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INVESTIGATING THE RELATIONSHIP BETWEEN ECONOMIC GROWTH AND ECOLOGICAL FOOTPRINT IN EGYPT

Amr Abdelmeguid Edris Eissa[1]
Department Of Economics, Faculty of Management Sciences
October University for Modern Sciences and Arts (MSA), Egypt
Email: aedrees@msa.edu.eg

Abstract *The paper aims to investigate the relationship between Economic growth and Ecological footprint in Egypt for a time series from 1971-2022. The study adopts unit root tests, granger causality tests and autoregressive distributed lag (ARDL) tests to analyze the relationship between six variables, Ecological Footprint measured by (gha), Economic growth measured by GDP (current US$), Total natural resources rents measured by (% of GDP), Gross capital formation as a% of GDP, Inflation measured by GDP deflator, unemployment measured by total (%of total labor force) National Estimate.*

Main findings; GDP has a significant and positive relationship to the ecological footprint in the long and short run, which means if the GDP of Egypt increases by (0.61%) the ecological footprint will increase by (1%) in the short run. Natural resources rent has a significant negative relationship with Ecological footprint in the short run and a significant positive relationship in the long run. Gross capital formation has an insignificant relationship to Ecological footprint in the short run, whereas it has a significant positive relationship to Ecological footprint in the long run. Both unemployment and Inflation, have an insignificant relationship to ecological footprint in the short run, and only Unemployment has a significant negative relationship to Ecological footprint in the long run. Egypt can achieve economic growth without depleting the environment in both the long and short run by letting both the private sector and government develop and implement technology that decreases pollution while permitting continuous economic expansion, aided by public policies that range from command-and-control restrictions to direct and indirect government subsidies.

Keywords: Ecological footprint - Economic Growth – Egypt- ARDL.

JEL Codes: Q 28 – Q29 - Q51 - Q56 – Q57 – Q58 -Q59

[1] ORCID iD 0000-0002-3882-6807

Introduction

Due to its numerous functions and direct contribution to production, the natural environment is vital to any economy. Resources found in the environment, such as minerals and fossil fuels, directly aid in the creation of commodities and services (Wang et al., 2023). Other services that the environment provides to support economic activity include soil formation, flood risk reduction, carbon sequestration, and pollution filtration of the air and water (Pan et al., 2023). Also, it is essential to our well-being since it gives us leisure time, enhances our health, and does a lot more for us (Taneja et al., 2023). It is very important to keep and protect our environmental resources, such actions cannot be done without an depth study of that environment to reduce our harmful activities. Utilizing natural resources effectively, avoiding pollution, and considering other environmental considerations are now essential for long-term economic growth possibilities, as Taneja et al. (2023) highlight in their work. It is feasible to protect the environment while pursuing economic growth, which is one of the most important aspects in raising the well-being of communities, individuals, and financial development, which is also necessary for economic growth. (Acar et al., 2023). Ecological limitations will probably determine our life in the 21st century given the exponential rise in human demand on nature (Mehmood et al., 2023). Climate change, water shortages, urbanization, dwindling fisheries, food crises, and rising energy prices are some examples of these restrictions (Iyke-Ofoedu et al., 2023). Despite the obvious scarcity of ecological capital, most governments do not have reliable instruments to assess their natural capital, and decision-makers are still hesitant to move quickly to lower resource risks. The Ecological Footprint provides an answer to a specific question: What percentage of the planet's potential for regrowth is required for human activities like eating, travelling, building shelter, and utilizing commodities and services? (Kurniawan et al., 2023; Arnaut & Dada, 2022; Kılıç et al., 2023).

The Ecological Footprint (EF) idea has received considerable acceptance as a novel method of conveying messages regarding the global consequences of current resource usage (Lee et al., 2023). The Ecological Footprint (EF) measures the pressures on nature's biological production and the capacity imposed by human lifestyles (El-Deeb & Halim, 2020). The ecological footprint is often regarded as the most acceptable metric of environmental harm in modern environmental sustainability literature (Kalmaz & Awosusi, 2022). Yet, substantial scholarly and political emphasis on environmental sustainability has not fully reflected on ecological footprint due to a lack of clarity in its link with economic growth, ecosystem services, biodiversity, and human well-being. (Addai et al., 2022) Based on S. T. Hassan et al. (2019) the footprint, however, is poorly understood and frequently ignored in political decision-making because of the complicated feedback on the linkages between economic development, biodiversity, environmental services, and human well-being.

Egypt has had an ecological deficit since 1961, which has been made feasible in part by the country's capacity to buy resources with revenue from oil sales (Karasoy, 2022). (gha) needed to sustain life exceeded the biocapacity of the country. This will lead to the depletion of its natural capital reserves. For example, in the year 2022 Bio-capacity per person in Egypt was 0.3 gha compared to Ecological Footprint per person of 1.5 gha which will lead to a capacity deficit of -1.4 gha (Open Data Platform,2023. n.d.).

The basic point of view about Economic growth is a rise in the production of goods and services within a certain period relative to a prior period is known as economic growth (Ahmed & Edris, 2018). Economic growth has raised standards of living and improved people's quality of life globally, but it has led to the depletion of natural resources and the destruction of ecosystems (Ikram et al., 2021). There has been significant discussion over whether economic growth can be achieved without unsustainable environmental damage, there is a growing understanding that economic growth cannot continue indefinitely at the current pace of depletion of environmental assets (S. T. Hassan et al., 2019). Egypt’s Real GDP growth in 2021–2022 surged to an expected 6.6%, led by the gas extraction industry, communications, agriculture, and building. However, manufacturing did not reach its full potential. Investments and household spending drove demand-side growth. (African Development Bank Group., 2023). On the other hand, the weakening of the Egyptian pound versus the US dollar by 16% in May 2022 and rising international food and energy costs were the main causes of the increase in inflation from 4.5% in 2020/21 to 8.5% in 2021/22. In 2020, the poverty rate was 29.7%. In June 2022, the unemployment rate was constant at 7.2%. (Mahmoud., 2023).

About $19.75 billion in funding is required annually for Egypt to adapt to climate change effectively. The financial gap over 2020–30 will be $18 billion per year if Egypt receives the same $1.25 billion in climate finance that it did between 2010 –2020. (African Development Bank Group., 2023).

Egypt is ranked 18th in proven gas reserves and 28th in proven oil reserves as of 2021. Egypt's natural resources might provide funding for green economic initiatives and climate change starting a carbon market, issuing green bonds, developing 15 new green towns, and putting into practice the Integrated Sustainable Energy Strategy—which aims to increase the share of renewable energy in the power mix to 42% by 2030—are some of Egypt's most important long-term strategic prospects to reduce its Ecological footprint, on the same time enhance Economic growth. (Ahmed & Edris, 2018; F. M. Ahmed et al., 2020; Karasoy, 2022).

This study aims to investigate the relationship between economic growth and ecological footprint in Egypt from 1971 to 2022. Six variables will be analyzed: ecological footprint, gross domestic product, gross capital formation, natural resources rent, inflation, and unemployment. The univariate root test, Granger causality test, and autoregressive distributed lag model will be used to analyze the relationship between the variables. Economic growth is influenced by several factors. Changes in gross domestic product are linked to fluctuations in inflation rates and unemployment levels. Gross capital formation and natural resources rent also provide insights into economic growth patterns over time. All of these economic indicators likely influence a country's ecological footprint, which can be considered a proxy for changes in biocapacity.

A review of previous literature reveals few studies have specifically examined the Egyptian case. Additionally, clarity is lacking regarding the causal link between ecological footprint and economic growth. The government of Egypt also lacks reliable tools for assessing natural capital, and decision-makers remain hesitant to expedite lower-risk natural resource management decisions. Through quantitative analysis, this study aims to improve understanding of the ecological footprint-economic growth nexus in Egypt between 1971-2022. Findings may offer practical implications for balancing continued development with environmental sustainability. Addressing current information shortcomings could support more informed policymaking regarding Egypt's natural resource management and economic planning.

Literature review:

Ecological footprint:

Abbas et al., (2023b) show how various factors (Economic complexity, clean energy consumption, technology, population, and natural resources) impact the ecological footprint in 50 large complex economies.

The study uses an expanded STIRPAT equation using data spanning the years 1990 to 2018. The researchers utilize the STIRPAT equation to test the environmental Kuznets curve (EKC) hypothesis and investigate the effects of renewable energy, technology, population, and natural resources. The study's findings indicate the presence of the EKC in these complex economies. Economic complexity, clean energy use, and population density all have a considerable negative influence on the ecological footprint, whereas natural resources have negligible effects. The study closes with policy recommendations for attaining long-term development in these large, complicated countries.

Addai et al., (2022) aimed at finding the relationship between urbanization, economic growth and ecological footprint through empirical analysis applied to Eastern Europe between 1998Q4 and 2017Q4. The study uses CADF unit root test, Westerlund cointegration test, common correlated effects and Dumitrescu Hurlin causality approaches. The study's results of the Westerlund cointegration test show cointegration among the variables, (ii) the Dumitrescu Hurlin causality test shows long-run unidirectional causality operating from growth to ecological footprint, and (iii) urbanization does not cause ecological footprint homogeneously. The findings have implications for regional policy measures that might help reduce ecological deficits through development and urbanization policies aimed at enhancing regional environmental quality.

Arnaut & Dada, (2022) investigates the role of economic complexity, disaggregated energy consumption in addition to economic growth, financial development, globalization, and urbanization on the ecological footprint of the United Arab Emirates (UAE). This study employs unit root tests (with and without a structural break), ARDL bounds tests, and dynamic ordinary least squares (DOLS). The ARDL model results indicate that economic complexity, nonrenewable energy, and economic expansion increase the ecological footprint in both the short and long run, hence degrading the ecosystem. However, renewable energy and urbanization minimize the ecological footprint in the UAE throughout both times, increasing environmental quality. Globalization and financial growth have distinct effects on the ecological footprint during these times.

Chen & Madni, (2022) attempt to narrow the gap for the 45 BRI nations from 1995 to 2020. Because previous research has provided insufficient information regarding the influence of economic complexity, natural resources, and green investment on the ecological footprint of countries participating in the Belt and Road Initiative (BRI), the study used a variety of ways to solve the issue of cross-sectional dependency before determining cointegration using the Lagrange multiplier bootstrap method. The Driscoll-Kraay standard error approach is used to calculate long-run estimates, while panel-corrected standard errors (PCSE) and feasible generalized least squares (FGLS) are used to assess the robustness of the estimated findings. The results indicate that green investment has a large negative influence on ecological footprint, but natural resources, economic complexity, economic growth, and globalization have significant and positive effects on ecological footprint. These findings shed light on natural resources, green investments, and economic complexity in the context of long-term sustainability.

Chiad et al., (2022) determine what variables impact environmental deterioration as assessed by the ecological footprint in Algeria. The study investigates short- and long-term repercussions utilizing a 37-year secondary data time series and the "autoregressive distributed lag" time-series model. The findings are: Economic growth has a significant beneficial influence on the ecological footprint in both the long and medium term, according to the research. Credit and education both have a detrimental impact on environmental deterioration. This implies that loan availability and education are both negative short- and long-term determinants of Algeria's ecological footprint, but economic development is a positive short- and long-term indicator. Furthermore, bidirectional causation is established between credit availability and environmental footprint, whereas the Granger causality technique reveals unidirectional causality from economic development to environmental footprint. Without any feedback, education also Causes an ecological imprint.

El-Deeb & Halim, (2020) focuses on the trend of sustainability reports as a growing trend, particularly in the era of integrative reporting. At the same time, one of the key goals of the 2030 Egyptian plan is to improve the hospitality sector, which is reflected in the tourist business in Egypt. The environmental implications of the hotel business are well known. As tourism is expected to rise over the next decade, there is an urgent need for the hospitality industry to embrace sustainability principles so that visitors may continue to travel while having the least possible impact on the natural environment. The Ecological Footprint is a technique for measuring humanity's demands on the natural biosphere and their impact on countries' national resources. It records the biologically productive land and water necessary to generate all of the resources used by a population and to separate its wastes. The information was obtained as, Hotel managers were asked to provide information on accommodation aspects such as occupancy rates, property sizes, average water and energy usage, waste management routines, and data to determine the average ecological footprints of tourists in the selected hotels. To comprehend the link between the environmental impact and visitor behaviour. The study of this data provides an indicator of the existing green state of hospitality as well as recommendations for greater environmental practices.

Iyke-Ofoedu et al., (2023) looks at how Tunisia's ecological footprint is affected by the carbon footprint of fossil fuel subsidies (TFFS) and bank loans (CFBL). Using a linear and nonlinear ARDL framework and data from 1990 till 2022, According to the study findings, an increase of 1% in TFFS is linked to an increase of 0.80% in ecological footprint, whereas an increase of 1% in CFBL is linked to an increase of 0.15% in ecological footprint. This implies that, in comparison to CFBL, fossil fuel subsidies have a more negative effect on the ecological footprint. Also, the findings show that there is an uneven link between ecological footprints, TFFS, and CFBL. In particular, there is a strong positive correlation between CFBL and ecological footprint: for every 1% rise in CFBL, there is a corresponding 0.01% increase in ecological footprint, and for every 1% drop in CFBL, there is a corresponding 0.002% increase in ecological footprint. With a 1% rise linked to a 0.14% drop and a 1% decline linked to a 0.30% decrease, TFFS has a more noticeable effect on ecological footprint—a twofold increase.

Kalmaz & Awosusi, (2022) assesses the relationship between ecological footprint and the following possible factors: domestic capital investment, oil consumption, economic growth, and renewable energy. For the years 1965 through 2017. The traditional unit root technique (ADF and PP unit root) and structural break unit root (ZA unit root) are used to examine the stationary nature of the parameters. The limits method and Kripfganz and Schneider's (2018) critical approximation p-values created a cointegration relationship between the measured parameters. The main findings are: The ecological footprint is influenced by both economic growth and oil use, according to the ARDL concept. Moreover, the ecological footprint is decreased via gross capital development and the use of renewable energy. The ARDL estimators' sensitivity analysis was conducted using the FMOLS and DOLS estimators. Additionally, the causal relationship between the causes of ecological footprint and its spectrum BC causality method was also examined.

Kılıç et al., (2023) provide a comprehensive approach to the study of the environmental Kuznets curve. The ecological footprint, a measure of environmental degradation, will be the dependent variable in the model used to test the validity of the environmental Kuznets curve, while the independent variables will be the economic complexity index, per capita income, and the trade-to-GDP ratio. The main findings are: When considering the value-added by industry as a proportion of GDP between 1970 and 2017, the research validates the validity of the environmental Kuznets curve for the top nine industrialized nations. Furthermore, the study demonstrates that an economy's ecological footprint is reduced by economic complexity. The ecological footprint variable and each of the independent variables have a causal link, according to the findings of the causality test.

Moreover, Kurniawan et al., (2023) assess the short- and long-term impacts on Indonesia's ecological footprint from 1990 to 2020 of the industrial sector, renewable energy consumption, and nonrenewable energy consumption. This research investigates the link over the short and long terms using vector error correction model (VECM) analysis. The main findings are: that the impulse response function is employed to facilitate ecological footprint projections up to 2060 as an indicator of environmental deterioration brought on by shifts or shocks in industrial value-added, renewable energy consumption, and nonrenewable energy consumption. Moreover, forecast error decomposition of variance (FEVD) analysis is performed to estimate the proportion of each variable's volatility that contributes to changes in a particular variable. Within the context of VECM, Granger causality testing is performed to improve the analytic results. At 246%, the rate of correction for environmental degradation is rather rapid in the short run. Based on this research, it appears that the ecological footprint adjusts at a rate of 246% per year to bring the short-term imbalance in industrial value-added, renewable energy consumption, and nonrenewable energy consumption in balance over the long run. Then, over time, nonrenewable energy usage has the most impact on Indonesia's ecological footprint. The Granger causality test and the FEVD results indicate that nonrenewable energy consumption will account for 10.207% of total energy consumption in 2060 and will be the primary driver of the ecological footprint in the years leading up to net-zero emissions in that year, further supporting this. Over an extended period, the ecological footprint is negatively impacted by the use of renewable energy, whereas nonrenewable and industrial value-added energy use has a beneficial impact.

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Economic Growth:

Scholars investigate the impacts of economic growth, financial development, and trade openness on environmental quality as assessed by CO2 emissions in Egypt from 1965 to 2014(F. M. Ahmed et al., 2020). The study uses the vector error correction model approach to create a long-run model based on the series that were stationary in their first variance form. The results show that the variables are cointegrated, showing that the variables have a long-run connection. The empirical data show a negative influence of economic growth and a financial effect of CO2 emissions from the preceding era, but these effects are not substantial in the near term. Any departures from the long-run equilibrium return fast, accounting for 59% of the adjustment pace.

In 2018, Ahmed & Edris showed the effect of Liberalization of the exchange rate for the Egyptian pound and domestic tourism in Egypt, as a part of Economic growth factors tourism plays a central role in achieving more growth and domestic tourism is an important factor in achieving that goal and the link to economic growth. The study uses a descriptive-analytical method to explore the relationship between the Liberalization of the exchange rate for the Egyptian pound and domestic tourism in Egypt between 2010 and 2017. The study concluded several findings, including that there is a strong relationship between inflation caused by exchange rate liberalization and domestic tourism in two dimensions: the first is to reduce the purchasing power of domestic tourism consumers as a direct result of the state inflation experienced by Egyptian society since 2016 and so far. The second dimension is the outcome of the liberalization of the direct exchange of domestic investment in the tourist industry; both dimensions had a negative influence on domestic tourism, necessitating the state's reduction of the effect and the creation of a swift correction to avoid the negative impact.

Hassan et al., (2023) examine the effects of green growth, ICT, environmental innovation, and natural resources on the ecological footprints of developing and industrialized economies. The researchers used CS-ARDL approach to calculate long-run and short-run estimations of the aforementioned correlations. The main findings are Green growth, ICT, and environmental innovation minimize the ecological footprint of developing countries in the long run, according to the research. Natural resources, on the other hand, increase the ecological imprint of growing economies in the long run. Green growth, ICT, natural resources, and environmental innovation lower the ecological footprint of industrialized economies in the long run.

Ikram et al., (2021) show the effects that economic activity and structural changes have on Japan's environment. The authors employed ecological footprint and economic complexity as critical considerations rather than the more conventional economic and environmental factors. The recently created Quantile ARDL (QARDL) model is utilized, reflecting the dynamic character of the link between economic activity and the environment. The main findings are In both low and high quantiles, the Quantile Granger-causality results demonstrate a bidirectional causal relationship between economic growth, economic complexity, and ecological impact. Similarly, QARDL results show an unbalanced positive relationship between environment and economic growth over the long and short terms.

Mahmoud.,(2023) empirically investigates the impact of Changes in energy prices affect economic growth in Egypt and recognises the negative effects of the Russia-Ukraine war economically on the world generally and on Egypt especially. This study investigates the idea that rising global energy costs have a negative impact on Egypt's economic growth. The analysis of the link between energy costs and economic development in Egypt is based on the ARDL model. The analysis concluded that the crisis complicated the plans of all stakeholders in the petroleum and natural gas industry, including producers, consumers, and multinational corporations, and that this required a reevaluation of their next course of action. It also raised inflation rates and decreased economic growth globally. Given that there is a strong correlation between changes in the global energy index and the prices of oil and gas, as well as changes in Egyptian economic growth, the Ukrainian-Russian crisis both contributed to Egypt's economic downturn and had a major effect on the country's food supply during that time.

Later, Muhammad et al., (2023) focuses on trade openness and non-renewable energy use, this study looks at the impact of financial development and economic expansion on ecological footprint. The authors employed data from the years 1992–2017, yearly statistics from the ten nations with the largest ecological footprint—China, the United States, India, Japan, Brazil, Indonesia, Mexico, Korea, Turkey, and the United Kingdom—are utilized. The findings of the Westerlund and Edgerton (2007) Panel LM bootstrap test show that the variables are cointegrated. Furthermore, expanding ecological footprint, financial development, economic expansion, and non-renewable energy use have a detrimental impact on environmental quality, according to the results of the Common Correlated Effects (CCE) coefficient estimator. Conversely, it is discovered that trade openness has no statistically significant impact on ecological footprint. Furthermore, the panel causality test results indicate that there is a bidirectional causal relationship between economic growth and ecological footprint, but a unidirectional causal relationship between financial development and ecological footprint.

Öncel et al., (2023) looks at the connections between economic growth, the ecological footprint, and the use of renewable and nonrenewable energy for the top 14 nations that bought Russian energy from 2000 to 2018. This study uses a VEC model to compute the long-term correlation between variables using PVAR analysis. By including endogenous interactions between the variables in the model, the VAR method resolves the endogeneity problem. Furthermore, the functions of impulse response and the impact of different factors on certain delays are assessed. To further explore the long-term connection, cointegration between variables was evaluated using panel analysis with DOLS and FMOLS. The main findings are: that all of the series have a cointegration connection, as our results show. The results of the impulse response analysis indicate that the nations' ecological footprint will be reduced and economic development will be adversely impacted by a Russian energy shock. The ecological footprint grows when household energy consumption rises, both for renewable and non-renewable sources. However, the impact of renewable energy consumption appears to be smaller. The elasticity of economic growth improves by 0.61% with a 10% increase in Russian fuel exports, according to DOLS data.

Taneja et al., (2023) examine the effect of total natural resource rents (NRR) on India's GDP, as It is now imperative to use natural resources responsibly, cut pollution, and consider other environmental considerations if we are to achieve sustainable development and long-term economic progress. The data sample is made up of GDP and NRR information gathered between 1993 and 2020 from the World Bank's official website. A bound test for augmented autoregressive distributed lag (ARDL) and the Granger causality test were employed in the investigation. The main findings are: ARDL model findings on the framed time series data set indicate that the NNR has a major influence on India's GDP. Moreover, the ARDL bound test indicates that the NRR has a noteworthy short- and long-term effect on India's GDP. The purpose of this study is to better understand whether the intricate interconnections between different forces in the political, social, and economic spheres can be effectively managed using an exclusive policy.

Vu et al., (2023) examines the dynamic relationship between the factors of financial inclusion, ecological innovation growth and globalization, the study takes into account several statistical estimations and techniques. Data is collected for the mentioned panel economies under the MENA area between 1990 and 2017. The main findings are: for the variables of interest, there is slope heterogeneity, stationarity properties, and cross-sectional dependency. Additionally, the results from the CS-ARDL show that financial inclusion, economic progress, and globalization as measured by GDP have a major and direct influence on the emergence of new environmental problems like EFP. On the other hand, ecological innovation is considerably contributing to the reduction of ED for the chosen economies. Lastly, when CS-ARDL was used to assess the results, strong checks using the "Augmented Mean Group and Common Correlated Effect Mean Group" also produced consistent results.

Relation between Economic Growth and Ecological footprint:

Acar et al.,(2023) aims to address the issue of whether it is feasible to safeguard the environment while pursuing economic growth, which is one of the most important variables in raising the well-being of communities and individuals, and financial development, which is also necessary for economic growth. In the Republic of Azerbaijan. From 1996 until 2017, the ARDL bound test with structural breakdowns was used. The research intends to contribute to the expanding body of scholarship on the interaction between the economy and the environment. The study's findings revealed an inverted U-shaped environmental Kuznets curve between economic growth and ecological footprint, implying that financial progress also lowered ecological footprint. While focusing on economic and financial growth, the proposals underlined that public authorities, financial institutions, producers, and people should behave with a pro-environmental conscience in the production, consumption, and decision-making processes.

Alruweili, (2023) aims to examine the hypothesis of the environmental Kuznets curve (EKC) within the context of Saudi Arabia from 1981 to 2017. The study uses the ARDL method to calculate the link between an individual's ecological footprint, energy consumption, trade openness, and GDP per capita. The findings demonstrate that GDP per capita, trade openness, and energy consumption all have a beneficial influence on the environmental footprint, and they also show that there is a feedback link between GDP per capita and energy consumption. The findings support the EKC's empirical validity, revealing an inverted U-shaped link between GDP and ecological footprint. As a result, as Saudi Arabia's economic development rate rises, so do its environmental circumstances. Saudi Arabia is being pushed to significantly boost its use of renewable energy sources and develop a more efficient energy strategy to decrease its ecological imprint even more.

Boukhelkhal, (2022) explores the drivers of ecological footprint as a proxy for environmental quality in Algeria from 1980 to 2017. Using a variety of economic metrics. The study's other goal is to see how education and life expectancy, as social variables, affect environmental quality. The study estimates the developed environmental degradation models and the autoregressive distributed lags (ARDL) technique is employed. The findings demonstrate that contrary to economic development, energy usage, export, and natural resource rent, the collected data suggest that import is a key factor that decreases ecological footprint in the long- and short-run. According to the data, education and life expectancy promote environmental damage in the short run. However, although life expectancy increases long-term environmental deterioration, education decreases it. Based on these findings, the current research makes many recommendations for improved management of the country's natural and human resources, which might aid policymakers in steering the country toward sustainable development.

S. Chen et al., (2023) examine the influence of green economic recovery on the economic growth of emerging Asian nations. From 2000 to 2020, most nations prioritized economic strategy aimed at achieving long-term economic growth as measured by Gross Domestic Product (GDP). However, economic growth has increased the ecological footprint, which is a major worry considering that global warming and climate change are among the most important global concerns. The study uses the correlated mutual influence mean group (CCE-MG) and the Dumitrescu and Hurlin (D-H) causality tests were used. According to the study, urbanization (UR) and green economic recovery (GR) have a positive impact on GDP in developed countries. In contrast, this influence is reported to be adverse in Asian emerging countries. The effect of natural resources on GDP produced a conflicting result. To encourage economic growth, the report suggests prioritizing natural resource development while implementing environmental restrictions to protect the environment.

Gülmez et al., (2020) explores the non-linear causation from energy use and economic growth to Turkey's ecological impact. ARDL Models and ECM-Based Granger Causality were used to analyze data from 1961 to 2016. The major findings of the research to the literature are as follows: (i) the data period of the empirical analysis of the study is much longer than one of the other studies for the case of Turkey; (ii) ecological footprint, which has rarely been used in the studies for the same case, is taken as a sophisticated proxy of environmental degradation; and (iii) it is discovered that the sophisticated key term 'awareness' requires much more multidisciplinary attention and wider mind maps as the case.

S. T. Hassan et al., (2019) show that the ecological footprint has received a lot of attention in the literature as an indication of environmental degradation. The footprint, however, is poorly understood and frequently ignored in political decision-making because of the complicated feedback on the linkages between economic development, biodiversity, environmental services, and human well-being. This research investigates the link between economic growth and the environmental impact in terms of biocapacity and human capital. The research used data from 1971 to 2014 are analyzed using the autoregressive distributive lag (ARDL) econometric technique with a structural break, the main findings are it becomes evident that economic expansion raises the ecological footprint, which exacerbates environmental deterioration. Furthermore, biocapacity adds to environmental deterioration and expands the ecological footprint. According to a causality study, the link between ecological footprint and economic development is not causative.

Javeed et al., (2023) show the connection between economic activity that accelerates environmental indicators in Asia and environmental rationality. By analyzing data from 1990–2017, Panel OLS, fixed effects, random effects, completely modified OLS, DOLS, and generalized methods of moments are the econometric approaches that are used. The findings demonstrate that improving the proportion of renewable energy in overall energy consumption improves environmental quality. The results of the Pedroni cointegration test indicate that there is a sustained correlation between environmental factors, economic growth, and globalization. The outcomes of every method demonstrate the comparable efficacy of every economic indicator included in the model, which perturbs the environment to varying degrees in every test. Based on FM-OLS data, the ecological footprint grows by 0.55%, 0.08%, 0.06%, and 0.03% for every 1% rise in economic growth, globalization, biocapacity, and population density. However the environment benefits from renewable energy by 0.04%. A bidirectional causal relationship between the ecological footprint and both globalization and energy intensity was found using the Granger causality methodology.

Karasoy, (2022) show how Egypt's ecological footprint is affected between 1977 and 2014 by factors that contribute to environmental deterioration, such as remittance inflows and the usage of alternative energy sources, both combustible and non-combustible. The autoregressive distributed lag approach is used to estimate the short- and long-run coefficients once the co-integration of the chosen variables has been confirmed. The long-term results show that Egypt does not embrace the environmental Kuznets curve theory since wealth has a U-shaped effect on ecological footprint. Furthermore, over time, the use of fossil fuels and financial growth exacerbate ecological imprints. Furthermore, the use of non-combustible alternative energy has little effect on Egypt's ecological footprint; nevertheless, over time, the use of combustible alternative energy and worldwide commerce have reduced it. The findings also show that remittance inflows to Egypt have a long- and short-term positive impact on the environment. Some policy recommendations and conclusions are made in light of the findings.

(Lee et al., 2023) This study's goal is to look at how different economic developments have affected the ecological footprint (EF) of OECD nations between 1995 and 2017. Using distributional heterogeneity in a panel quantile regression framework, based on a sample of 36 OECD nations. The findings indicate that, at all EF levels, there is a non-linear connection between economic growth and EF. Additionally, the link between EF and economic growth has an inverted U-shape, supporting the Environmental Kuznets Curve (EKC) idea. These findings suggest that while environmental contamination increases initially as these countries expand economically, it eventually declines. This study's originality demonstrates that, depending on a country's ecological footprint level, the consequences of economic expansion on ecological footprint might vary.

(Mehmood et al., 2023) This study aims to explore the effects of biocapacity, urbanization, economic growth, and human capital on the variables influencing the ecological footprint (EF) of five South Asian nations. In most previous studies, the ecological footprint (EF) has been employed as an environmental indicator. Because the relationships between human development and economic progress are so intricate, policymakers have not fully comprehended EF. This analysis uses yearly data for Pakistan, India, Bangladesh, Nepal, and Sri Lanka from 1990 to 2022 to offer empirical support. The results validate that GDP, human capital, biocapacity, and urbanization all positively contribute to EF. The causality study demonstrates the feedback relationship between EF and GDP, EF and human capital, and EF and biocapacity.

(Pan et al., 2023) The study took into account the relationship between economic growth, EF, and its constituent parts for the Pakistani economy. The analysis of the short-run (ECM) and long-run connection was conducted using the Johansen co-integration approach. The findings demonstrated that while rainfall and carbon dioxide emissions have a negative impact on EFs, urbanization, financial development, economic growth, and the temperature had favourable effects on EFs. The ECM test shows that the analyzed factors account for less than the moderate threshold, or 46% of the disequilibrium in EF. EF's model, on the other hand, shows that the system is diverging from equilibrium and correcting its prior period disequilibrium at a rate of 663% per year through a negative coefficient of temperature in the long-run speed. Conversely, the system is converging towards equilibrium and correcting its prior period disequilibrium at a rate of 77.2% per year through a positive coefficient of CO2 emissions.

Wang et al., (2023) studied 36 OECD nations, to check the connections between industrialization, financial development, renewable energy, economic efficiency, and ecological impact between 1995 and 2018. The environmental Kuznets curve (EKC) hypothesis is supported in OECD nations by an empirical investigation using the completely modified Ordinary Least Square approach, which shows an inverted U-shaped curve link between economic efficiency and ecological footprint. The results of the Dumitrescu-Hurlin panel causality study demonstrate that there is a bidirectional causative link between the three variables—economic efficiency, financial development and use of renewable energy, and ecological footprint. On the other hand, there is a unidirectional causal link between the level of industrialization and ecological impact. These empirical results give helpful policy suggestions for promoting sustainable development in OECD nations. They also provide insightful information and useful lessons that can guide the creation of pertinent policies in other nations and areas.

Summary for the Main Literature - Table (1)

#	Author	Main Variables Considered	Countries Considered	Model Employed or approach used
1	(Abbas et al., 2023)	Renewable energy/ natural resource depletion/ Ecological footprint	50 comple x Econo mies	An expanded STIRPAT equation to test the environ-mental Kuznets curve (EKC) hypothesis.
2	(Acar et al., 2023)	Financial development / GDP / Ecological footprint/ Gross capital formation.	Republic of Azerbaijan.	The ARDL bound test with structural breakdowns.
3	(F. M. Ahmed et al., 2020)	CO_2 emissions/ (GDP)/ domestic credit (% of GDP)/import + export	Egypt	vector error correction model
4	(Alruweili, 2023)	energy consumption/ import + export/ GDP per capita	Saudi Arabia	ARDL approach to test environmental Kuznets curve (EKC)
5	(Arnaut & Dada, 2022)	Ecological footprint / Economic complexity/ Fossil fuel energy consumption/ GDP/ Financial development/ population/Globalization.	United Arab Emirates	ARDL model &dynamic ordinary least squares (DOLS)
7	(Chiad et al., 2022)	Credit/ education/ Ecological foot print / GDP	Algeria	ARDL model
8	(Gülmez et al., 2020)	Ecological footprint/ GDP per capita/Energy consumption per Capita	Turkey	ARDL Models and ECM-Based Granger Causality
9	(S. T. Hassan et al., 2019)	ecological footprint/ Bio-capacity/ human capital/ GDP per capita	Pakistan	(ARDL) econometric technique with a structural break

10	(Iyke-Ofoedu et al., 2023)	Ecological footprint/ carbon footprint of bank loans (CFBL)/ and fossil fuel subsidies (TFFS)	Tunisia	linear and nonlinear ARDL
11	(Kalmaz & Awosusi, 2022)	Ecological foot print/domestic capital investment/oil consumption/ renewable energy	Malaysia	The limits method and Kripfganz and Schneider's (2018)
12	(Karasoy, 2022)	Ecological foot print/ GDP / globalization/ development of financial sector/ remittance in flow/ alternative combustible and None combustible energy.	Egypt	(ARDL) econometric technique with a structural break
13	(Kurniawan et al., 2023)	Ecological footprint/ renewable energy consumption /nonrenewable energy consumption /value added from the industrial sector	Indonesia	vector error correction model (VECM) analysis & forecast error decomposition of variance (FEVD) analysis
14	(Pan et al., 2023)	Urbanization/ financial development/GDP/temperature/rainfall /carbon dioxide emissions/ Ecological foot print	Pakistan	The Johansen co-integration technique
15	(Taneja et al., 2023)	Natural Resources rent, GDP.	India	(ARDL) and the Granger causality test

The problem of the study:

The researcher found that the neglect of studying the impact of economic growth on Ecological Footprint in developing countries specifically Egypt, could be an issue or key issue for this research because most of the Literature and models used - to the knowledge of the researcher – did not analyze the direct relationship between the economic impact of growth on Ecological footprint, their attention on the other Macroeconomics variables for example (Energy, Economic complexity, trade openness or Financial development) which reduces the accuracy of estimation of such relationship and reduces the ability to achieve goals of such assessment, and in the presence of correlation between economic and Ecological footprint as an emerging phenomenon

In this context, the researcher went to the First question: Is it possible to assess the relationship between Economic growth and Ecological footprint in both the short and long run for developing countries? Second question: Does it help to measure the impact on the Egyptian economy? Building on all these facts, the researcher elaborated the main problem purely as follows :
Is it possible to measure the impact of Economic growth on the Ecological footprint of the developing economy to help in producing an effective model for that purpose & apply it to the Egyptian Case?

Importance of the study:

- A lack of clarity in the link between economic growth, ecosystem services, biodiversity, and human well-being imposes itself when predicting any economic and environmental issue.
- The important to understand the meaning and uses of ecological footprint in today's Economies.
- The importance of the current study about economic growth and its effects on Ecological footprint as an emerging topic for more studies in the future.
- Despite the obvious scarcity of ecological capital, most governments do not have reliable instruments to assess their natural capital, and decision-makers are still hesitant to move quickly to lower resource risks.
- Scarcity of analytical studies on the relationship between Economic growth and Ecological Footprint in developing countries like Egypt.
- A need to work on the Macroeconomics level to measure and understand the mutual impact of growth on the environment to help policymakers.

Objectives of the study:

- Understand the meaning of both Ecological footprint and Economic growth as shown in Literature and study the most important factors affecting both.
- Study the relationship between Economic growth and Ecological footprint in both the short and long run.

- Find the most appropriate model or methods and levels of integration between Economic growth and Ecological footprint in the Egyptian Economy.
- Highlight reliable instruments to assess natural capital and help decision-makers.

Hypotheses:

- (H1) - There is a correlation between Economic growth and Ecological foot print in the Egyptian Economy.
- (H2) - There is a short and long-run correlation between some of the factors affecting economic growth (gross capital formation, Natural resources rent, Inflation, and unemployment) used in this study and Ecological footprint in Egypt.

Methodology:

This study depends on time series analysis depending on secondary data obtained by the World Bank.

Table (2): Variables and data

#	Variable	Symbol	Unit of measurement	Source	Used in Literature
1	Ecological Foot Print	EF	Global hectares per capita	Footprint network organization	Positive
2	Gross Domestic Product	GDP	(current US$)	World Bank	Positive
3	Gross Capital Formation	GCF	(% of GDP)	World Bank	Positive
4	Natural Resources Rent	NRR	(% of GDP)	World Bank	Positive
5	Inflation	INF	(annual %)	World Bank	Negative
6	Unemployment	UNP	(% of total labor force)	World Bank	Negative

Proposed model:

The function that expresses the variables will be as follows:

$Y1t = f(X1t, X2t, X3t, X4t, X5t, Tt)$ where

$EF = f(GDP + GCF + NRR + INF + UNP)$

This study will examine these variables depending on the ARDL test and its validity in the long run which will be explained by the following model:-

EF= β0 + β1 GDP + β2GCF + β3 NRR+ β4INF + β5UNP

Where EF stands for Ecological footprint measured by (gha), GDP stands for GDP growth rate (current US$), NRR represent Total natural resources rents (% of GDP), GCF stands for Gross capital formation (% of GDP) INF represents the inflation rate GDP deflator (annual %), UNP stands for Unemployment, total (%of total labor force) National Estimate

Results:

To estimate the results, the researcher depends on several statistical tools. This analysis begins with the statistical description and then moves to the unite root test ending with the ARDL test:-

Table (3): Descriptive statistics

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
EF	98618282	89683032	1.78E+08	26432138	48217507	51
GDP	6.945981	6.931318	8.365302	5.489488	0.821055	51
GCF	21.70472	19.52708	33.11688	15.17162	5.351346	51
INF	11.07778	10.80567	29.51848	2.377681	5.771398	51
NRR	11.00374	9.402908	32.50937	1.717489	6.903152	51
UNP	7.916923	8.400000	13.15000	1.530000	3.218686	51

In describing the data statistically, the average EF was (98618282) over the years while the variation of EF was high (CV=48.9%). The lowest recorded EF was (26432138) at year 1970 while the highest was (1.78E+08) at year 2018. It found that the greater mean is the EF followed by GCF then both INF, and NRR then UNP and the lowest mean for GDP as shown in table 3. Also, it is clear that in all results the mean is greater than the median which means that the tail of the curve will be at the highest values of all variables used.

Pearson Correlation Coefficients of the variables in phenomenon - Table (4)

	EF	GDP	GCF	INF	NRR	UNP
EF	1.00					
GDP	-0.922221	1.00				
GCF	-0.743903	0.664469	1.00			
INF	-0.592729	0.337295	0.108811	1.00		
NRR	-0.699781	0.635166	0.706781	0.110621	1.00	
UNP	-0.360867	0.135210	0.106781	0.229544	0.121412	1.00

Calculations based on Data from World bank 1971-2022 "If the p-value is not low (generally higher than 0.05)"

Ecological footprint (EF) was significantly correlated moderately with GDP, GCF, IN, NRR, and UNP. However, it was strongly correlated with GDP, GCF, and NRR. The EF and unemployment have a weak correlation with UNP. Correlations are a good indicator for the relationship between variables but do not consider the simultaneous effect of different variables on the tax revenue.

Unit root test: this test began with the following hypotheses:

H0: variables have unit root and stationarity.

H1: Variables have neither unit root nor stationarity.

Table (5): unit root test

	Level		**1st difference**	
	Intercept	Trend & intercept	intercept	trend & intercept
EF	ADF: -0.753039	ADF:-6.399428	ADF:-1.617934	ADF:-6.35686***
	PP:-0.753567	PP:-1.773073	PP:-6.399417***	PP: -6.355076***
GDP	ADF: -0.657257	ADF:-2.486698	ADF: -5.367511***	ADF:-5.327910***
	PP: -0.419942	PP:-2.071910	PP:-5.328422***	PP:-5.352662***
GCF	ADF: 2.906563	ADF: -0.202203	ADF:-2.972028**	ADF:-7.370712***
	PP: 2.621561	PP: -0.313775	PP:-6.536953***	PP:-7.428692***
INFL	ADF:4.604859	ADF:4.611278	ADF:-0.107378*	ADF:2.641115
	PP:3.243483	PP:-3.853873	PP: -1.369837	PP: -2.459328
NRR	ADF: 2.601081	ADF:1.175394	ADF: 3.120392	ADF:3.449083
	PP: 4.123217	PP: 3.882656	PP: -5.805798***	PP: -6.496473***
UNEMP	ADF: -1.936427	ADF: -0.669971	ADF: -5.450287***	ADF: -5.794936***
	PP: -1.986333	PP: -1.241688	PP: -5.55897***	PP: -5.821730***

Stars refer to different significance ∗ (10%) , ∗ ∗ (5%), ∗∗∗(1%) - Calculations based on Data from World bank 1971-2022

By conducting the unit root test, the researcher found that there is no stationarity and so the model is valid at the level I (0) and the first difference I (1). Therefore two ways of testing the stationarity -whether ADF or PP- concludes the variables are stable in the long run as well as in the short run. So the first hypothesis is rejected and the second one is accepted. On other words based on the results of ADF test, I can reject the null hypothesis and conclude that the time series is stationary.

Pairwise Granger Causality Tests - Appendix (1)

(Lags: 2)Granger causality test results, the purpose of this test was to determine which variables are dependent and which are independent. The test revealed that unidirectional causality exists in my research from EF to GDP, GCF, NRR, INF, UNP. As Gülmez et al.,(2020) & Taneja et al., (2023) used in their work.

For tests (2), (6), (10), (11), and (12) EF has an effect on GDP, GCF, NRR, INF, UNP. For tests (1), (3), (4) GDP has an effect on GCF, INF, NRR. For tests (5), (14), and (15) UNP has effect on GDP, INF, and NRR. For tests (7) INF has effect on GCF. For tests (8), (13) NRR has an effect on GCF, and INF.

As a result, the upcoming analysis will assess the long and short run effects of EF on GDP, GCF, NRR, INF. And UNP and independent variable will be (EF) Ecological Footprint.

Table (7) : ARDL Model for the variables -

Variable		**Estimate**	**Std. Error**	**Pr (>|t|)**
(Intercept)		17.6200***	4.0220	0.0004
L(EF of GDP, 1)		0.61687***	0.1417	0.0006
L(EF of GDP, 2)		-0.0781	0.1593	0.6268
L(EF of GDP, 3)		0.1004	0.1504	0.1188
L(EF of GDP, 4)		-0.3143**	0.1434	0.0332
GCF		0.0000	0.0000	0.6757
L(GCF, 1)		0.0000	0.0000	0.10754
L(GCF, 2)		0.6100**	0.0000	0.0364
L(GCF, 3)		0.0000	0.0000	0.7439
L(GCF, 4)		0.0000	0.0000	0.4312
L(GCF, 5)		0.0000	0.0000	0.3842
NRR		-0.0022	0.0055	0.6881
L(NRR, 1)		0.0145	0.0089	0.1106
L(NRR, 2)		-0.0124**	0.0057	0.0368
UNP		-1.1910*	0.6251	0.0639
L(UNP, 1)		0.1276	0.6991	0.8561
INF		0.0000	0.0000	0.6548
L(INF,1)		0.0887	0.1436	0.5405
R square	0.998566	F-statistic	667.2877	
R square adjusted	0.997069	P-value	1.21e-05	

Sig values: ***<0.01, **<0.05, *<0.1, “”>0.1 - Calculations based on Data from World Bank 1971-2022 Dependent variable is Ecological footprint.

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The model was found to be significant since p-value is less than significance level. The 99.70% of the variation in (EF) was explained by the ARDL model. The GDP, GFC and NRR, had a significant effect on EF at 90% confidence. GDP lag2 was found to be statistically significant at 90% confidence level. Their coefficients suggest that a one-unit increase in these variables would increase (EF) by 0.6100 units respectively, holding all other variables constant. This shows that there is an effect of GDP, on EF in short run. At 10% significance level, NRR had a significant impact on EF. In short run, it had a significant negative effect on EF. UNP had a significant negative impact on EF in the long run. These results were obtained using the auto ARDL command in R ensuring that the order with lowest AIC of 23.33 is selected.

Table (8): model results

	Short run	**Long run**
GDP	Sign & +	Sign & +
NRR	Sign & -	Sign & +
GCF	Insign	Sign & +
UNP	Insign	Sign & -
INF	Insign	Insign

Conclusion & discussion:

In this paper, the researcher examined the relationship between economic growth and various variables commonly studied in the literature. These variables include gross capital formation, natural resources rent, inflation, and unemployment, as indicated by previous studies (Ahmed & Edris, 2018; Hassan et al., 2023; Ikram et al., 2021; Öncel et al., 2023; Taneja et al., 2023; Vu et al., 2023). The researcher also explored the ecological footprint as a measure of environmental degradation, which has been confirmed by previous studies (Abbas et al., 2023b; Addai et al., 2022; Arnaut & Dada, 2022; Chen & Madni, 2022; Chiad et al., 2022; El-Deeb & Halim, 2020; Iyke-Ofoedu et al., 2023; Kalmaz & Awosusi, 2022; Kılıç et al., 2023; Kurniawan et al., 2023). The analysis was conducted using data from Egypt spanning from 1971 to 2022.

To investigate the relationship between these variables, the researcher employed various techniques such as the Pearson correlation test, unit root test, Granger causality tests, and the autoregressive distributed lag (ADRL) model. The results indicated that GDP has a significant and positive relationship with the ecological footprint. This suggests that a 0.61% increase in Egypt's GDP would lead to a 1% increase in the ecological footprint, indicating an increased burden on biocapacity. These findings align with the actual situation in Egypt in 2022, where the bio-capacity per person was 0.3 gha and the ecological footprint per person was 1.5 gha, resulting in a bio-capacity deficit of -1.4 gha (Open Data Platform, 2023). From my perspective, achieving economic growth without depleting the environment can be accomplished through technological advancements that reduce pollution, accompanied by public policies ranging from restrictions to subsidies (Acar et al., 2023; Alruweili, 2023; Boukhelkhal, 2022; Chen et al., 2023; Gülmez et al., 2020; Hassan et al., 2019).

In terms of natural resources rent, the results showed a significant negative relationship in the short run and a significant positive relationship in the long run with the ecological footprint. This can be explained by the cost of using natural resources, where increased utilization over time depletes resources and leads to a larger ecological footprint in the long run. However, in the short run, due to time lags associated with investments and infrastructure development, the impact of natural resources rent on the ecological footprint is relatively smaller. To address this issue, society can implement incentives or taxes to promote green investment and consumption, ensuring the sustainable utilization of natural resources (Abbas et al., 2023; Gülmez et al., 2020; Taneja et al., 2023).

Regarding gross capital formation, the relationship with the ecological footprint was found to be insignificant in the short run, but significantly positive in the long run. This can be attributed to the time required for investments to transform into physical capital. In the short run, the impact on the ecological footprint is minimal, whereas in the long run, gross capital formation has a positive effect. Similar solutions applied to natural resources rent can be implemented for gross capital formation (Mehmood et al., 2023; Pan et al., 2023; Acar et al., 2023). Unemployment and inflation were found to have an insignificant relationship with the ecological footprint in the short run, while unemployment exhibited a significant negative relationship in the long run. Previous research suggests that high unemployment costs lead to a decline in consumers' purchasing power, resulting in a slowdown of the economy and less environmental stress, thereby improving environmental quality (Ahmed et al., 2020; Ahmed & Edris, 2018). To address this issue, Egypt needs to focus on reducing unemployment and implementing policies that maintain a balance between the environment and the economy.

This study highlights the factors influencing economic growth, such as changes in gross domestic product resulting from inflation rates and unemployment, as well as gross capital formation and natural resources rent. These factors also have an impact on the ecological footprint, which reflects changes in Egypt's biodiversity. The value of this study lies in its focus on the Egyptian case, as well as in providing clarity on the link between the ecological footprint and economic growth. Furthermore, it highlights the need for reliable instruments to assess natural capital and the importance of prompt decision-making to mitigate resource risks, which can apply to other countries with similar economic and environmental characteristics.

Policy recommendations:-

The findings of this study have significant policy implications for understanding the importance of maintaining a sustainable environment in Egypt and other developing nations.

Egypt has the potential to achieve economic growth without depleting the environment in both the short and long term. This can be accomplished by encouraging the private sector and government to develop and implement technologies that reduce pollution while allowing for continued economic expansion. Public policies, ranging from command-and-control measures to government subsidies, can support this transition.To effectively manage natural resources, capital formation, and unemployment, Egypt should utilize both fiscal and monetary economic policies. Egypt must establish reliable instruments for assessing natural capital and make prompt and decisive decisions to mitigate resource risks. While this study has provided insights into the relationship between ecological footprint, economic growth, gross capital formation, natural resources rent, unemployment, and inflation in Egypt, future research should focus on other developing countries at both panel and individual levels. Additionally, exploring other factors such as social and economic organizations using nonlinear models can further enhance our understanding of this relationship.

Limitations of the study:

The application is on the Arab Republic of Egypt using data from the years 1971 to 2022. The period under study is limited to 51 years to ensure the accuracy of analysis in the long run as well as in the short run.

References:

Abbas, S., Ghosh, S., Sucharita, S., Doğan, B., Değer, O., & Mariev, O. (2023). Going green: understanding the impacts of economic complexity, clean energy, and natural resources on ecological footprint in complex economies. Environment, Development and Sustainability. https://doi.org/10.1007/s10668-023-04154-4

Acar, S., Altıntaş, N., & Haziyev, V. (2023). The effect of financial development and economic growth on ecological footprint in Azerbaijan: an ARDL bound test approach with structural breaks. Environmental and Ecological Statistics, 30(1), 41–59. https://doi.org/10.1007/s10651-022-00551-6

Addai, K., Serener, B., & Kırıkkaleli, D. (2022). Empirical analysis of the relationship among urbanization, economic growth and ecological footprint: evidence from Eastern Europe. Environmental Science and Pollution Research, 29(19), 27749–27760. https://doi.org/10.1007/s11356-021-17311-x

African development bank group. (2023). Egypt economic outlook. https://www.afdb.org/en/. Retrieved December 22, 2023, from https://www.afdb.org/en/countries/north-africa/egypt/egypt-economic outlook#:~:text=In%202021%2F22%2C%20real%20GDP,by%20household%20consumption%20and%20investment.

Ahmed, E. A., & Edris, A. E. (2018). The effect of the liberalization of the pound exchange rate on domestic tourism in Egypt. Egyptian Journal of Tourism and Hospitality, 25(2), 66–81. https://doi.org/10.21608/ejth.1999.233727

Ahmed, F. M., Hadi, D. M., & Ahmed, A. K. (2020). Impact of economic growth, financial development, and trade openness on environmental degradation in Egypt. PolyTechnic, 10(1), 98–102. https://doi.org/10.25156/ptj.v10n1y2020.pp98-102

Alruweili, F. (2023). Impact of GDP growth on the ecological footprint: Theoretical and empirical evidence from Saudi Arabia. International Journal of Advanced and Applied Sciences, 10(5), 120–129. https://doi.org/10.21833/ijaas.2023.05.015

Arnaut, M., & Dada, J. T. (2022). Exploring the nexus between economic complexity, energy consumption and ecological footprint: new insights from the United Arab Emirates. International Journal of Energy Sector Management, 17(6), 1137–1160. https://doi.org/10.1108/ijesm-06-2022-0015

Boukhelkhal, A. (2022). Impact of economic growth, natural resources and trade on ecological footprint: do education and longevity promote sustainable development in Algeria? International Journal of Sustainable Development and World Ecology, 29(8), 875–887. https://doi.org/10.1080/13504509.2022.2112784

Chen, Q., & Madni, G. R. (2022). Encirclement of natural resources, green investment, and economic complexity for mitigation of ecological footprints in BRI countries. Sustainability, 14(22), 15269. https://doi.org/10.3390/su142215269

Chen, S., Wang, F., & Haroon, M. A. (2023). The impact of green economic recovery on economic growth and ecological footprint: A case study in developing countries of Asia. Resources Policy, 85, 103955. https://doi.org/10.1016/j.resourpol.2023.103955

Chiad, F., Moumeni, S., & Aoussi, A. (2022). The joint effect of financial development and human capital on the ecological footprint: The Algerian case. Economics and Policy of Energy and the Environment, 1, 69–93. https://doi.org/10.3280/efe2022-001005

El-Deeb, M. S., & Halim, Y. T. (2020). Using Ecological Footprint Accounting model as a tool for sustainable development in the hospitality industry: Evidence from Egypt. Al-Fikr Al-Muhasabī, 24(2), 564–602. https://doi.org/10.21608/atasu.2020.95130

Gülmez, A., Altıntaş, N., & Kahraman, Ü. O. (2020). A puzzle over ecological footprint, energy consumption and economic growth: the case of Turkey. Environmental and Ecological Statistics, 27(4), 753–768. https://doi.org/10.1007/s10651-020-00465-1

Hassan, A., Yang, J., Usman, A., Bilal, A., & Ullah, S. (2023). Green growth as a determinant of ecological footprint: Do ICT diffusion, environmental innovation, and natural resources matter? PLOS ONE, 18(9), e0287715. https://doi.org/10.1371/journal.pone.0287715

Hassan, S. T., Baloch, M. A., Mahmood, N., & Zhang, J. (2019). Linking economic growth and ecological footprint through human capital and biocapacity. Sustainable Cities and Society, 47, 101516. https://doi.org/10.1016/j.scs.2019.101516

Ikram, M., Xia, W., Fareed, Z., Shahzad, U., & Rafique, M. Z. (2021). Exploring the nexus between economic complexity, economic growth and ecological footprint: Contextual evidences from Japan. Sustainable Energy Technologies and Assessments, 47, 101460. https://doi.org/10.1016/j.seta.2021.101460

Iyke-Ofoedu, M. I., Nwonye, N. G., Abner, I. P., Ezeaku, H. C., & Ubani, O. (2023). Impact of carbon footprint of bank loans and fossil fuel subsidies on ecological footprint in Tunisia: A contingency and asymmetric analysis. Journal of Cleaner Production, 426, 139026. https://doi.org/10.1016/j.jclepro.2023.139026

Javeed, S., Siddique, H. M. A., & Javed, F. (2023). Ecological footprint, globalization, and economic growth: evidence from Asia. Environmental Science and Pollution Research, 30(31), 77006–77021. https://doi.org/10.1007/s11356-023-27754-z

Kalmaz, D. B., & Awosusi, A. A. (2022). Investigation of the driving factors of ecological footprint in Malaysia. Environmental Science and Pollution Research, 29(37), 56814–56827. https://doi.org/10.1007/s11356-022-19797-5

Karasoy, A. (2022). HOW DO CONSUMING ALTERNATIVE ENERGY SOURCES AND REMITTANCE INFLOWS IMPACT EGYPT'S ECOLOGICAL FOOTPRINT? Beykent Üniversitesi Sosyal Bilimleri Dergisi, 15(1), 8–28. https://doi.org/10.18221/bujss.1060051

Kılıç, C., Soyyiğit, S., & Bayrakdar, S. (2023). Economic Complexity, Ecological Footprint, and the Environmental Kuznets Curve: Findings from Selected Industrialized Countries. Journal of the Knowledge Economy. https://doi.org/10.1007/s13132-023-01411-9

Kurniawan, R., Nugroho, N. a. A., Fudholi, A., Purwanto, A., Sumargo, B., Gio, P. U., & Wongsonadi, S. K. (2023). The ecological footprint of industrial value added and energy consumption in Indonesia. International Journal of Energy Sector Management. https://doi.org/10.1108/ijesm-05-2023-0006

Lee, H. S., Chia, C. J., Liew, P. X., Lee, S. Y., & Har, W. (2023). The heterogeneous effect of economic growth on the ecological footprint in OECD countries. IOP Conference Series, 1135(1), 012032. https://doi.org/10.1088/1755-1315/1135/1/012032

Mahmoud, Nevin H. M. (2023). The impact of global energy prices on economic growth in Egypt during the period from 1965 to 2022 using the autoregressive distributed lag (ARDL) model. Journal of political & Economic Studies - Faculty of Politics & Economic –Suez University (JPES)487–453 ,(2)3 . https://doi.org/10.21608/psej.2023.199112.1056

Mehmood, U., Aslam, M. S., & Javed, M. A. (2023). Associating Economic Growth and Ecological Footprints through Human Capital and Biocapacity in South Asia. World, 4(3), 598–611. https://doi.org/10.3390/world4030037

Muhammad, S., Doğan, M., Akkuş, H. T., & Gürsoy, S. (2023). The effect of financial development and economic growth on ecological footprint: evidence from top 10 emitter countries. Environmental Science and Pollution Research, 30(29), 73518–73533. https://doi.org/10.1007/s11356-023-27573-2

Öncel, A., Kabasakal, A., Kutlar, A., & Acar, S. (2023). Energy consumption, economic growth and Ecological footprint relationship in the top Russian energy importers: a panel data analysis. Environment, Development and Sustainability. https://doi.org/10.1007/s10668-023-03517-1

Open data platform. (2023. n.d.). https://data.footprintnetwork.org/?_ga=2.77549205.1664921367.1703231231-1029425231.1698518942#/

Pan, C., Espinosa-Cristia, J. F., Irfan, M., Pan, Z., Ghardallou, W., Tahir, M., & Ali, B. (2023). Modelling the ecological footprints, climate change and economic growth nexus. Geological Journal, 58(9), 3348–3367. https://doi.org/10.1002/gj.4767

Taneja, S., Bhatnagar, M., Kumar, R., & Rupeika-Apoga, R. (2023). India's Total Natural Resource Rents (NRR) and GDP: an Augmented Autoregressive Distributed Lag (ARDL) bound test. Journal of Risk and Financial Management, 16(2), 91. https://doi.org/10.3390/jrfm16020091

Vu, T. L., Paramaiah, C., Tufail, B., Nawaz, M. A., Sadiq, M., & Huy, P. Q. (2023). Effect of financial inclusion, Eco-Innovation, globalization, and sustainable economic growth on ecological footprint. The Engineering Economics, 34(1), 46–60. https://doi.org/10.5755/j01.ee.34.1.32402

Wang, Q., Ge, Y., & Li, R. (2023). Does improving economic efficiency reduce ecological footprint? The role of financial development, renewable energy, and industrialization. Energy & Environment. https://doi.org/10.1177/0958305x231183914

<u>Appendix(1): Pairwise Granger Causality Tests</u>

Null Hypothesis:	Obs	F-Statistic	Prob.
1- GCF does not Granger Cause GDP	51	1.74983	0.1854
1- GDP does not Granger Cause GCF		2.67126	0.0801
2- EF does not Granger Cause GDP	51	2.57913	0.0870
2- GDP does not Granger Cause EF		1.59968	0.2132
3- INFL does not Granger Cause GDP	51	1.38681	0.2603
3- GDP does not Granger Cause INFL		2.46563	0.0964
4- NRR does not Granger Cause GDP	51	1.26899	0.2910
4- GDP does not Granger Cause NRR		1.69338	0.1954
5- UNP does not Granger Cause GDP	51	0.75480	0.4760
5- GDP does not Granger Cause UNP		0.11933	0.8878
6- EF does not Granger Cause GCF	51	4.07348	0.0237
6- GCF does not Granger Cause EF		2.40341	0.1019
7- INFL does not Granger Cause GCF	51	3.41789	0.0415
7- GCF does not Granger Cause INFL		2.48185	0.0950
8- NRR does not Granger Cause GCF	51	1.58802	0.2156
8- GCF does not Granger Cause NRR		0.97961	0.3833
9- UNP does not Granger Cause GCF	51	0.09554	0.9091
9- GCF does not Granger Cause UNP		0.30454	0.7390
10- INFL does not Granger Cause EF	51	1.07053	0.3514

10- EF does not Granger Cause INFL		1.38694	0.2603
11- NRR does not Granger Cause EF	51	0.06912	0.9333
11- EF does not Granger Cause NRR		4.27090	0.0200
12- UNP does not Granger Cause EF	51	0.72154	0.4915
12- EF does not Granger Cause UNP		3.53326	0.0376
13- NRR does not Granger Cause INFL	51	13.8226	2.E-05
13- INFL does not Granger Cause NRR		10.1290	0.0002
14- UNP does not Granger Cause INFL	51	4.88765	0.0120
14- INFL does not Granger Cause UNP		0.19543	0.8232
15- UNP does not Granger Cause NRR	51	5.87711	0.0054
15- NRR does not Granger Cause UNP		0.43951	0.6471