development*, 7(3), 208–222. https://doi.org/10.1080/17565529.2014.951021

Epo, B. N., & Nochi Faha, D. R. (2020). Natural resources, institutional quality, and economic growth: an African tale. *The European Journal of Development Research*, 32(1), 99–128. https://doi.org/10.1057/s41287-019-00222-6

Farhani, S., Chaibi, A., & Rault, C. (2014). CO_2 emissions, output, energy consumption, and trade in Tunisia. *Economic Modelling*, 38, 426–434. https://doi.org/10.1016/j.econmod.2014.01.025

Glaeser, E. L., & Saks, R. E. (2006). Corruption in america. Journal of public Economics, 90(6–7), 1053–1072. https://doi.org/10.1016/j.jpubeco.2005.08.007

Greaker, M. (2003). Strategic environmental policy; eco-dumping or a green strategy? *Journal of Environmental Economics and Management*, 45(3), 692–707. https://doi.org/10.1016/S0095-0696(02)00053-0

Harring, N. (2013). Understanding the effects of corruption and political trust on willingness to make economic sacrifices for environmental protection in a cross-national perspective. *Social Science Quarterly*, 94(3), 660–671. https://doi.org/10.1111/j.1540-6237.2012.00904.x

Hassan, S. T., Khan, S. U. D., Xia, E., & Fatima, H. (2020). Role of institutions in correcting environmental pollution: An empirical investigation. *Sustainable Cities and Society*, 53, 101901. https://doi.org/10.1016/j.scs.2019.101901

Huntington, S. P. (2006). *Political order in changing societies.* Yale University Press. Online: https://www.jstor.org/stable/j.ctt1cc2m34

Jacobi, J., Schneider, M., Bottazzi, P., Pillco, M., Calizaya, P., & Rist, S. (2015). Agroecosystem resilience and farmers' perceptions of climate change impacts on cocoa farms in Alto Beni, Bolivia. *Renewable Agriculture and Food Systems*, 30(2), 170–183. https://doi.org/10.1017/S174217051300029X

Jaja, J., Dawson, J., & Gaudet, J. (2017). Using Social Network Analysis to examine the role that institutional integration plays in community-based adaptive capacity to climate change in Caribbean small island communities. *Local Environment*, 22(4), 424–442. https://doi.org/10.1080/13549839.2016.1213711

Jambeck, J. R., Geyer, R., Wilcox, C., Siegler, T. R., Perryman, M., Andrady, A., Narayan, R., & Law, K. L. (2015). Plastic waste inputs from land into the ocean. *Science*, 347(6223), 768–771. https://doi.org/10.1126/science.1260352

Karşılı, H., & Erkut, B. (2022). Ecological Footprint-Environmental Regulations Nexus: The Case of the Union for the Mediterranean. *Energies*, 15(22), 8493. https://doi.org/10.3390/en15228493

Kihombo, S., Ahmed, Z., Chen, S., Adebayo, T. S., & Kirikkaleli, D. (2021). Linking financial development, economic growth, and ecological footprint: what is the role of technological innovation? *Environmental Science and Pollution Research*, 28(43), 61235–61245. https://doi.org/10.1007/s11356-021-14993-1

Kibria, M. G. (2023). Ecological footprint in Bangladesh: Identifying the intensity of economic complexity and natural resources. *Heliyon*, 9(4), e14747. https://doi.org/10.1016/j.heliyon.2023.e14747

Kohen, F. Z. (2021, August 2). *Leading the green energy revolution at the heart of Djibouti.* Siemens Gamesa. Online: https://www.siemensgamesa.com/en-int/explore/journal/2021/07/green-energy-revolution-djibouti

Kohler, M. (2013). CO_2 emissions, energy consumption, income and foreign trade: A South African perspective. *Energy policy,* 63, 1042–1050. https://doi.org/10.1016/j.enpol.2013.09.022

Lee, S. K., Choi, G., Lee, E., & Jin, T. (2020). The impact of official development assistance on the economic growth and carbon dioxide mitigation for the recipient countries. *Environmental Science and Pollution Research*, 27, 41776–41786. https://doi.org/10.1007/s11356-020-10138-y

Li, C., Wan, J., Xu, Z., & Lin, T. (2021). Impacts of green innovationinstitutional constraints and their interactions on high-quality economic development across China. *Sustainability*, 13(9), 5277. https://doi.org/10.3390/su13095277

Li, X., Yang, Y., Poon, J., Liu, Y., & Liu, H. (2018). Anti-drought measures and their effectiveness: A study of farmers' actions and government support in China. *Ecological indicators*, 87, 285–295. https://doi.org/10.1016/j.ecolind.2017.12.042

Lisciandra, M., & Migliardo, C. (2017). An empirical study of the impact of corruption on environmental performance: Evidence from panel data. *Environmental and resource economics*, 68, 297–318. https://doi.org/10.1007/s10640-016-0019-1

Lui, F. T. (1985). An equilibrium queuing model of bribery. *Journal of political economy*, 93(4), 760–781. https://doi.org/10.1086/261329

Makhdum, M. S. A., Usman, M., Kousar, R., Cifuentes-Faura, J., Radulescu, M., & Balsalobre-Lorente, D. (2022). How do institutional quality, natural resources, renewable energy, and financial development reduce ecological footprint without hindering economic growth trajectory? Evidence from China. *Sustainability*, 14(21), 13910. https://doi.org/10.3390/su142113910

Mehmood, U., Agyekum, E. B., Kotb, H., Milyani, A. H., Azhari, A. A., Tariq, S., ul Haq, Z., Ullah, A., Raza, K., & Velkin, V. I. (2022). Exploring the Role of Communication Technologies, Governance, and Renewable Energy for Ecological Footprints in G11 Countries: Implications for Sustainable Development. *Sustainability*, 14(19), 12555. https://doi.org/10.3390/su141912555

Méndez, F., & Sepúlveda, F. (2006). Corruption, growth and political regimes: Cross country evidence. *European Journal of political economy*, 22(1), 82–98. https://doi.org/10.1016/j.ejpoleco.2005.04.005

Michaelowa, A., & Michaelowa, K. (2007). Climate or development: Is ODA diverted from its original purpose? *Climatic change*, 84, 5–21. https://doi.org/10.1007/s10584-007-9270-3

Mishkin, F. S. (2009). Globalization and financial development. *Journal of development Economics*, 89(2), 164–169. https://doi.org/10.1016/j.jdeveco.2007.11.004

Momita, Y., Matsumoto, T., & Otsuka, K. (2019). Has ODA contributed to growth? An assessment of the impact of Japanese ODA. *Japan and the World Economy*, 49, 161–175. https://doi.org/10.1016/j.japwor.2018.11.002

Narayan, P. (2004). *Reformulating critical values for the bounds F-statistics approach to cointegration: an application to the tourism demand model for Fiji.* Monash University.

Nathaniel, S. P., & Bekun, F. V. (2021). Electricity consumption, urbanization, and economic growth in Nigeria: New insights from combined cointegration amidst structural breaks. *Journal of Public Affairs*, 21(1), e2102. https://doi.org/10.1002/pa.2102

Nathaniel, S., & Khan, S. A. R. (2020). The nexus between urbanization, renewable energy, trade, and ecological footprint in ASEAN countries. *Journal of Cleaner Production*, 272, 122709. https://doi.org/10.1016/j.jclepro.2020.122709

Nketiah, E., Song, H., Obuobi, B., Adu-Gyamfi, G., Adjei, M., & Cudjoe, D. (2022). The impact of ecological footprint in West Africa: the role of biocapacity and renewable energy. *International Journal of Sustainable Development & World Ecology*, 29(6), 514–529. https://doi.org/10.1080/13504509.2022.2051637

Oteng-Abayie, E. F., Mensah, G., & Duodu, E. (2022). The role of environmental regulatory quality in the relationship between natural resources and environmental sustainability in sub-Saharan Africa. *Heliyon*, 8(12), e12436. https://doi.org/10.1016/j.heliyon.2022.e12436

Ozcan, B., Apergis, N., & Shahbaz, M. (2018). A revisit of the environmental Kuznets curve hypothesis for Turkey: new evidence from bootstrap rolling window causality. *Environmental Science and Pollution Research*, 25, 32381–32394. https://doi.org/10.1007/s11356-018-3165-x

Ozturk, I., Al-Mulali, U., & Saboori, B. (2016). Investigating the environmental Kuznets curve hypothesis: the role of tourism and ecological footprint. *Environmental Science and Pollution Research*, 23, 1916–1928. https://doi.org/10.1007/s11356-015-5447-x

Payne, R. A. (1995). Freedom and the environment. *Journal of Democracy*, 6(3), 41. https://doi.org/10.1353/jod.1995.0053

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, 16(3), 289–326. https://doi.org/10.1002/jae.616

Pigou, A. C. (1951). Some aspects of welfare economics. *The American Economic Review*, 41(3), 287–302. https://www.jstor.org/stable/1802103

Pita, P., Winyuchakrit, P., & Limmeechokchai, B. (2020). Analysis of factors affecting energy consumption and CO_2 emissions in Thailand's road passenger transport. *Heliyon*, 6(10), e05112. https://doi.org/10.1016/j.heliyon.2020.e05112

Ponce, P., Álvarez-García, J., Álvarez, V., & Irfan, M. (2023). Analysing the influence of foreign direct investment and urbanization on the development of private financial system and its ecological footprint. *Environmental Science and Pollution Research*, 30(4), 9624–9641. https://doi.org/10.1007/s11356-022-22772-9

Ramsey, J. B. (1969). Tests for specification errors in classical linear least-squares regression analysis. *Journal of the Royal Statistical Society: Series B (Methodological)*, 31(2), 350–371. https://doi.org/10.1111/j.2517-6161.1969.tb00796.x

Reed, D., & de Wit, M. (Eds.). (2003). *Towards a just South Africa: The political economy of natural resource wealth.* WWF.

Rock, M. T., & Bonnett, H. (2004). The comparative politics of corruption: accounting for the East Asian paradox in empirical studies of corruption, growth and investment. *World development*, 32(6), 999–1017. https://doi.org/10.1016/j.worlddev.2003.12.002

Rose-Ackerman, S., & Palifka, B. J. (2016). *Corruption and government: Causes, consequences, and reform.* Cambridge University Press.

Rowat, D., Meekan, M. G., Engelhardt, U., Pardigon, B., & Vely, M. (2007). Aggregations of juvenile whale sharks (Rhincodon typus) in the Gulf of Tadjoura, Djibouti. *Environmental Biology of Fishes*, 80, 465–472. https://doi.org/10.1007/s10641-006-9148-7

Ryan, C., & Elsner, P. (2016). The potential for sand dams to increase the adaptive capacity of East African drylands to climate change. *Regional Environmental Change*, 16, 2087–2096. https://doi.org/10.1007/s10113-016-0938-y

Sekrafi, H., & Sghaier, A. (2018). Examining the relationship between corruption, economic growth, environmental degradation, and energy consumption: a panel analysis in MENA region. *Journal of the Knowledge Economy*, 9, 963–979. https://doi.org/10.1007/s13132-016-0384-6

Solomon, S., Qin, D., Manning, M., Averyt, K., & Marquis, M. (Eds.). (2007). *Climate change 2007-the physical science basis: Working group I contribution to the fourth assessment report of the IPCC.* Cambridge University Press.

Stock, J. H., & Watson, M. W. (1993). A simple estimator of cointegrating vectors in higher order integrated systems. *Econometrica: journal of the Econometric Society*, 61(4), 783–820. https://doi.org/10.2307/2951763

Sun, Y., Gao, P., Raza, S. A., & Khan, K. A. (2023). The nonparametric causal effect of sustainable governance structure on energy efficiency and ecological footprint: A pathway to sustainable development. *Gondwana Research*, 121, 383–403. https://doi.org/10.1016/j.gr.2023.05.007

Swaleheen, M. (2011). Economic growth with endogenous corruption: an empirical study. *Public Choice*, 146, 23–41. https://doi.org/10.1007/s11127-009-9581-1

The World Bank. (2022, November 4). *US$20 million Grant to Help Djibouti Mitigate Food Security Risks Resulting from Multiple Crises and Climate Change.* Online: https://www.worldbank.org/en/news/press-release/2022/11/04/us-20-million-grant-to-help-djibouti-mitigate-food-security-risks-resulting-from-multiple-crises-and-climate-change

Tobin, P., Schmidt, N. M., Tosun, J., & Burns, C. (2018). Mapping states' Paris climate pledges: Analysing targets and groups at COP 21. *Global Environmental Change*, 48, 11–21. https://doi.org/10.1016/j.gloenvcha.2017.11.002

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of econometrics*, 66(1-2), 225–250. https://doi.org/10.1016/0304-4076(94)01616-8

Torras, M., & Boyce, J. K. (1998). Income, inequality, and pollution: a reassessment of the environmental Kuznets curve. *Ecological economics*, 25(2), 147–160. https://doi.org/10.1016/S0921-8009(97)00177-8

Uddin, G. A., Alam, K., & Gow, J. (2019). Ecological and economic growth interdependency in the Asian economies: an empirical analysis. *Environmental Science and Pollution Research*, 26, 13159–13172. https://doi.org/10.1007/s11356-019-04791-1

Udi, J., Bekun, F. V., & Adedoyin, F. F. (2020). Modeling the nexus between coal consumption, FDI inflow and economic expansion: does industrialization matter in South Africa? *Environmental Science and Pollution Research*, 27, 10553–10564. https://doi.org/10.1007/s11356-020-07691-x

Ulucak, R., & Khan, S. U. D. (2020). Determinants of the ecological footprint: role of renewable energy, natural resources, and urbanization. *Sustainable Cities and Society*, 54, 101996. https://doi.org/10.1016/j.scs.2019.101996

UNEP-WCMC. (2023). *Protected Area Profile for Djibouti from the World Database on Protected Areas, October 2023.* Online: https://www.protectedplanet.net/country/DJI

Uzar, U. (2020a). Political economy of renewable energy: does institutional quality make a difference in renewable energy consumption? *Renewable Energy*, 155, 591–603. https://doi.org/10.1016/j.renene.2020.03.172

Uzar, U. (2020b). Is income inequality a driver for renewable energy consumption? *Journal of Cleaner Production*, 255, 120287. https://doi.org/10.1016/j.jclepro.2020.120287

Uzar, U., & Eyuboglu, K. (2023). Does income inequality increase the ecological footprint in the US: evidence from FARDL test? *Environmental Science and Pollution Research*, 30(4), 9514–9529. https://doi.org/10.1007/s11356-022-22844-w

Vázquez-Brust, D., Jabbour, C. J. C., Plaza-Úbeda, J. A., Perez-Valls, M., de Sousa Jabbour, A. B. L., & Renwick, D. W. (2022). The role of green human resource management in the translation of greening pressures into environmental protection practices. *Business Strategy and the Environment*, 32(6), 3628–3648. https://doi.org/10.1002/bse.3319

Welsch, H. (2004). Corruption, growth, and the environment: a cross-country analysis. *Environment and Development Economic*, 9(5), 663–693. https://doi.org/10.1017/S1355770X04001500

Zahra, S., Khan, D., & Nouman, M. (2022). Fiscal policy and environment: a long-run multivariate empirical analysis of ecological footprint in Pakistan. *Environmental Science and Pollution Research*, 29(2), 2523–2538. https://doi.org/10.1007/s11356-021-15665-w

Zhang, H., Cong, C., & Chakraborty, A. (2022). Exploring the institutional dilemma and governance transformation in China's urban regeneration: Based on the case of Shanghai Old Town. *Cities*, 131, 103915. https://doi.org/10.1016/j.cities.2022.103915

Zhou, J. Q., & Peng, M. W. (2012). Does bribery help or hurt firm growth around the world? *Asia Pacific Journal of Management*, 29(4), 907–921. https://doi.org/10.1007/s10490-011-9274-4.