NEAR EAST UNIVERSITY

INSTITUTE OF GRADUATE STUDIES

DEPARTMENT OF BUSINESS ADMINISTRATION

WHAT IS THE ROLE OF GOVERNMENTS IN ACHIEVING THE SDGS? EMPIRICAL EVIDENCE FROM EU NATIONS?

M.Sc. THESIS

ABDULLAH_S_G ABUSAMHADANA

Nicosia

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APPROVAL

We certify that we have read the thesis submitted by ABDULLAH_S_G ABUSAMHADANA titled "WHAT IS THE ROLE OF GOVERNMENTS IN ACHIEVING THE SDGS? EMPIRICAL EVIDENCE FROM EU NATIONS?." and that in our combined opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Educational Sciences.

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DECLARATION

I hereby declare that all information, documents, analysis and results in this thesis have been collected and presented according to the academic rules and ethical guidelines of Institute of Graduate Studies, Near East University. I also declare that as required by these rules and conduct, I have fully cited and referenced information and data that are not original to this study.

ABDULLAH_S_G ABUSAMHADANA

12/01/2024

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Abstract

What is the role of governments in achieving the SDGs?:

Empirical evidence from EU NATIONS

ABDULLAH_S_G ABUSAMHADANA

Supervisor: Assist. Prof.Dr. ALA FATHI ASSI

Masters, Department of Business Administration

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The main objective of this research was to investigate the obligations of governments in achieving the sustainable development goals in the EU nations from the year 2010 to 2021. The study seeks to comprehend and disseminate the factors that motivated European Union nations to achieve long-term development goals among 2010 and 2021. The effective approach, for the reason noted in the study contributions, is the Autoregressive Distributed Lag [ARDL]. This study examined the association among government spending on environmental protection, human development, the consumption of energy, and the environmental innovations that took place in European nations among 2010 and 2020. The focus of the recent research has been on whether large nations, economically large, have directed their economies toward environmental sustainability or not. The researcher has used these variables to help identify the main problem that leads to controlling the spending of government and the rates on environmental protection. Along with exploring the necessary measures that can help European nations, establish further growth and develop in a green environment without the need for financial spending to protect their environment. The ARDL, results showed evidence that there is a strong negative association among each of the following variables: financial development, Green energy, consumption, scientific innovations, human capital, and the acceleration rate of government spending on environmental protection. The results confirmed the positive association with fossil fuel consumption.

Key words: Financial development; Human capital; Fuel energy; Green energy; Eco-innovation performance; Government expenditure on environmental protection.

Özet

SürdürülebilirKalkınmaHedeflerineulaşmadahükümetlerinrolünedir?:
AB ULUSLARINDAN ampirikkanıtlar

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Ocak 2024, 85sayfa

Bu araştırmanın temel amacı, 2010 yılından 2021 yılına kadar AB ülkelerinde sürdürülebilir kalkınma hedeflerine ulaşmada hükümetlerin yükümlülüklerini araştırmaktı. Çalışma, Avrupa Birliği ülkelerini uzun vadeli kalkınmaya ulaşmaya motive eden faktörleri anlamayı ve yaymayı amaçlamaktadır. Çalışmada belirtilen katkılardan dolayı etkili yaklaşım, Otoregresif Dağıtılmış Gecikme [ARDL]'dir. Bu çalışma, 2010 ve 2020 yılları arasında Avrupa ülkelerinde gerçekleşen çevre koruma, insani gelişme, enerji tüketimi ve çevresel yeniliklere yönelik hükümet harcamaları arasındaki ilişkiyi incelemiştir. Son araştırmaların odak noktası, büyük ülkelerin ekonomik olarak Büyük çoğunluğu ekonomilerini çevresel sürdürülebilirliğe yönlendirmiş ya da yönlendirmemiştir. Araştırmacı bu değişkenleri, hükümet harcamalarının ve çevre koruma oranlarının kontrol edilmesine yol açan temel sorunun belirlenmesine yardımcı olmak için kullandı. Avrupa ülkelerinin çevrelerini korumak için finansal harcamalara ihtiyaç duymadan yeşil bir çevrede daha fazla büyüme sağlamalarına ve gelişmelerine yardımcı olabilecek gerekli önlemlerin araştırılması. ARDL sonuçları, şu değişkenlerin her biri arasında güçlü bir negatif ilişki olduğuna dair kanıtlar gösterdi: finansal gelişme, yenilenebilir enerji, tüketim, bilimsel yenilikler, insan sermayesi ve çevre korumaya yönelik hükümet harcamalarının hızlanma oranı. Sonuçlar fosil yakıt tüketimi ile pozitif ilişkiyi doğruladı.

Anahtar Kelimeler:

Finansal gelişme; İnsan sermayesi; Yakıt enerjisi; Yenilenebilir enerji; Eko inovasyon performansı; Çevre korumaya yönelik hükümet harcamaları

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LIST OF ABBREVIATIONS

GDP:	Gross Domestic Product
FD:	Financial Development
FDI	Financial development index
NR:	Natural Resource
GE:	GoveGovernmentenduture on environmental protection
IN:	Eco-innovation performance
HC:	Human Capital
RE:	Green energy
REC:	Green energy Consumption
HCI:	Human Capital Index
MG:	Mean Group
PMG:	Pool Mean Group
DFE::	Dynamic Fixed Effect
CSI:	Cross-Sectional Dependence
ARDL:	Autoregression Distributive Lag
ADF :	Augmented Dickey-Fuller
ECT:	Error Correction Term
CO2	Carbon Emossions
EU	Eruopean Union
R&D	Research and Development

EU-ETS	European Union Emoissions Trading System
GHGpc	Greenhouse Gas Emissions
EKC	Environmental Kuznets Curve
ARDL	Autoregressive Distributed Lags
CS-ARDL	Cross-Sectional Autoregressive Distributed Lags
FMOLS	Fully Modified Ordinary Least Square
PHH	Pollution Haven Hypothesis
GMM	Generalized method of moments
GNP	Gross national product

CHAPTER. I
Introduction

Introduction

The Republic of Global Sustainability is concerned with the analysis of economies worldwide, regardless of differences in development, geographical location, regional groupings, and so on. The term 'economic sustainability' is defined in a variety of ways; however, in this thesis, it refers to the use of both economic models and econometric techniques to provide practical solutions to economic and environmental sustainability issues. This was accomplished through economic lenses on financial development, human development, eco-innovation performance, energy consumption [fuel and renewable], and government spending on environmental protection, resulting in robust public policy and regulatory responses for global sustainability.

Background

Environmental pollution has become an increasingly serious concern as the global economy has grown stronger. The United Nation's 2030 Agenda for Sustainable Development has established new goals to address these future economic and environmental challenges which will allow nations to make improvements in their development models and improve their green transformations. The popularity of green innovations and green low-carbon transitions are today's important issues.

In line with international _policies and procedures towards environmental problems, governments assume certain responsibilities of national importance about the environment. Governments have many responsibilities, the most important of which is protecting the public interest by preserving the environment. Because there is a possibility of external negative factors about environmental corruption, market operations are not able to be an effective part of sustainable environmental protection, which may lead to the failure of these operations. Those in the market may put their interests ahead and this may result in ignoring their contributions to the cause and

quality of the environment. Based on ignoring these negative externalities, the collective harm of a marginal nature can exceed the marginal personal harm, which results in the resulting good in the market. With this happening, the government has to intervene, with various legal regulations, taxes, and subsidies aimed at controlling production. Here, what is called the tragedy of the commons can occur as a result of the _lack of _competition in the _market for the consumption _of _environmental _resources. On the other hand, the shared resources may be limited, so that there are no restrictions on the consumption of these resources, which leads to the possibility of _consumption. Because of all these issues, it is the role of governments to develop appropriate financial policies that promote social interest, and develop individual interest at the same time to achieve the sustainability of the economy and the environment _at the _same time {Stiglitz 2000} and {He.et _al 2018}. Thus, environmental issues are viewed _from the _perspective of overheads.

In a study by Antweiler.et, al _{2001} to investigate the effects of trade _on environmental _pollution _ within the confines of domestic commodity markets, it was found that effects of composition, scope, and methods are instrumental in environmental pollution issues. Lopez's study has confirmed (López-Menéndez, A. J., Pérez, R., & Moreno, 2014) these effects, as this study showed three stages of government influence on environmental issues and spending. The first stage is related to the balance effect, whereby government spending on public goods achieves a good economic _outcome, which increases environmental pressure. In the second stage, the composition _effect, governments allocate a large proportion of their spending on human capital-intensive _activities that aim to improve environmental quality over industries that require a large amount of money and that may cause environmental pollution. As for the last stage, the impact stage of this method comes, thanks to the improvements in human capital-intensive activities, the percentage of pollution output decreases, labor _productivity increases and _government spending increases on research and development for clean technologies.

Statement of the Problem

As many papers on the EU have indicated, the EU is comprised of nations with various levels of Socioeconomic development. Beginning with the heterogeneity of the members the Europeans strategy includes the differences of each member state, its national objectives may vary from the objectives in the European _strategy, depending on the conditions in each country, the starting point, and the bottlenecks that can occur on economic growth, _or other economic _processes, which are specific to each member state. The chosen approach, which was quite flexible, included the European objectives that were translated into national objectives that reflected the peculiarities and uniqueness of each country, the objectives that were common: and did not involve the division of tasks: and these were implemented through European level and national measures.

To support the implementation of the strategies, and priorities, coordinated activities at all the national, EU, and international levels were required. As a result, the research gap was identified as follows: There were several studies on the EU and international involvement and the effects of national involvement in achieving these goals outlined in the European strategies. A discovery of a lack of research was identified. The intended goal of the study was to look at how governments in the European nations used the available resources {as measured by government spending} to achieve the SDG's.

Research Questions

The primary goal of the research was to investigate the duties of governments in achieving sustainable developmental goals in the EU nations from the years 2010 to 2021. This study makes a novel contribution by inquiring on the following questions.:

1. What was the job of governments in achieving the SDG's in the short and long term?
2. What is important for the EU nations to achieve sustainable development?
3. How does achieving sustainable development affect various economic and environmental measures?
4. Are macroeconomic outcomes responsible for achieving the SDG's in these nations?

5. How does change in the economic structure affect the achievement of the SDG's?

Study Objectives

Specifically, the aims of the study are:

1. Studying what determines the role of governments in achieving the goals of sustainable development in the short and long term.
2. Analyze the factors that matter to achieving the goals of sustainable development in every field of the economy and the environment of the European Union nations.
3. Analyze the factors influencing the achievement of the goals of sustainable development at the various economic and environmental levels.
4. Verify the impact of micro and macro-economic results on achieving development goals.
5. Inquiry about the role of change in the economic structure of these nations, taking into account micro and macro-economic changes.

Study Justifications

This study undertakes an evaluation of a plan for sustainable development in EU nations, because due to the strengthening of the global economy, environmental pollution is now increasingly serious, where governments maintain specific duties on a national scale. Regarding the environment, governments have a variety of functions. First, environmental protection serves the public good. Due to environmental pollution caused by negative externalities, market actions cannot serve as an active participant in achieving a sustainable environment, leading to further market failure. In reality, the EU is made up of nations with varying levels _of socioeconomic development, as described in papers about the EU. {Fura and Wang, 2017: Alexa et al., 2019} To support the achievement of the priorities proposed in the strategy, combined activities at the national, EU and international levels were required. The purpose of this research was to evaluate

how governments used available resources and how it affected the achievements of the targeted groups in the SDGs by using government expenditures from European nations.

Contributions of the Study

The significance of the study stems from the fact that it is an important addition to the environmental economics literature in three ways: The first aspect is that, after reviewing the environmental economic literature, we discovered that this is the first initiative for an empirical study of the effects. Human development index, environmental performance, innovation, energy, consumption, and financial development in European nations. Environment protection. In the European Union's national literature, the EPE index has been used to represent government spending on environmental protection and environmental quality indicators. With this significance, the study provides an opportunity for researchers and decision-makers to demonstrate the negative effects of government spending on environmental protection in European economies.

The second aspect, the ECO index, was used to investigate the impact of environmental spending on innovation, energy consumption, performance, human capital, and financial progress in light of the Sustainable Development Goals[SDGs]. As a result, through domestic policies and planning, SDGs 6, 13, and 15 will be pursued to mitigate the effects of climate change. The EPE index is a critical tool in government policy [UN, 2022b]. Although no study has focused on the association among ecological footprint and CO_2 emissions to the best of our knowledge, ecology, EPE, environmental innovation, and other variables are all together. As a result, this study contributes to the literature by providing strong sign on the effects of financial development and innovation in the fields of environment: energy consumption, and human capital, particularly the performance of environmental innovation, which is one of the most important indicators and explanatory variables for EPE.

The ARDL method will be used in the third aspect of this study to study the effect of these variables on the indicator of government spending on environmental protection. Furthermore, this method ensures that all units are heterogeneous in the short run while remaining homogeneous in the long run. This method is economically justified because the association among EPE and all independent variables remains constant over time. As a result, we expect EU nations to pursue a variety of economic and environmental policies shortly. That is, these nations are not expected to implement common policies in the short term, but these nations can develop and implement common policies in the long term. Based on this data, the ARDL approach is the best fit for this study.

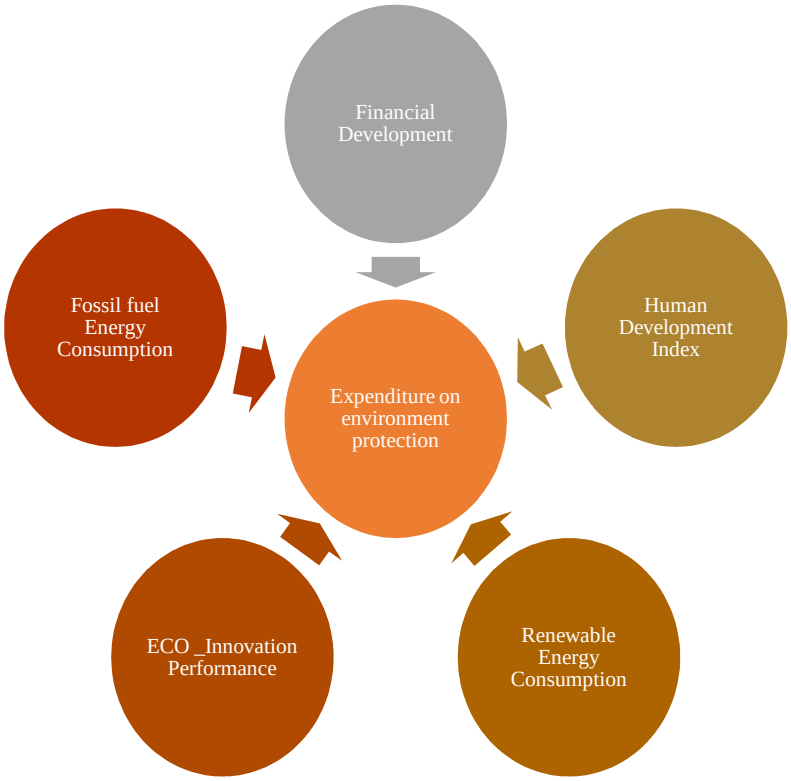
Research Model

The described model is not adopted from any particular formal theoretical background. However, it is based on a pluralistic path tied to empirical literature as reviewed. The explained variable is the expenditure on environment protection {E^P } while the explanatory variables consist of Eco _Innovation performance {E_{I} }, Green energy consumption {R_{C} }, Fossil fuel ebergy consumption {F_{C} }, Human Development Index {H_D }, financial development {F_d }. The model is given as:

$$E^P = E_{I} + R_{C} + F_{C} + H_D + F_d$$

Figure [1] shows the association among the dependent variable and independent variables.

Figure 1: Research Model



Research Method

The study seeks to comprehend the factors that motivate European Union nations to achieve long-term development goals among 2010 and 2021. The best approach is the Autoregressive Distributed Lag [ARDL] for the reasons stated in the study contributions section. When investigating the effects of these variables on EPE, this CS _ARDL analysis method considers cross-section dependence, heterogeneity, and internal heterogeneity. Furthermore, this approach allows all units to be homogeneous in the long run while ensuring heterogeneity in the short run. This model is economically justified because the association among EPE and the independent variables remains constant over time. As a result, it can be assumed that the guidelines for European nations are aimed at implementing short-term policies that are diverse and distinct rather than common. As a result, the possibility of all European nations implementing common policies in the near future is very low, but they can develop long-term common policies.

The primary goal is to learn more about the variables that motivate European Union nations to achieve the SDGs among 2010 and 2022. The ARDL method was used. When investigating the effects of these variables on EPE, the ARDL model takes heterogeneity, sectional dependence, and internal homogeneity into account. Furthermore, the ARDL method allows all modules to be heterogeneous in the long run while maintaining heterogeneity in the short run. Because the association among dependent and dependent variables remains constant over time, the ARDL model is economically justified. However, it is reasonable to assume that the EU nations' guidelines for implementing short-term policies vary. As a result, while all nations are unlikely to implement common policies shortly, common EU policies may emerge over time. With all of this data, ARDL should be able to determine the best method for this study.

Concepts of the _Study

The main concept in this _study

- Expenditure on environmental protection: how much money each government spends on environmental protection measures as a percentage of GDP. These factors and activities are considered functions of the government, which include:pollution control, biodiversity protection, waste management, and other related activities.
- Eco _innovation performance: The _innovation Index assesses EU member states environmental innovation performance using the 12 indicators included in the measurement framework. The classification distinguishes four types of Eco _innovation: technological, social, business, park-related, and organizational.
- Green energy consumption: This indicator is used to compare different nations and regions that seek to achieve economic and environmental development goals by investing in Green energy production and projects based on this type of energy. The total percentage of Green energy consumption from its various sources determines these nations' ability to change the economic structure in the long run.
- Fossil fuel energy consumption: represents the nations, per capita, energy, consumption by residential, commercial, and industrial users. This is a critical

indicator that nations can use to plan various conservation and efficient related interventions to optimize energy use{percentage of total} Coal, oil, petroleum, and natural gas are examples of fossil fuels.

- Human development index: the index qualifies and tracks nations human capital, development, and deployment overtime. It examines the levels of education, skills, and employment available to people in five age groups over the course of their lives.
- Financial development: This indicator measures market depth by the volume of market liquidity and the ability of individuals and businesses to access these funds, which results in the institution's ability and efficiency in providing financial services at a low cost while maintaining sustainable financial returns.

Research Design

The design of the research is structured in an essay form, evaluating the plan for sustainable development in EU nations using CS _ARDL methodologies through evaluation of the capacity of a governments expenditure on environmental protections. The general purpose of Chapter 2 is to present a well-grounded, theoretical framework and empirical literature. It provides a wide theoretical review of the literature, regarding expenditure on environmental protection in EU nations. In the Third Chapter, the drivers of expenditure on environmental protection are examined in the short _run and long _run using bootstrap cointegration and panel CS _ARDL techniques. The chapter also provides solutions to the first research question. In Chapter 3, the analysis of the drivers and the resultant effect of expenditures on environmental protection. Chapter 4 investigates the factors that matter for the expenditure on environmental protection in the EU nations. The study relies on the Pedroni call integration and pull mean group estimation approach. It answers the second research question. Chapter 5 provides the conclusion of the findings, the policy recommendations, the limitations of the specific study, and areas that need further research.

CHAPTER. II
Literature Review

Introduction

This chapter includes two sections, The first section presents previous studies on Eco-Innovation performance, expenditure on environmental protection, Green energy consumption, financial development, fossil fuel energy consumption, and human development. The first part will provide an overview of each variable.

First Section:
Overview of expenditure on environmental protection

Environmental Protection Expenditure Accounts [EPEA] evaluates the economic resources devoted to preventing, reducing and eliminating pollution. It covers the expenditure of units residing in the country [i.e. its enterprises, households, and government] on environmental protection [EP] services such as [water, soil, air, and noise] pollution control, biodiversity protection, waste and wastewater management, and education and training activities and related research and development. Environmental protection services are produced companies and the government. EPEA data are available broken down by institutional sector. while Data on the production of environmental protection services by the environmental field.

Government expenditures on a specified set of activities including pollution abatement, protection of biodiversity landscape, waste and wastewater management, within the framework of the Classification of Functions of Government [COFOG]. All activities undertaken for resource management are outside the scope of the Environmental Protection Agency (EPEA), and related expenditures are not included in National Environmental Protection Expenditure [’NEEP’]. Such as renewable energy production, forest management, and energy efficiency.

Overview of Eco-Innovation Performance

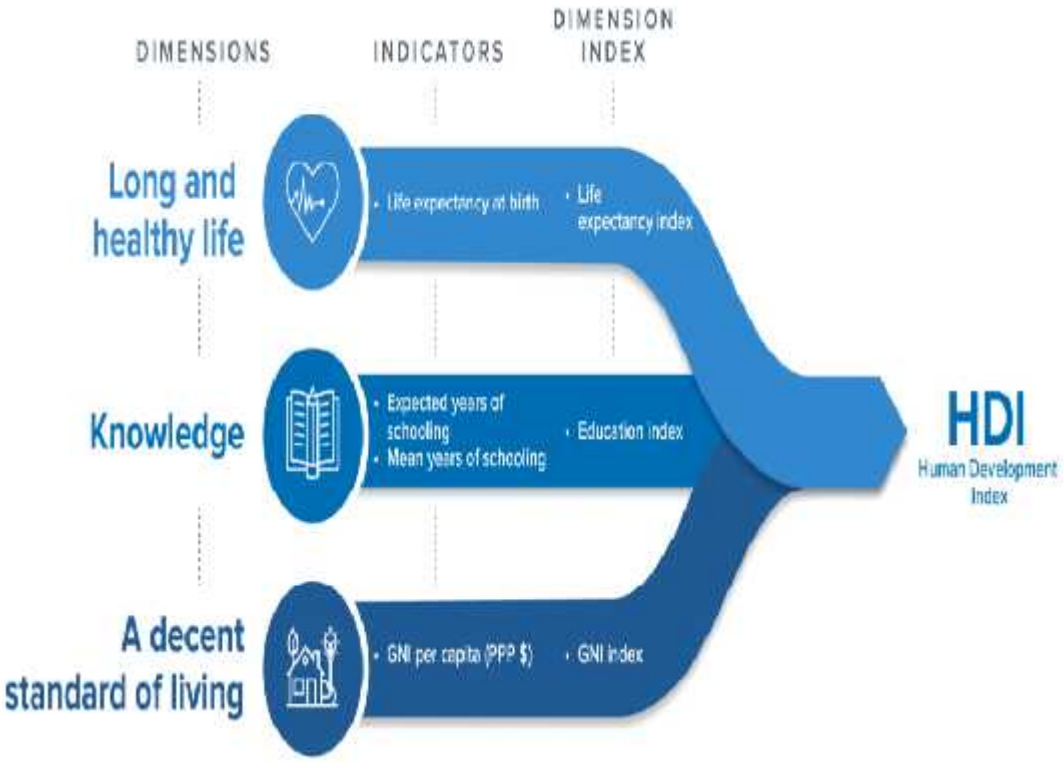
To achieve the European Green Deal, it is necessary to move towards environmental innovation to support the circular economy by increasing the ability to withstand external pressures and use resources efficiently. The eighth environmental program issued by the European Union aims to support the balance between economic activities and environmental quality by accelerating the transition to a renewable economy, specifically through technological innovation and adaptation to new challenges. The report presents practices, drivers, as well as challenges that innovation may face.

Overview of Human Development

The Human Development Index (HDI) assesses progress in three key areas of human development: enjoying a decent standard of living, acquiring knowledge,healthy life and

living a long, Human Development Index (HDI) was defined as the geometric mean of natural indicators in each of the three dimensions, as illustrated in Figure [2]. The educational dimension is measured by the average number of years of study for adults aged 25 years and over, as well as the expected number of years of study for children in school. The health aspect is measured by average life expectancy at birth. Gross national income per capita is used to determine the standard of living. The Human Development Index employs the logarithm of income to reflect the declining importance of income as GNP increases. The indicator scores for the three Index of Human Development dimensions are then combined to form an overall index using the geometric mean. Additional information can be found in the technical notes.

Figure 2: Human Development Index



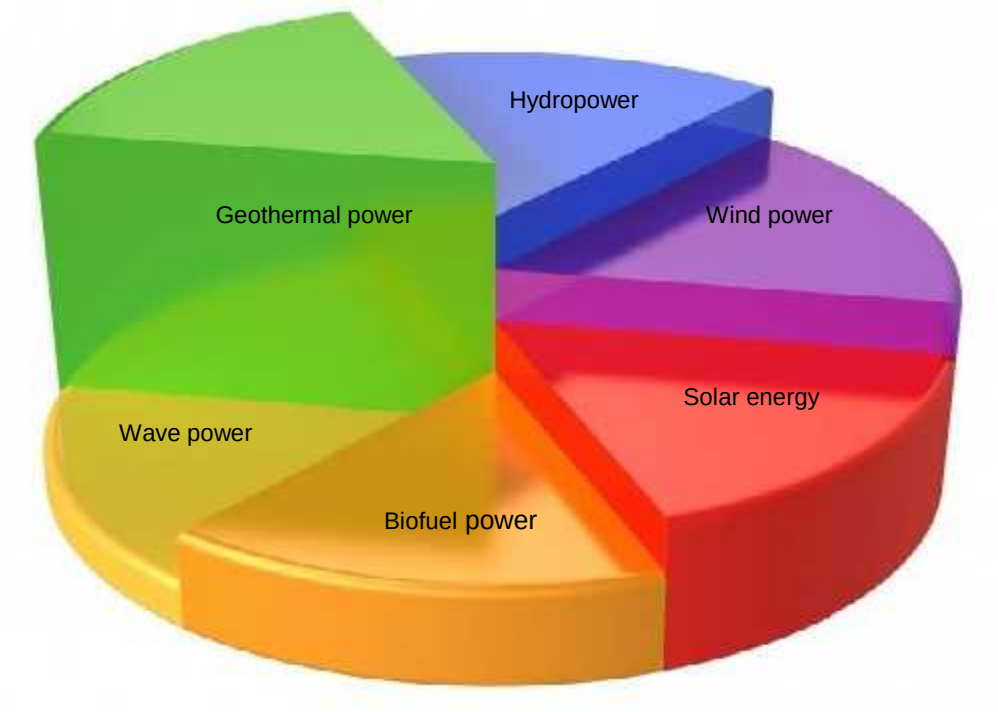
Overview of Energy Consumption

Fuels and renewable energy are the most common types of energy used in economic activities. Both energy sources are important for economic growth and sustainability. Economic activity depends on two main types of energy:

Green energy Consumption

The term green, clean, renewable, or alternative energy are all terms used to describe the forms of energy that are obtained naturally without leaving traces of environmental destruction, such as energy extracted from water, solar energy, wind energy, bioenergy, and others as presented in the Figure [3]. Using this energy is of great benefit from two angles. The first is the ability of this energy to run the wheel of the economy without depletion, as it is available and available as well. The second is the friendship that brings this energy together with the environment, as it contributes to maintaining a clean environment. This energy is characterized by low maintenance costs.

Figure 3: Green energy Sources

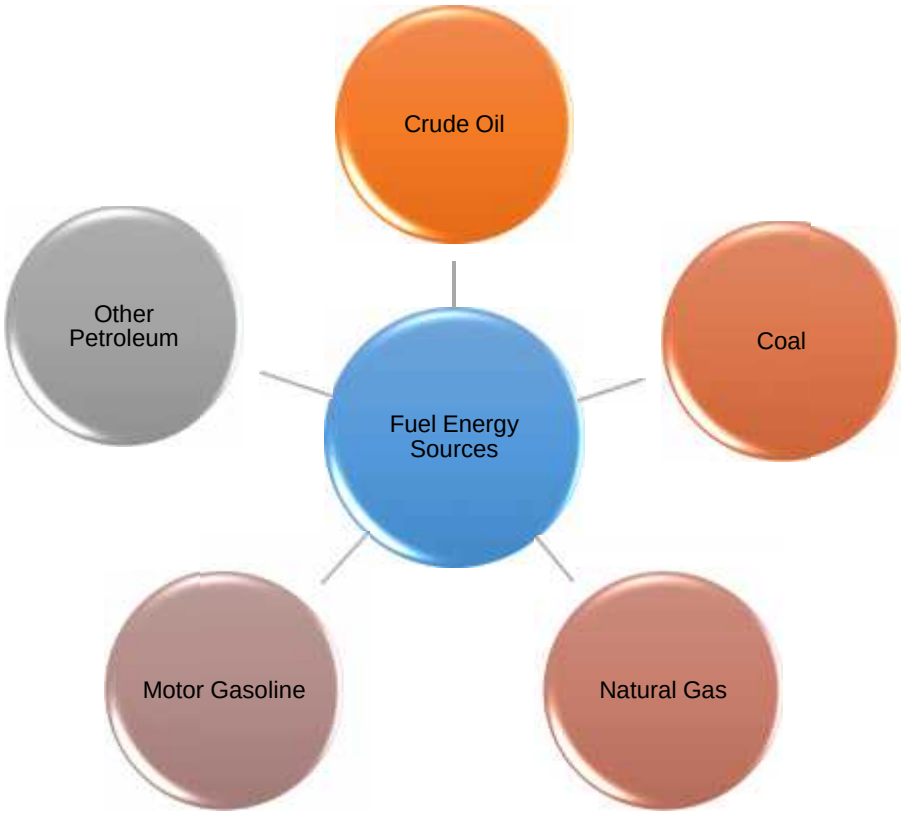


The Consumption of Fossil Fuel Energy

Fossil fuel energy also important in economic activities is increasing continuously and is likely to be the primary source of energy which is expected to increase more than 90% in demand. Accordingly, the expected rise of global oil demand is [1.6%] annually from 75 million barrels each day in 2000 to about 120 million barrels a day by 2030, the increase in demand of the transportation sector will realize about 3/4 of an increase. The primary fossil fuel in land, sea, and air transport will remain in the form of oil for the foreseeable future [IEA, 2002]. The nonrenewable fossil fuels that consume, coal and hydrocarbon fuels consist of plant and animal matter that has been degraded. The three top forms of these fuels include natural gas, coal, and oil. See Figure [2.3].

The industrial revolution was by the use of fossil fuels. Since then that form of energy has become the primary energy source for all economic activities to date..

Figure 4: Fuel Energy Sources



Financial development index

Based on the depth, accessibility and efficiency of the state's financial institutions and financial markets, the financial development index [FD] was created. It is an indicator that measures and analyzes the factors that allow financial systems in various economies to develop. It gives economies a comprehensive way to measure different aspects of their financial systems.

The developed financials that allow for low costs to firms, increased, business activity, or the start-up of a new business. All of this can increase the need for additional energy. Credit institutions contributed to creating wealth for families. Figure [2.4] shows the financial indicators that fall within the financial development under the three aspects which are depth, accessibility and efficiency plan in influencing total energy consumption. A series of financial developments initially led to economic growth and, as a result, an increase in energy consumption, then the relevant literature identified empirical works provided by different periods and places.

Figure 5: Financial Development Indicators

Second section:

Introduction:

In the second section, the researcher presents the outcomes of previous research that tested the eco-innovation functions and performance of financial development, Green energy use, and the consumption of fossil fuel energy and human development on expenditures of environmental protection.

Overall

The amount and composition of expenditures by governments can influence pollution for a variety of reasons. The level and composition of fiscal expenditure can affect the overall level of pollution via four mechanisms: size, composition, technology, and income effects. In some cases, economic growth contributes to the first reason. The majority of cases can result in increased environmental pressures, specific issues that the

government must address, and increased public spending. The change in environmental quality resulting from the change in the range of goods produced is the second, respectively, effect. This effect can be negative or positive depending on the pattern of specialization caused by trade. As human activities resulting from the accumulation of human capital have a greater impact than the accumulation of capital(Islam, A. M., & López, 2013).

The change in total pollution resulting from the shift in more environmentally sustainable production techniques, measured by the technology factor, is an effect that can be clearly seen in rich countries, which have taken practical steps to protect their resources from two angles. Methods: One is through environmental standards. The second step is to increase investment in green technology. The third effect is followed by income growth, through an increase in the level of environmental confidence, which exposes the government to accountability and pressure to increase its spending on environmental protection[Zhang, Q., Zhang, S., Ding, Z., & Hao, 2017].

Eexpenditure on environmental protection and financial development nexus

Based on public finance theory, environmental pollution has clear negative externalities that contribute to its occurrence. Differences between net marginal social costs and private costs lead to misallocation of resources and low social efficiency, which is an important factor in the trend towards consuming less expensive products, even if they are harmful to the environment.At this point, the market may be unable to solve the problem of external effects of environmental pollution, resulting in a market failure. According to studies, there are three types of measures that are commonly used for controlling environmental pollution in some nations or major regions. Governments can tax producers who have negative externalities to effectively internalize the externalities.[Goulder, L. H., & Schein, 2013][Goulder, L. H., & Schein, 2013] When weighing the benefits of a carbon tax, a pure carbon trading system, and the hybrid option (a carbon trading system serves as botha price floor, and a price ceiling). The different options turn out to be equivalent in more the dimensions than they are now. Confess frequently. Furthermore, an important dimension through which this approach has different effects is highlighted, some of which have received little attention in

previous literature. Neither option is superior to the others, and the key point is that pricing external carbon dioxide emissions, whether through a hybrid option or a carbon tax has several significant benefits for cap-and-trade .To avoid problematic interactions with other climate policies and potential wealth transfers in oil-producing countries. An external pricing policy was adopted to prevent price fluctuations and reduce expected errors in cases of uncertainty.When evaluating the attractiveness of a carbon tax, we should consider a pure carbon trading system as well as a hybrid carbon trading system with a cap or price. It turns out that the various options are more equal than is usually the case. As a result, there are important dimensions with varying outcomes and impacts, such as some evidence that has received less attention in previous research findings. However, no one option outperforms the others, and the fact is that pricing external emissions, whether through a hybrid option or a carbon tax has several important advantages in terms of emissions capping and trading.

Second, when monitored by government oversight, negotiations among polluters and pollution victims allow for negotiations to clarify rights to property, making the ability to use the property trading system in order to achieve a Pareto equilibrium in the efficiency of discretionary production among institutions. On a theoretical basis, a reciprocal plan to address climate change was developed by the European Union(EUETS). This plan focused on educational testing services to be one of the effective mechanisms in this matter. As a result, the purpose of this paper was to summarize the main arguments of imperial studies on the European Union’s crossfire system, which have garnered a lot of attention around these critical topics. The EUETS research is presented in light of the shortcomings of current research and the future requirements for the development of EUETS. Overall, this overview of the research scheme may aid in recognizing the benefits of the above scheme and its impact on others.

EUETS is Europe’s primary climate policy. Its lax regulation undermined the system in some ways, resulting in interferences with other undesirable public policies, as well as a widespread economic and financial crisis that drastically reduced market bonus prices. The present study attempts to identify favorable conditions that will lead to success in the coming years in order to activate the coming years. Based on historical lessons

learned over the past eight years, the scheme is now operational and includes several public-sector interventions that are currently being discussed and could help to revive the market. (De Perthuis, C., & Trotignon, 2014)study concluded that development plans have been put in place all over the world, especially China and South Korea, aimed at preserving the environment.

Moreover, to boost producers to produce cleaner products and innovate technologicallywith increased government expenditures.To motivate producers to innovate technologically and produce more environmentally friendly goods while increasing government spending, In the long term, the negative impact of government spending is controlled by creating positive indirect effects, the result of which will be a noticeable reduction in the percentage of pollution. The study emphasized the role of financial tools to achieve this goal. This study was applied to families, governments, and companies as well from 1990 to 2015 using panel data technique with a heteroscedasticity-adjusted method(Adewuyi, 2016). The positive indirect effect reduces the short-term direct negative effect, resulting in a marginally positive overall effect. The long-run effects of consumption by households were negative, but the short-run effects could be relatively larger. Private investment had a positive impact, but household expenditures on sectoral carbon emissions had a negative impact, indicating that government spending was diverse.

(Halkos, G. E., & Paizanos, 2016)Using vector autoregressions on US annual data from 1973-2013, the (Halkos, G. E., & Paizanos, 2016)paper examines the effects of fiscal policy on CO2 emissions. We also investigate the short- and medium-run interactions among emissions and fiscal policy constraints in order to determine policy margins, a deficit-maintenance scenario, and financed spending and tax cuts for deficit-financed taxes. They realized differences in CO2 emissions from consumption and manufacturing in order to identify potential differences in the impact of fiscal policy on pollution sources. The implementation of expansionary budgeting has reduced pollutant emissions, whereas the fiscal deficit, funded by tax cuts, has increased CO2 removal from consumption. The pattern of the resulting effects is determined by the admission source, the fiscal policy scenarios used, and the increase in the functional category of actual

government expenditures.(Islam, A. M., & López, 2013) and (López, R., & Palacios, 2014)study used newly collected data on government spending to present outcomes on the effects of combining state, state, and federal spending on air pollutants in the USA. It was discovered that shifting spending by local and state governments from private goods [RME] to public and social products [PME] resulted in lower SO2 concentrations, whereas the composition of government spending had no effect. Sulfur dioxide concentrations decreased by 0.03 to 0.05 PM 2.5 concentrations decreased by 0.02-0.03 and ozone emissions decreased by 1 to 0.02 with a 0.01 increase in the share of state and local public products and local government spending on social services. The various sensitivity tests were all successful. Uses station-level disaggregated data from the 12 European nations among 1995 to 2008examine the role of energy taxes and trade on environmental quality, as well as the role of fiscal policy in Europe.

(De Perthuis, C., & Trotignon, 2014)stressed that responsibility for environmental degradation is based on the financial policies and tools applied in the state. Increasing financial spending on maintaining environmental quality indicates the loss of this money and its ineffectiveness in green investment. As a result, governments must replace spending with revenue by imposing taxes on energy, especially fossil energy and all its products.

(Galinato, G. I., & Islam, 2017)established a theoretical framework that explains the association among government spending composition, governance quality, and pollution as a byproduct of spending processes. This identified the effect of spending by the government that avoids market failure, such as poor-person subsidies that reduce environmental regulations and credit market failure that correct pollution externalities. The change in government expenditure on goods that mitigate market failures results in compensatory efforts. Consumption pollution rises as income rises, but consumption pollution falls as environmental regulations tighten. Depending on whether the government adopts a democratic system, the impact of regulations pertaining to the environment may outweigh the impact of income, resulting in a reduction in consumer pollution.The results varied according to the level of income, well-being, and per capita pollution. Some governments tend to increase spending to stimulate the economy,

especially during a recession. Although this spending is directed towards environmental protection, social programs, and other benefits, it has an impact on economic growth. Economic researchers believe that increasing spending without transforming the economy will have a negative impact. (López, R., Galinato, G. I., & Islam, 2011)studied seventy-seven countries to examine government environmental spending over the period from year to year. The results showed that there is an indirect but successful effect. It has a strong influence on income and level of well-being. Likewise, (Halkos, G. E., & Paizanos, 2013)calculated the government's carbon footprint and proved its negative impact on per capita emissions. As for the direct impact, it was slight on the level of pollution.

Other studies have been steered to study the role of foreign direct investment that has been associated with noticeable and rising pollution or environmental degradation. Because Financial development index is an important channel for technology transfer and dissemination, it has an impact on host nations and the production structure. Many people have expressed concern that Financial development index has turned nations or regions into pollution hotspots(Lan, J., Kakinaka, M., & Huang, 2012). (Omri & Kahouli, 2014)from 1990 to 2011, the causal association among co2 emissions, economic growth, and foreign direct investment was examined using simultaneous dynamic equations for a global panel of 54 nations. Losses in the dynamic trend of economic growth and financial development index flows; and the increase CO2. (Lan, J., Kakinaka, M., & Huang, 2012) examined the association among financial development index, environmental pollution, and human capital in china from 1996 to 2006, using plotted OLS methods and regional socioeconomic and environmental data. It has been discovered that the effects of financial development index on emissions of pollutants were highly dependent on human capital, and that the sign of effects on each emission of pollutants required different human capital threshold levels. This suggests that phh is only found in china's provinces with low human capital. (Shahbaz et al., 2015)investigate the nonlinear connection among energy use, Financial development index, and GDP growth in high, middle, and low-income nations. At the global level, the authors' evidence supports the PHH and [EKC] hypotheses by used fully modified ordinary least squares [FMOLS] method. (Seker et al., 2015) examined the associations

among GDP, energy, consumption, and carbon dioxide emissions, and foreign direct investment in turkey from 1974-2000 by using an autoregressive distributed distribution [ARDL] test. At the global level, the researchers presented evidence in support of the [EKC] and PHH hypotheses. (Shahbaz et al., 2015)emphasized that the [EKC] hypothesis actually exists, and that foreign direct investment has led to environmental degradation in the world.(Ren, S., Yuan, B., Ma, X., & Chen, 2014) using input-output analysis of china's industrial sectors from 2000 to 2010, the ala confirms the connection among GDP per capita, exports, trade, Financial development index, imports, openness, and co2 emissions. it have been discovered evidence for an inverted U-kuznets curve and that financial development index inflows increased china's co2 emissions.(Haisheng, Y., Jia, J., Yongzhang, Z., & Shugong, 2005) investigated the effect of trade and financial development index on the [EKC]association. The authors discovered no direct impact of trade on Egypt'sArab republic by using panel data analysis in china's 30 provinces from 1990-2002. The results of (Pao & Tsai, 2011) and (Tamazian & Bhaskara Rao, 2010) agreed that there was a direct positive relationship between foreign investment and environmental pollution. The influx of capital by 1% led to an increase of 0.098% in carbon dioxide emissions.

Researchers have reported the PHH hypothesis in many countries and over different time periods. This hypothesis states that financial liberalization has a positive relationship with pollution in the absence of a very strong institutional structure. (Lau, L. S., Choong, C. K., & Eng, 2014) confirmed this result by verifying this relationship in Malaysia using the ARDL method in the time period from 1970 to 2008. (Solarin et al., 2018) also applied his study to Ghana during the period from 1980 to 2012 and confirmed the validity of the hypothesis as well.

(AlAwadhi & Al-Daihani, 2019); (Shahbaz, M., Balsalobre-Lorente, D., & Sinha, 2019); (Hanif et al., 2020), and [sarkodie & strezov, 2019] also applied Hypothesis PHH to South Africa, India, Iran, China, and Indonesia in the period from 1982 to 2016. With the aim of studying the relationship between fossil energy consumption, capital flow, and economic growth on carbon emissions. The hypothesis was also fulfilled. Similar to this study, both (AlAwadhi & Al-Daihani, 2019)and (Shahbaz, M., Balsalobre-Lorente,

D., & Sinha, 2019)studied the same relationship in Pakistan, fifteen Asian countries, and Middle Eastern countries in the period from 1975 to 2016, from 1990 to 2003, and from 1990 to 2015. using the GMM technique and the ARDL technique, respectively.

The results supporting the pollution and halo hypothesis, on the other hand, have been shown to be opposite according to the "halo effect," in which Financial development indexinflows have positive externalities through the transfer of superior technologies as well as reduced carbon emissions.(Doytch, N., & Narayan, 2016)[doytch, n., & narayan, 2016]. [kivyiro, p., & arminen, 2014] used an ARDL model to carefully study the flow of causality among energy consumption,GDP growth, andcarbon dioxide emissions in six sub-SaharanAfrican nations. The researcher discovered evidence supporting the [EKC] hypothesis and acknowledged that financial development index increases co2 in some nations but not all. Using panel data analysis to examine the effect of carbon emissions, energy consumption,financial development, and temperature in 14 non-OECD nations. The author discovered that financial development index had no discernible impact on host country air pollution or energy consumption. (Eskeland, G. S., & Harrison, 2003) and (Aliyu, 2005)established conclusively that foreign plants use cleaner energy than domestic plants.

(Tamazian et al., 2009)used panel data analysis to study the influence of financial development on enviro nmental degradation in bric nations from 1992 - 2004. The researchers discovered that increased economic growth and electronic data interchange resulted in less pollution. For example, (Rafindadi, A. A., Muye, I. M., & Kaita, 2018)examined and evaluated the impacts of energy consumption and foreign direct investment inflows on pollution levels in GULF cooperation council nations. During the period 1990-2014, the nations of the GCC discovered that, while foreign direct investment reduces CO2, while energy consumption causes CO2 to worsen.He used tools to attract capital on carbon emissions. The role of the carbon footprint and environmental impact of twenty countries was calculated from 1982 to 2013. The results confirmed the positive relationship between them. In Hassan, (Durusu-Ciftci et al., 2017)study investigated the role of green development indicators on carbon emissions in the BRICS countries between 2000-2013

showed completely opposite results, as the relationship turned from positive to negative. Likewise, both (Liobikienė, G., & Butkus, 2018);(Liobikienė, G., & Butkus, 2019)and (Tamazian et al., 2009)in one hundred and forty-seven countries from 1990 to 2013, and in another forty-seven countries from 1990 to 2012, confirmed the negative relationship when increasing the market share of green energy and raising the level of energy efficiency.

Green energy consumption and expenditure on environmental protection nexus

Technology has a strong and clear impact on environmental protection and the level of state spending. Richer countries have a greater ability to protect their resources in two ways. The first: setting strict environmental standards. Second: Moving towards green, environmentally friendly investment. Here, these countries must focus on investing in sustainable technologies, which requires creating a structural change in the economy.

The current study discovers the protective power of Green energy consumption on government expenditures on environmental protection. Green energy has been recognized at the international and national levels as an important instrument for achieving improving the environment, which means decreasing government spending on it. The research confirmed that Green energy is critical to reducing global carbon emissions. Such as[Yao et al., 2019]investigated the changing association among RER and hypothesis of EKCover a time period using two datasets from 17 major nations, both developing and developed, as well as six global geo-economics areas. Among 1990-2014. According to the findings, expanding Green energy consumption would result in lower carbon emissions, implying lower government expenditures on environmental protection. [Aydoğan, B., & Vardar, 2020] The study investigated the existence of the hypothesis of EKC for a panel of E7 nations from 1990- 2014. CO2 and utilization of Green energy are estimated to have a negative association. Long-run estimates support the [EKC]’s inverted U-shaped shape in these selected nations. Regarding the Granger causality analysis, there is a bidirectional Granger causality among Green energyprocedure and CO2 in the long term; thus, policy recommendations and their implications for E7 nations should continually boost the share of Green energy in order

to protect the environment. Environment, which has the potential to reduce government spending.

Many nations are taking steps to meet their carbon reduction targets in tandem with the UN Sustainable Development Goals [SDGs]. Because nations have limited financial resources, effective use of public spending is critical for carbon reduction policies. Researchers have failed to assess the quality of the environment in EU nations by examining environmental protection spending and Green energy usage. Many studies have been shown to explore the influence of the usage of Green energy and protection of the environment expenditures on load capacity factor and environmental supply and demand trends. As a result, this work helps to achieve the EU22 nations' development goals. The research employs CS-ARDL technique, which considers cross-sectional dependence. There is both homogeneity and heterogeneity. Empirical analysis revealed that EU economies' spending on environmental protection is insufficient. Furthermore, the usage of green energy has helped to improve the quality of environment. To ensure environmental protection, EU nations have to allocate bigger funds based on results rather than general budgets. Policies that benefit both the public and private sectors must be implemented(Caglar, A. E., Yavuz, E., Mert, M., & Kilic, 2022).

(Tutak, M., & Brodny, 2022)Countries aim to bring about a radical transformation in their economies in order to preserve the environment. Recently, green technological developments have been clearly active in order to eliminate the use of traditional energy. This is not the only reason countries seek to support the transition in energy use. It also looks to a secure, sustainable, independent economy that maintains and increases its economic growth. This has led countries to reformulate new strategies that meet the desired goal. Decisive measures have also been taken regarding implementation. Green energy sources have grown in importance as a result of technological advancements, and they are increasingly replacing conventional sources of energy. Aside from the environmental benefits, Green energy allows for higher levels of energy independence and develops the ability of countries without conventional energy resources to produce alternative energy.These factors compel nations and groups to take increasingly bold steps to develop Green energy. The European Union has ambitious plans in this area and

is the undisputed leader in enacting pro-environmental regulation. Due to the difference in levels of growth between European countries and their wealth as well. The study revealed the dynamics of change in green energy use by using different economic methods among 2000-2019. The sectors that used green energy were studied, such as industry, agriculture, fishing, and others. The results showed an increase in production and greater independence for these countries (Tutak, M., & Brodny, 2022).

[Bórawski, P., Bełdycka-Bórawska, A., Szymańska, E. J., Jankowski, K. J., Dubis, B., & Dunn, 2019]promotes the growth of the market for energy in the EU, with a focus on biofuels. The examinationinvolved data on the share of clean energy sources in total energy usage on the island, the changes in energy from 2004- 2016 and the amount of liquid biofuels. The authors of the paper described the changes in bioenergy energygrowth in the EU using descriptive and statistical methods. The highest proportion of biofuels energy and renewable waste can be createin Latvia, Finland, and Sweden[0.31], [0.26] [0.24] respectively.

As a result of significant rises in carbon dioxide (CO2) In the last few decades, numerous research efforts in the field of energy and environmental development aim to identify the determinants of (CO2). The selection of data is one criticism leveled at the existing literature. The common of studies use total consumption of energy and another point of contention is the use of panel datamethods. Most of studies employ panel dataapproaches, as disregard dependence of cross-sectional. the gaps in the studies, (Dogan & Seker, 2016) intends to use robust cross-sectional panel estimation techniques to explore the effects of real income, trade openness,fuel energies, and renewable energies on carbon dioxide in the EU by applied EKC hypothesisbetween 1980 -2012. The [EKC] hypothesis is supported by using the method of ordinary least squares test to conduct that trade decreases CO2 and Green energy while fossil fuel use increases CO2 emissions. The non-causal Dumitrescu-Hoerlin approach proposes a bidirectional association among carbon emissions and energy ofenvironment sources.Also, unidirectional causality among carbon emissions and real GDP, carbon emissions and fuel energy, and trade openness and carbon emissions.

(Bekun, F. V., Alola, A. A., & Sarkodie, 2019) examines a long-term causal association among economic growth, Green energy usage, and nonrenewable use of energy in the carbon function. The study contains additional variable in the model, which is natural resource rent. The scientific proof is founded on cross-sectional data from selected 16 European Union nations from 1996 -2014. The result reveals that carbon emissions, GDP, natural resource rents, and renewable and fuel energy usage are all cointegrated. The pooled average distribution lag autoregressive model [PMG-ARDL] indicates a significant positive associationin long rum among natural resource rent and CO2. This means that ignoring conservation and management options has a negative impact on the sustainability of the environment of ECLAC nations. The study shows that fuel energy use and economic expansion increase carbon emissions, whereas utilization of Green energy decreases them. The feedback mechanism among economic growth and the usage of energy that is both renewable and fuel is revealed by a causal association analysis. We also discovered a link among economic growth and resource rent. It is possible to draw effective political implications toward modern and green energy sources, particularly in the pursuit of long-term expansion goals. In order to explore the connection among CO2, GDP, both energies fuel and renewable use, and financial development indexinflows in 26 European nations. (Mert, M., Bölük, G., & Çağlar, 2019)study estimated an unbalanced data analysis N. Additionally, the significance of regulations on the environment in validating the pollution haven hypothesis of [PHH] is being investigated in EU nations, namely [EU1-IV and EU5,] where periods of adjusting to environmental regulationpossibly will indicate variances. Results for EU nations in general verified the strength of EKC hypothesis and the PHH hypothesis as well. However, the results vary across EU country groups. While the findings support [EKC] evidence in expansion nations 5 and 6, they do not support expansion nations 1-4.

Although environmental regulations do not have a strongeffect on PHH, they do have a significant impact on the health of [EKC] in EU nations in general. According to Granger data, economic growth leads to increased utilization of energy and foreign direct investment inflows. Because Green energy reduces emissions, European Union nations must work together to promote energy efficiency and green technology in order to confirm sustainability. It is also critical for EU nations to stiffen environmental

guidelines governing the flow of financial development index(Amin, A., Altinoz, B., & Dogan, 2020)As a result, our findings support the European Commission's new framework for exploring financial development indexflows across the region of the EU. The continued rise in carbon emissions from transportation and the transportation sector has piqued the interest of policymakers working in the field of sustainable transportation. At theend, it is critical to understand the factors that contribute to transportation pollution. The drive of research is to study the effects of development on GDP, CO2 emissions, and green energyusage in the transportation sector for EUby using the hypothesis ofEKC. The G2 team's long-term estimates from 1980- 2014 are subjected to a causality test. According to empirical evidence, increasing Green energyusage reduces carbon from sector of transportation, whereas development has a strong positive effect. Concerning emotions. Increased use of Green energy reduces CO2 emissions from that sector by about 12%. Hypothesis of[EKC] was proven correct. Furthermore, one-way causality extends from growth, Green energy, and urbanization to transportation emissions. This suggests that the study's findings promote sustainablelity in the sector of transportation by indorsing environmentally quality and cost-effective transportation and raising urban residents' environmental awareness and public concern about transportation-related environmental issues. This study provides concrete evidence for European policymakers, particularly for sector-based Green energy projects, by drawing attention to the impact of atmospheric greenhouse gases on the EU transport segment.

When pollution becomes a thoughtful issue, contributing strong significantly to warming global, it becomes necessary to develop a sustainable, emissions-free transportation system. clear energy is the effective solution for protecting (Raza et al., 2019). Existing research has primarily focused on nonrenewable/bundled energy Such as: (Danish et al., 2018; Du et al., 2022; Saboori & Sulaiman, 2013); However, no research has been done on the connection among Green energy consumption and CO2 emissions from transportation. The goal of this research is to raise awareness about the importance of energy from sources of renewability for environmentally friendly and sustainable transportation. Green energy is thought to reduce carbon emissions if produced sustainably (Danish et al., 2018). The following Green energy experiments have been carried out in the transportation sector. Biodiesel helps to reduce CO2 emissions, as

(Rahman et al., 2022)claims that biodiesel reduces more than 0.75 of carbon emissions when compared to petroleum diesel. It is produced by hydrogen as a transportation energy source that can help to reduce greenhouse gas emissions. Methanol is produced from natural gas or wood and contributes 0.60 less carbon emissions than gasoline (Siemens, 2016). Furthermore, few studies have attempted to reduce transportation emissions through the use of alternative modes of transportation[Hermes & Lensink, 2003] by utilizing alternative fuels (Zhao et al., 2020)or the implementation of different policies [Bekhet et al., 2017]; [Sun et al., 2022]. According to (Marousek, J., Strunecky, O., & Stehel, 2019) -(Marousek, J., Strunecky, O., & Stehel, 2019) and(Maroušek, J., Vochozka, M., Plachý, J., & Žák, 2017)(Maroušek, J., Vochozka, M., Plachý, J., & Žák, 2017). Marousek substantially decreases carbon emissions as an alternative source of Green energy, and this type of fuel is also considered a green option for the transportation sector. Marousek has become recognized as a promising carbon sequestration technology (Marousek, J., Strunecky, O., & Stehel, 2019) and (Maroušek, J., Vochozka, M., Plachý, J., & Žák, 2017), Furthermore, because Marousek chars at lower temperatures and a shorter period of time, it produces fewer CO2 during the production steps(Marousek, J., Strunecky, O., & Stehel, 2019).

Similarly, (Balsalobre-Lorente et al., 2018)(Balsalobre-Lorente et al., 2018)examined 5 EU nations and exposed that RECs have a strong positive effect on CO2. (Bekun, F. V., Alola, A. A., & Sarkodie, 2019) investigated 16 European Union economies and discovered that Green energy is less damaging to the environment than fossil fuels in EU. (Ahmad et al., 2019) found Green energy has reduced its environmental footprint; similarly, ,(Usman & Balsalobre-Lorente, 2022)found that Green energy reduced their environmental footprint. Biochar produces fewer emissions than charcoal because it is carbonized at lower temperatures and for a shorter period of time(Akadiri, S. S., Adebayo, T. S., Riti, J. S., Awosusi, A. A., & Inusa, 2022)discovered a strong positive effect of the consumption of renewable energy on LCF in India. In another side, both (Jalil & Feridun, 2011) studied South Korea and (Xu et al., 2022)studied Brazil and both reported a negative effect on LCF. (Pata, U. K., & Samour, 2022) investigated France and (Pata, U. K., & Samour, 2022)investigated Japan and discovered that the

consumption of renewable had no effect on LCF. There is a new indication is required for EU, as well as to increase the literature on the relationshipof LCF and REC.

Fossil fuel energy consumption and expenditure on environmental protection nexus

The increase in the use of fossil energy constitutes a major crisis in the country. The environmental issue takes a prominent role as a result of the excessive use of fossil energy. The use of this energy disrupts the environment and causes countless problems. In order to avoid and reduce these effects, governments must have a prominent role in this issue in terms of spending, laws, and strategies that support the environment. Numerous research results have shown the positive relationship between the use of fossil energy and government spending on the environment. The excessive use of fossil energy in the economy indicates an increased role for the government in its spending on protecting the environment in order to reduce negative impacts and achieve a desired balance[Shahbaz et al., 2013]; [Heidari, H., Katircioğlu, S. T., & Saeidpour, 2015].

[Aydoğan, B., & Vardar, 2020]study looks at the associations between fuel energy and green energies consumption, as well as the existence of the hypothesis of EKC for a group of E7 nations from 1990 - 2014. fuel energyusage is thought to have a strongassociation with CO2. Long-term estimation results support the inverted U-shaped shape of the [EKC] in these nations that were chosen. There is a two-way Granger causality among long-term CO2 and fuel energyusage, according to Granger causality analysis. Regarding the political ramifications and recommendations for the nations that make up the G7, the share of non-Green energy should be reduced to protect the environment; otherwise, the government will be forced to increase the rate of government spending to compensate.

[Saboori & Sulaiman, 2013]CO2 emissions, Economic growth, and energy usage in the [ASEAN] nations from 1971 to 2009. The analysis was carried out using the [ARDL] technique and the Granger causality method based on [VECM]. In all of the nations studied, there is a cointegration association among the variables, with a statistically significant positive association among energy consumption and carbon emissions in short and long terms. In terms of carbon emissions, The elasticity of energy consumption

in the long run is greater than the elasticity in the short run. This implies that the level of carbon emissions has been shown to rise with energy consumption in the selected ASEAN economics over time. The researchers emphasized the importance of reactivating the state's role in this issue.

The panel vector error correction model indicated the importance of the relationship between carbon emissions, economic growth, and electricity use in Southeast Asia. The results concluded that there is a positive relationship between emissions and energy use, as well as a non-linear relationship between growth and emissions. While the long-term estimates do not indicate any causal relationship between the variables. The study praised several important recommendations for decision-makers in these countries in order to preserve the environment[Lean & Smyth, 2010].EKC theory was applied to some countries, such as the data from 1990 to 2015 for the five BRICS countries,and South Africa, using several analytical methods, and according to the results, natural resources have an impact on carbon emissions and are not environmentally friendly due to the unsustainable use of resources. Therefore, the use of green energy contributes to reducing pollution[Baloch et al., 2019].

One of the most pressing issues in the global economy and environment recently is the focus on the natural link between energy consumption and the environment. This is what researchers have been active in to obtain clear results that can be developed with policies and strategies to sustain the environment and the economy at the same time. The interaction between the carbon function and the consumption of both fossil and green energy, in addition to growth in sixteen European countries over the period of one year, was analyzed by [Bekun et al., 2019]. The results showed the positive relationship between carbon emissions and the extraction of natural resources, which means excessive use of these resources by the state, which led to environmental degradation. Excessive consumption of fossil energy also causes environmental deterioration, unlike the consumption of green energy, which has the opposite effect. It is possible to draw political implications for environmentally friendly energy sources while creating clear economic growth.

Previous studies have shown that negative shocks have a negative impact on the environment, unlike positive shocks that contribute to reducing environmental damage [Caglar, A. E., Yavuz, E., Mert, M., &Kilic, 2022]. In the period 1985-2016, [EU-5] countries were studied by [Balsalobre-Lorente et al., 2018] which investigates the relationship between economic growth and increasing emissions in [EU-5] countries .This allows us to study the phenomenon of the EKCe, which describes the relationship between environmental degradation and economic growth using the carbon emission function. The empirical results confirm an N-shaped association between economic growth and CO2 emissions in the EU5, when additional variables such as green electricity consumption, trade openness, natural resource abundance, and energy innovation are included to increase carbon.

[Balsalobre-Lorente, D., & Shahbaz, 2016] investigates the relationship between economic growth and the use of renewable electricity. The researcher stressed the necessity of developing green energy systems aimed at increasing renewable sources and encouraging innovation in the field of energy in order to reduce the negative effects of fossil energy and its resources on environmental degradation. Determine whether implementing environmental innovations in green energy has consequences beyond the environmental correction process. A detailed experimental system is applied to the Spanish economy to study not only the relationship between economic growth and environmental pollution, but also to study the effects of energy use, energy innovation, and trade openness. This research confirms that green energy sources help reduce [GHGpc].

Eco Innovation performance and expenditure on environmental protection nexus

The United Nations Conference on Global Environmental Agreements has attracted the Chinese government to attach great importance to issues of environmental management and protection, and has taken a series of steps and measures that have formulated relevant policies to effectively promote the deep involvement of European governments. Governments in the field of global environmental governance. Because of the significant impact of viruses on environmental problems. This activity aims to improve the environment and reduce pollution. This respectively brought forward the 22 basic

national policies for saving resources and environmental protection, while promoting the development of ecological civilization and increasing environmental protection Lee, K. H., & Min, B. [2015]. The environmental environment, and solving outstanding environmental problems. All of these policies came about bringing about a fundamental change in the process of government spending on protecting the environment. The prominent role of governments was to reduce spending on environmental protection in exchange for a radical change in practical innovations.

Due to a lack of data capacity and theoretical foundation, discussions on the association among the environmental performance of companies and financial results of companies have remained inconclusive over the last four decades. The researcher investigates the influence of green investment in both financial and environmental performance which emphasizes the importance of capabilities and resources. From 2001 to 2010, the study used a sample of Japanese firms with an emphasis on development investment, green research as an important indicator of emissions, and technological advances in the performance of the environment.

The findings revealed a link between green innovation and investigation and carbon emissions. While green technology has a strong positive association with the firm-level financial sector, these findings support the notion that firms must urgently marshal additional resources and capabilities in order to adopt a proactive environmental strategy to manage their financial and ecological performance to their best advantage. The study's findings provide valuable insights and a foundation for scholarly debate on how companies use unique capabilities and organizational resources to produce larger corporate financial and environmental results. [Apergis & Payne, 2013]investigates the influence of research and development expenses on [CO2] before and after mandatory adoption of IFRS at the firm level in European nations. Using data from 1998 to 2011, an autoregressive model is estimated that expenditures on research and development in the year of mandatory adoption after IFRS illustration a decline in corporate CO2. a higher rate of reduction in CO2. This is most likely because of the new disclosure system's incentives. In terms of sector analysis, company size, and the implementation of the [EU-ETS] in the three nations, our findings remain robust.

Environmental innovation is defined as developing long-term capabilities to create environmentally friendly technologies and investing in projects that support this type of technology as part of the development strategies that countries seek. Environmental innovation refers to practices within the framework of the state through trade, industry, and operational management. Innovation is based on two important angles: Efficiency and effectiveness. When a company engages in supporting environmental innovation and makes a great effort to reduce the negative effects of economic activities on the environment, this means reconsidering production, operations, and manufacturing processes as well[Cheng et al., 2014]; [Lee, K. H., & Kim, 2011]; [Kemp, R., & Pearson, 2007]; [González-Benito, J., & González-Benito, 2005].

According to the study of environmental performance and environmental management, the environmental performance of some companies may improve through their application of environmentally friendly innovations and directing their investments towards the projects they support. It is a measure of the company's success in reducing the negative impact of its activities on the environment. Environmental performance includes the company's efficiency in using its resources and controlling waste, as well as its energy consumption. Environmental innovation may help companies identify shortcomings in improving energy efficiency and production [Gutowski, T. et al., 2005]; [Sambasivan et al., 2013].

Investing in green technology to reduce pollution and emissions necessitates redesigning production, and product creation should lead to improved operational performance. For example, some researchers have discovered a link between environmental expenditures and operational performance [González-Benito, J., & González-Benito, 2005]. This research has revealed a strong positive relationship between R&D expenditures and environmental management systems, and similarly, research has found a positive relationship between proactive environmental management and environmental performance [López-Menéndez, A. J., Pérez, R., & Moreno, 2014]. But there is also a negative relationship between R&D expenditures and emission levels [Padgett, R. C., & Galan, 2010]and[Fonseca et al., 2010].

From another perspective, adopting environmental innovation for these companies means making a long-term commitment in order to complete the process of environmental research and technological development. Most environmental innovations focus on improving a company's internal resources and capabilities to reduce impacts. Companies that embrace eco-innovation through investment and activities in green R&D seek to increase productivity and efficiency while reducing costs and environmental impacts. Integrating eco-innovation into a company's sustainable strategy entails resolving conflicts between economic and environmental criteria by exploring new combinations of resources and deploying existing resources. Many studies have examined the relationship between environmental performance and corporate performance technologies [ÇETİN, 2013]; [Gautam & Sharma, 2017]; [Popp, 2001]; [Herrerías et al., 2016].

Eco-innovations contribute to reducing pollutant emissions, and these eco-innovation activities highlight the importance of environmental management systems that enable companies to achieve environmentally enhancing organizational learning. The IFRS system is, in part, a regulatory environmental innovation by allowing companies to adopt new environmental approaches and organizational structures to reduce industrial waste and pollution while improving product quality [Anton & Elena, 2020]; [Sadik-zada & Gatto, 2021].

CHAPTER .III
Methodology

Theory

According to public finance theory, negative externalities contribute to differences in net marginal private and social costs, leading to misallocation of resources and lower social efficiency. The market may not be able to solve the problem of environmental pollution externalities, leading to “market failure.” Previous research indicates that three types of measures are commonly used to control environmental pollution. Taxing producers of negative externalities in order to achieve efficient cost internalization [Goulder, L. H., & Schein, 2013] and [Marron, D. B., &Toder, 2014]. Governments may also assume a supervisory role in negotiations between polluters and pollution victims, after which a property rights trading system can be used to optimally balance production efficiency between firms. [De Berthois, C., &Trotignon, 2014]. Finally, using increased government spending to encourage manufacturers to innovate technologically and produce cleaner products [Halkos, G. E., &Paizanos, 2016]. As a result, studying the

effects of government environmental management on environmental quality can not only improve environmental quality, but also reduce the burden of countries' demand for fossil energy, maintain energy security, and stabilize economic activities.

Introduction

The primary goal of this chapter is to explain the research design and methodology explicitly. To fully explain what the researchers intended to accomplish, the research study will first restate the research hypotheses. It is also necessary to investigate the target population, sample size [both main and sub-samples], sample design, data collection and analysis, and so on.

Research Hypotheses

The primary goal of the research was to investigate the duties of governments in achieving the sustainable developmental goals in the EU nations from the years to 2010 to 2022. This study makes a novel contribution by inquiring on the following hypotheses:

- **H_1:** There are significant dynamic associations among expenditure on environmental protection, financial development, Eco-Innovation performance, human development, fuel energy and Green energy consumptions in the EU nations from 2010 to 2022.
- **H_2:** achieving sustainable development is significant affect various economic and environmental measures.
- **H_3:** There are a causality relations among macroeconomic outcomes to achieving the SDG‘s in these nations
- **H_4:** There are significant dynamic associations among the role of governments in achieving the SDG's in the short and long term.

Data Source

The role of governments in achieving the SDGs in EU nations from 2010 to 2022. This section contains the panel data set derived from various official data sources and data websites. The dependent variable is the expenditure on environmental protection {E^P }, which measures the role of the government in achieving sustainable development goals over the previous period. The independent variable data was gathered from Climate Change Indicators Government Policy Indicators | Climate Change Indicators Dashboard {imf.org}. While the independent variable is Eco _Innovation performance {E_{I} }, its data was obtained from the European Commission's Eco _Innovation website Eco-Innovation {europa.eu}. In addition, data on Green energy consumption {F_{c} }and fossil fuel energy consumption {R_{c} }} were collected from the Our World in Data. For Human Development Index {H_D }data downloaded from Human Development Reports website Human Development Index | Human Development Reports {undp.org}. Finally, the Financial development index{F_d } collected from International Monetary Fund {IMF}[*Fund, M. [2016]. International Monetary Fund. Publication Services.*, n.d.]Financial Development Copy of Query IMF Data. This study's 27 European nations include:

In additional Green energy consumption {R_{c} }and Fossil fuel energy consumption {F_{c} }data collected from Our World in Data website Our World in Data. For Human Development Index {H_{DI}}data downloaded from Human Development Reports website Human Development Index | Human Development Reports {undp.org}. Finally, the Financial development index{F_d } collected from International Monetary Fund {IMF} Financial Development _ Copy of Query _ IMF Data. This study includes the following 27 European nations: _. We believe that these nations are ideal for this study because of the diversity of their economic policies and social structures, and because their governments have called for a common long _term goal of achieving economic and environmental sustainability despite achieving high levels of economic growth. The framework of this study enabled it to investigate the association in the following ways:

$$\Delta E^P = \Delta E_{I} + \Delta R_{c} + \Delta F_{c} + \Delta H_D + \Delta F_d$$

Data descriptive

The table [3.1] contain the measures of central tendency the mean, median, maximum, minimum, standard deviation. Mean is the average value of each of the variable, median value tells us the middle value of each of the variables, maximum tells us the highest value and minimum tells us the lowest value of each of the variables, standard deviation tells us the deviation from the sample mean for each of the variable. The result of financial development shows that the mean value if %54.64, the deviation from sample mean is %19.06, the minimum value is %19.65 and the maximum value is %90.1. human development index has the mean value of %88.66 and the deviation from the sample mean is %3.99, the minimum value %79.0 and the maximum value is %96. The variable of expenditure on environmental protection has the mean value of %72.18 and the deviation from sample mean is %34.9, while the minimum value is %-25.84 and the maximum is 1.699. Green energy consumption has a mean variable of 24.180 and the deviation from sample mean is 15.906, the minimum value is 3.6800 and the maximum value is 82.79. Fuel energy consumption has the mean value of 30.160 and the deviation from the sample mean is 15.460 and the minimum value is 2.8090 while the maximum value is 140.5. Lastly, the value of Eco _Innovation performance has the mean value of 98.385 and the deviation from the sample mean is 35.981, the minimum value is 12.46 and the maximum value is 181.55.

Table 1: Descriptive Test Result

	OBS.	**MEAN**	**STD.DEV**	**MIN**	**MAX**
$\mathbf{E^{PE}}$	312	0.7218	0.3490	-0.2584	1.699
$\mathbf{H_{DI}}$	312	0.8866	0.0399	0.7900	0.960
$\mathbf{FE_{CON}}$	312	30.160	15.460	2.8090	140.5
$\mathbf{RE_{CON}}$	312	24.180	15.906	3.6800	82.79
$\mathbf{F_{DEV}}$	312	0.5464	0.1906	0.1965	0.901
$\mathbf{ECO_{INN}}$	312	98.385	35.981	12.46	181.55

Econometric Model

To determine the role of governments in achieving the sustainable development goals in EU nations by using these independent variables: eco _Innovation performance, Green energy consumption, Fossil fuel energy consumption, Human Development Index, and financial development, looking into the long and short-term effects of government expenditure on environment protection. For the estimation of panel data in this study, innovative methods were used. [Pesaran & Shin, 1998] assert that the Autoregressive Distributed Lag [PMG _ARDL] cointegration process is a useful tool since it gives both short and long term estimation in response to the endogeneity query asked by [Pesaran, M et al., 2001].

Econometrics Method

Panel _Unit Root Test

Verifying the reliance of cross _sectional data is crucial when working with panel data analysis because it might produce inaccurate results and lead to estimator inconsistencies. [Grossman, G. M., & Krueger, 1995];[Pesaran, 2004]:[Ulucak & Bilgili, 2018]. Hence [Breusch & Pagan, 1980] propound Lagrange Multiplier {LM} statistics adopt the cross _sectional dependence panel data:

$$\mathcal{LM} = \sum_{i=1}^{\mathfrak{N}-1} \sum_{j=i+1}^{\mathfrak{N}} \mathcal{T}_i \ \bar{\mathcal{P}}_i \ \rightarrow \mathrm{X}^2 \frac{\mathfrak{N}\{\mathfrak{N}-1\}}{2}$$

Furthermore, the CD test of {Pesaran 2004} is applied.

$$\mathcal{C} \ = \sqrt{\frac{2\mathcal{T}}{\mathfrak{N}\{\mathfrak{N}-1\}}} \sum_{i=1}^{\mathfrak{N}-1} \sum_{j=i+1}^{\mathfrak{N}} \frac{(\mathcal{T}-\mathcal{K})\bar{\mathcal{P}}_{ij}^2 \ - \mathbb{E}[(\mathcal{T}-\mathcal{K})\bar{\mathcal{P}}_{ij}^2]}{v \quad \left[\{\mathcal{T}-\mathcal{K}\}\bar{\mathcal{P}}_{ij}^2\right]} \qquad \{1\}$$

The period is denoted by $\mathcal{T}$, $\mathfrak{N}$ is the sample size, $\bar{\mathcal{P}}_{ij}^2$ is the pair _wise association coefficient for each cross _section dimension I that was determined through OLS estimation.

The first _generation panel unit root tests can be used to take into account the impact of reliance in cross _sectional data., Augmented Dickey _Fuller {ADF}, PhillipsPerron {PP}, Levin _Lin Chu {LLC}, and ImPesaran _Shin {IPS}, the validity of the logic was questionable and cannot be regarded as valid [Pesaran, 2007]. Due to that, [Pesaran, 2007] the panel unit root tests {second _generation} was propounded among which the cross _sectionally _augmented Dickey _Fuller {CADF} and cross _sectionally augmented LM _Pesaran _Shin {CIPS}, which are valid in the presence of cross _sectional dependence. To calculate CADF statistics the following are used:

$$\Delta \nexists_{\square,t} = u_i + u_{\square} \nexists_{\square t-1} + u_{\square} \bar{x}_{t-1} + \sum_{\square=0}^{n} u_{\square} \Delta \bar{\nexists}_{t-1} + \sum_{i=1}^{n} u_{\square i} \Delta \nexists_{\square,t-i} + \square_{it} \qquad \{2\}$$

Where $\bar{x}_{t-1}$ a $\Delta \bar{\nexists}_{t-i}$shows the first differences of individual series, the cross _sectional averages of lag levels, The following is how the value of CIPS is obtained:

$$\widehat{\text{CIPS}} = \frac{1}{N} \sum_{\square=1}^{n} C \qquad \square \qquad \{3\}$$

The techniques from equation {2}, i.e., cross _section augmented Dickey _Fuller is represented by the term CADF in Equation {3}.

Cointegration Test

A long _term association among the variables must be verified, whether series are integrated. All independent variables are related to each other in long run. The null hypothesis state that, there is no cointegration equation, which means, variables are not related to each other. 5% significant level to either reject the null or fail to reject the null. [Westerlund, 2007] and [Pedroni, 1999] approach was used to verify the long run association of variables we employed the test. Following [Caglar, A. E., & Yavuz, 2023], [Haseeb, M., Kot, S., Hussain, H. I., & Jermsittiparsert, 2019]. To determine cointegration, the equation adopted are as follows:

$$\Delta \nexists_{i,t} = K_t + \delta_i \left(\nexists_{i,t-1} - \acute{B}_i X_{i,t-1} \right) + \sum_{k=1}^{y_i} p_{i\,} \nexists_{i,t-j} + \sum_{k=0}^{y_i} p_{i\,} X_{i,t-j} + \square_{i,t} \qquad \{4\}$$

Equation must be adjusted to achieve equilibrium. The adjustment term in equation {4}, I is utilized to calculate the speed.[Westerlund, 2007] The null hypothesis assumes that there is no cointegration, and the test is constructed using the least squares estimates of _i. The following is how group means statistics are calculated:

$G_t = \frac{1}{y_i}\sum_{i-1}^{y_i}\frac{\delta_i}{S\{\delta_i\}}$ And $G_a = \frac{1}{y_i}\sum_{i-1}^{y_i}\frac{T_i}{\delta_i\{1\}}$

Where G_t a G_a means existence of cointegration in at least one cross _sectional unit of panel, thereby: we reject the null hypothesis.

We drive the following formula from panel statistics.

$P_t = \frac{\delta_i}{S\{\delta_i\}}$ And $P_a = T_i$

The panel as a whole rejected the null hypothesis, leading to the conclusion that cointegration exists.

Panel PMG _ARDL Approach

Government expenditure on environment pollution, eco _Innovation performance, Green energy consumption, Fossil fuel energy consumption, Human Development Index,, and financial development in EU nations was investigated using ARDL panel approach. To estimate the heterogenous data the dynamic panel data was employed. Three estimators were used in the error correction, and ARDL with autoregressive distributed lag was also used. Mean group, pooled mean group, and dynamic fixed effects for both the long and short term are also included. But in this study, the pooled mean group {PMG} will be taken into account and examined since it is the most reliable and effective, and because the estimator falls somewhere among MG and DFE. The three models are thought to be the heterogeneity of the dynamic adjustment process and long _term equilibrium.[Caglar, A. E., & Yavuz, 2023]. The {PMG} model, The {ECT} error correction term incorporates dynamic non _homogeneous panel regression according to[Samargandi, 2019] as follows:

$$G^{P}_{it} = \omega_i + \sum_{k-1}^{a1} \tau_i \; EC_{i\,t-k} + \sum_{k-1}^{a2} \delta \; R_{c\,t-k} + \sum_{k-0}^{v} B_{ti}\, X_{ti-k} + \mu_{ti}$$

Where = [1,2,. . , i] is the nation's number, [1,2,3,. . , t] the annual periods, [k] represent the number of time lags, [a] is the lag variable of the dependent, and [v] represent the lag variable of the independent. E a R are the eco _innovation and Green energy consumption index, respectively, are the crucial elements at play. A vector of variables regulator is represented by [X], and includes $FE_c + H_D + F_d$ which represent the fuel energy consumption, human development index, and Financial development index. And [μ_{it}] the fixed effects error term.

[Johansen, 1995]; [Phillips & Hansen, 1990] A relatively new cointegration test is the ARDL technique in error correction form. However, these researchers stressed the significance of making straightforward adjustments to conventional methodologies in order to provide precise and effective parameter estimations in a long _term correlattion. These studies found that long _term partnerships can only exist when several factors are taken into account. Whereas, [Pesaran & Shin, 1998] The hypotheses were underlined, and several quantitative advantages of the PMG and MG approaches over other techniques were demonstrated. To begin, researchers can use PMG and MG estimators, as well as the integration among variables and level of stationary to calculate long _term correlattions and the pre _test for unit roots. This is because the approach gives room for forecasting the variables with varied stationary orders, this means that variables are either in the order of I{0} or I{1}. More also, it is proper and fitting model for panel data with large N and T dimensions. Also, the estimator has a favorable effect on ARDL in the short and long terms. Another reason is that, due to endogeneity problems in the model, there is a worry that projections on coefficient estimations over the long term would be overlooked. [Engle & Granger, 1987] The technique can be defeated by employing the ARDL model. However, in order to select among the possibilities offered, it must strike a balance among consistency and efficiency. It will be preferable to have entire knowledge, facts, and conditions for the estimator's approach in order to achieve satisfaction. Pesaran, Shin, and Smith [Pesaran, M et al., 2001] propound the following equation Eq. {3}, thus, it is a reformulation

$$\Delta G^{P}_{it} = \omega_i + \alpha E_{i,t-1} + \Gamma_i X_{it-1} + \sum_{k=i}^{\sigma-1} \gamma_{ik} \Delta E_{i,t-k} + \sum_{k=0}^{\theta-1} \delta_{ik} \Delta X_{it-k} + \mu_{it} \quad \{6\}$$

Where:

$\Delta G^{P}_{it} = -1\,(1 - \sum_{k=1}^{\sigma} Y_{ik}), \dot{B}_i = \sum_{k=0}^{\sigma} m_{ik}, G_j = -\sum_{k=1}^{\sigma} G_{ik}, k = 1,2,3,\ldots,\sigma - 1, a$ $m_{ik} = -\sum_{m=k+1}^{\sigma} G_{ik}, j = 1,2,\ldots,6 - 1$.

Eq. {4} can also be rewritten from the formula of the error correction model by way of categorizing the variables at their levels.

$$\Delta G^{P}_{t} = \omega_i + \vartheta_i\left(G^{P}_{it-1} - \Gamma_i X_{it-1}\right) + \sum_{k=i}^{\sigma-1} \eta_{ik} \Delta G^{P}_{it-k} + \sum_{k=0}^{\theta-1} \delta_{ik} \Delta X_{it-k} + \mu_{it} \quad \{7\}$$

Where $\Gamma_i = \{B_i / g_i\}\, m$ the long _term equilibrium association among $\Delta G^{P}_{it}\, a$ X_{it}. In contrast, $\eta_{ik}\ a$ δ_{ik} represent the short _term coefficient based on historical data and the development of other elements, such as changes in X_{it}. Finally, g i indicates the error correction coefficient, which illustrates how quickly ΔG^{P}_{it} it adapts to a change in X_{it} in order to reach the long _term equilibrium. A long _term association must meet two requirements: the coefficient must be negative {g i0} and significant. The integration among ΔG^{P} and X_{it} it is therefore supported where the {g i} is substantial and negative. Consequently, the estimations are determined as follows:

$$\hat{\hat{U}}_P = \frac{\sum_{i=1}^{n} \hat{U}_i}{n}, \hat{\hat{A}}_{ki} = \frac{\sum_{i=1}^{n} \check{A}_i}{n}, \hat{\hat{E}}_{ki} = \frac{\sum_{i=1}^{n} \check{E}_i}{n}, a \quad \hat{\hat{R}}_{ki} = \frac{\sum_{i=1}^{n} \check{R}_i}{n} \quad \{8\}$$

Where, $k = 0,1,\ldots,i - 1$, $\hat{\hat{U}}_P = \hat{U}$. The formulated model based on the following Eq. {7} methodology.

$$\Delta G^{P} = \Delta E_{i} + \Delta R_{c} + \Delta F_{c} + \Delta H_D + \Delta F_d$$

$$\Delta G^{P}_{i,t} = \omega_i + \square_i \left[G^{P}_{i,t-1} - \nexists_1 E_{n\ i,t-1} - \nexists_2 R_{c\ i,t-1} - \nexists_3 F_{c\ i,t-1} - \nexists_4 H_{D\ i,t-1} - \nexists_5 F_{d\ i,t-1} \right] + \sum_{k-1}^{\sigma-1} \gamma_k^i \Delta\{G^{P}_{i\ t}\}_{t-1} + \sum_{k-0}^{\sigma-1} \theta_{1k}^i \Delta\{EC_{n\ i\ t}\}_{t-1} + \sum_{k-0}^{\sigma-1} \theta_{2k}^i \Delta\{R_{c\ i\ t}\}_{t-1} + \sum_{k-0}^{\sigma-1} \theta_{3k}^i \Delta\{F_{c\ i\ t}\}_{t-1} + \sum_{k-0}^{\sigma-1} \theta_{5k}^i \Delta\{H_{D\ i\ t}\}_{t-1} o + \sum_{k-0}^{\sigma-1} \theta_{6k}^i \Delta\{F_{d\ i\ t}\}_{t-1} \quad \{9\}$$

Independent variables are displayed in Formula {9}. The serial association and endogeneity bias of the ARDL panel technique are two benefits that are highlighted. In order to counteract the serial association, the dependent variable categorically starts the difference operator. The long _run coefficients vector shows the rate of readjustment, which should be slow and important. Long _term non _heterogeneity is assumed while short _term heterogeneity is permitted if there is adequate connectivity in the lag of the dependent.

Panel Causality

We utilize the causality test to assess the significance of one variable about the other.[Dumitrescu, E. I., & Hurlin, 2012] established the test, which is used to ascertain whether there is causality among the series. In cases when T > N or T N, the Granger causality test is used in an imbalanced panel and heterogeneous model {Dumitrescu and Hurlin 2012}. The following is how the study used the heterogeneous linear model:

$$Y_{i,t} = \theta_i + \sum_{i-1}^{f} \beta_i^k Y_{i,t,-k} + \sum_{i-1}^{f} \square_i^{\{f\}} X_{i,t,-k} + \mu_{i,t}$$

Where $f, \mu, \tilde{\square}^{+}$ a constant term, $f, \mu, \tilde{\square}$ is the lag parameter, $\square_i = \left(\square_i^1, \dots, \square_i^f\right), \theta_i, \beta_i^k, \square_i^f$ indicate the coefficient's slope. The absence of Granger causality among all units causes the conclusion to be non _homogeneonon-homogeneouserves as a confirmation of the null hypothesis. Depending on the findings of the panel, a different hypothesis on

Granger causality will be tested. The following is the estimator for alternative and null hypotheses:

$H_0 = \square_i = 0$ And $H_1 = \begin{bmatrix} \square_{i=0} \mathcal{H}_i = 1,2,3, \dots \square \\ \square_{i \neq 0} \mathcal{H}_i = \bar{\square}_1 + 1, \bar{\square}_2 + 2, \dots, \square \end{bmatrix}$

Chapter Summary

In this chapter, the researcher summarize the research hypotheses, data collection, data descriptive, and the econometric model in which the autoregressive distributed lag [ARDL] panel was considered, with special emphasis on the experimental models for EU nations. The following chapter will look at the empirical results of our data analysis.

CHAPTER .IV

Results and Discussion

Introduction

The researchers discuss the results in this chapter, which will set the stage for both theoretical and strategic implications arising from this study, which will be presented later in the conclusion and policy recommendation chapter. This chapter will specifically address the how, why, and what questions raised by this research study.

Association results

The association test is used to determine the association among variables. The association test results are shown in Table [4.1]. Human development and expenditure on environmental protection were found to be weakly related, with a coefficient of

0.6582, which was lower than the moderate and strong results. Green energy consumption and expenditure on environmental protection were also statistically significant and strongly negatively correlated with a coefficient of -0.8343. Eco _Innovation performance and expenditure on environmental protection have a negative and insignificant association. With a score, fuel energy consumption and financial development have a strong and positive significant association. Finally, the association among financial development and Green energy was statistically significant, with a score of 0.8824. Furthermore, the analysis revealed that the model has no multicollinearity, and thus the probability values among the series are less than the 0.850 rule of thumb.

Table 2: Association Test Result

	E^{PE}	H_{DI}	FE_{con}	RE_{con}	F_{dev}	ECO_{inn}
E^{PE}	1.000					
H_{DI}	0.6582	1.000				
FE	0.7688	0.4841	1.000			
RE	-0.8343	0.6657	-0.6445	1.000		
F	0.8623	0.5712	-0.2179	0.8824	1.000	
ECO	-0.7947	0.7155	0.2633	0.6927	0.8118	1.000

Integration Order

Table [4.2] shows the results of the unit root test, which is used to assess the degree of stationarity in time series. The table displays the results of CIPS and CADF. According to CIPS and CADF findings, Eco-Innovation performance, expenditure on environmental protection ,Green energy consumption, and fossil fuel energy consumption "are not stationary at level but after the first difference the variables" become stationary. As a result, we can conclude that the series is free of spurious regression and is a mix of I[1] and I[0].

Table 3: Unit Root Test Result

Variables	**Level**	**First Difference**

	CIPS	**CADF**	**CIPS**	**CADF**
E^{PE}	-1.258	-1.258 [0.90]	-3.642*	-3.642 [0.00]
H_{DI}	-2.194*	-2.194 [0.01]*	-3.093*	-3.093 [0.00]
FE	-1.406	-1.406 [0.61]	-3.097*	-3.097 [0.00]
RE	-1.016	-1.016 [0.85]	-3.488*	-3.488 [0.00]
F	-2.729*	-2.729 [0.00]*	-4.011*	-4.011 [0.00]
ECO_{inn}	-1.667	-1.499 [0.84]	-2.943*	-2.871 [0.00]

Cointegration Results

Following the "the unit root test is the cointegration" test shown in Table [4.3], the testing of the null hypothesis to whether the variables are cointegrated is substantiated by G_t, G_a, P_t, and Pa probability value of no cointegration against the alternative hypothesis of cointegration. The G_t and G_a is the "hypothesis of no cointegration" while P_t and P_a is the alternative hypothesis. The result disclosed a 1% and 5% probability value of significance.

Table 4: Panel Cointegration Test Result

Statistic	Value	Z-Value	P-Value
Gt	-2.336	-4.644	0.000
Ga	-1.500	4.032	1.000
Pt	-26.326	-16.216	0.000
Pa	-4.602	-2.188	0.014
Notes: ** Refer significant at 1%.			

Panel Autoregressive Distributed Lag approach [ARDL]

In this subsection, the researcher presents the main results for the EU nations. The results for panel system ARDL estimations are presented in Table [4.4] below. An evaluation of the type and scale of the association for the model in short-range and long-range through three models PMG, MG, and DFE [Pesaran et al., 1999] was carried out. To demonstrate a significant long-term association, an error-correction term must be significant and negative. Empirical results confirmed the short-run and long-run associations concerning energy consumption for both models through the [ECT] value, indicating a high speed of adjustment for the imbalance correction in the long-term equilibrium in both scenarios. For the researchers to observe the efficiency and consistency of all estimators, the research study employed a Hausman test [Hausman, 1978]. The validation of the long-term homogeneity constraints was examined for EU nations; therefore the efficacy of the PMG estimators on the MG and DFE estimators was examined by way of an Hausman test. The Hausman test results accepted the null hypothesis of the existence of some homogeneity restrictions on long-term regressors, indicating that PMG is more robust as compared to MG and DFE techniques.

The results in table [4.4] below indicated that the Financial development index has a significant constructive and negative association with government spending on environmental protection in the three models. This result on the left side of the table [4.4] indicates that government spending on environmental protection decreases as fiscal developments increase [improve] in the short and long run. According to the theory of public finance and externalities, environmental pollution has obvious negative externalities. Negative externalities contribute to differences among net marginal private and social costs and lead to misallocation of resources and lower social efficiency. At present, the market alone may not be able to solve the problem of external effects of environmental pollution, thus creating the so-called "market failure". Previous studies indicate that three types of measures are usually adopted to address environmental pollution in some major nations or regions. First, governments may impose taxes on producers with negative externalities to effectively absorb externalities. Develop the relative attractions of a carbon tax, a “pure” carbon trading system, and a “hybrid” option [a carbon trading system with a price ceiling and/or price floor]. We have shown that the different options are equivalent on more dimensions than is often recognized. In

addition, we highlight important dimensions along which approaches have very different impacts, including some that have received little attention in previous literature. Although neither option dominates the others, the main finding is that pricing external emissions [whether through a carbon tax or the hybrid option] has several important attractions in capping and trading emissions. This calls for governments to take action. Reduce your spending on environmental protection as [Marron, D. B., & Toder, 2014] and [Goulder, L. H., & Schein, 2013]

Second, governments may take a supervisory position over negotiations among the polluters and pollution victims; the parties may negotiate to clarify property rights, after which a property rights trading system may be used to achieve the Pareto optimal production efficiency balance among enterprises. The European Union Emissions Trading Scheme [EU ETS] is supposed to be an important mechanism for addressing climate change. Up to now, the theoretical foundation of EU ETS has been widely acknowledged, but empirical research on its current situation has only been published recently or is forthcoming. Therefore, this paper aims to summarize the main arguments of empirical studies on the EU ETS, in terms of two aspects, i.e., the operating mechanism and economic effect of the EU ETS, which are two crucial topics and have been given much attention. Based on the shortcomings of current research and future requirements of the EU ETS evolution, finally, we also present some further directions of the EU ETS research. Overall, the research overview here may be helpful in recognizing the features of the EU ETS and its effect on others., The European Emissions Trading Scheme [EU ETS] is the centerpiece of European climate policy. [De Perthuis, C., & Trotignon, 2014]and [Zhang, Y. J., & Wei, 2010] have proven the same result.

Third, increased government expenditure may be used to encourage producers to be technologically innovative and produce cleaner products. in the long run, the positive direct effect of investment expenditure was reduced by the negative indirect effects, resulting in a negative total effect on aggregate carbon emissions. However, the negative short-run direct effect was reduced by the positive indirect effect leading to a marginal positive total effect. The total direct effect of household consumption spending was

negative in the long run and could be relatively large in the short run. The effect of household expenditure on sectoral carbon emissions was negative, while that of private investment was positive, and that of public spending was diverse. Similar results were found by [Halkos, G. E., & Paizanos, 2016] and [Adewuyi, 2016][Halkos, G. E., & Paizanos, 2016].

The results in Table [4.4] below indicated that Green energy consumption has a significant constructive and negative association with government spending on environmental protection in the two models PMG and DFE. This result indicates that government spending on environmental protection decreases as the consumption of Green energy increases in the short and long run. This is demonstrated by the development of financial policy that directed the production of environmentally friendly goods and the trend towards using alternative energy instead of unclean energy. The study confirmed the importance and effective role of the consumption of Green energy on the environment and the low rates of pollution, which calls for concern about the government's role in its spending on environmental protection. The technique effect which measures the change in aggregate pollution resulting from switching to more environmentally sustainable production techniques, is specific and can be better observed in wealthier nations that are generally more willing and able to protect their resources mainly in two ways: by establishing higher environmental standards and by investing a lot more in sustainable technologies. let's focus on the way of investing a lot more in sustainable technologies like change in the economic structure when they use Green energy instead of fossil fuel energy. The study finds the protective power of Green energy consumption on government spending on environmental protection. At the international and national levels, Green energy is recognized as a leading tool for achieving environmental improvement, which means reducing government spending on it. Green energy plays an important role in reducing global carbon [CO2] emissions. Similar results found by[Caglar, A. E., Yavuz, E., Mert, M., & Kilic, 2022]and [Aydoğan, B., & Vardar, 2020]and [Tutak, M., & Brodny, 2022].

The main reason for the ongoing process of energy transition in the global economy is the need to protect the environment, especially the climate. Increased public awareness

about the destruction of the Earth's ecosystem and technological development have resulted in increased importance of Green energy sources, which are increasingly replacing conventional sources. In addition to the environmental aspect, Green energy also gives a chance for greater energy independence and the ability to produce energy by nations without conventional energy resources. These factors cause individual nations and their groups to take more and more decisive actions to develop Green energy. Particularly ambitious plans in this area are presented by the European Union, which is the undisputed leader in introducing pro-environmental legislation. Therefore, the following article presents the results of research on the degree of Green energy use in selected sectors of the economy and households in the European Union nations among 2000 and 2019. The impact of the use of Green energysources based energy on economic indicators and the consumption of energy from conventional sources was also determined. Due to the different levels of economic development and wealth of nations, the study also refers to the groups of "old" and "new" European Union nations. The study showed the concentration and dynamics of change in the consumption of Green energy in the studied sector and households for individual nations and their groups. The Kohonen artificial neural networks were used to analyze similarities among the European Union nations in terms of the use of energy from Green energy sources in the sectors studied. In addition, associations were established among economic and environmental parameters for the whole economy, industry, and agriculture/forestry/fishing sectors and the consumption of energy from Green energy sources, as well as the impact of this energy consumption on the consumption of conventional energy. The results obtained showed a significant increase in the consumption of energy from Green energy sources in the European Union nations in the studied period, as well as significant differences in the use of this energy among the studied nations, their groups, and sectors.

The results in Table [4.4] below indicated that fuel energy consumption has a significant constructive and positive association with government spending on environmental protection in the three models MG, PMG, and DFE. This result indicates that government spending on environmental protection increases as the consumption of fuel energy increases in the short and long run.This study confirms that as energy

consumption increases in any country, it creates many environmental problems leading to environmental degradation due to excessive energy consumption. The consumption of natural resources such as coal, energy, gas, fossil fuels, etc. disrupts the environmental process and causes many environmental problems. To overcome these problems and avoid the toxic effects of energy consumption on the environment in the European country, there is a need to provide sufficient funds for spending on the environment. Therefore, higher energy consumption leads to higher public spending on the environment. This was confirmed by [Shahbaz et al., 2013]. Given the growing interest of European nations in improving financial policies that supported environmental preservation by encouraging the consumption of environmentally friendly products and shifting the reliance of their economic system on alternative energy instead of fossil energy, the results of the study showed that Europe was able to overcome this dilemma and build an effective economic system. And environmentally safe. It seemed clear that the result of the variable “fossil energy” was positive, while alternative energy was negative for the same equation. It is estimated that there is a positive association among carbon dioxide emissions and non-Green energy consumption. The results of long-run estimations support the inverted U-shaped shape of the [EKC] in these nations. This means that the share of non-Green energy must continue to be reduced and replaced with Green energy to protect the environment. Otherwise, the government will be forced to raise the rate of government spending to protect the environment.Similar results were found by [Ali Suleiman Alshatti, 2016] and [Aydoğan, B., & Vardar, 2020].

The results in Table [4.4] below indicate that the human development index has a significant constructive and negative association with government spending on environmental protection in the three models MG, PMG, and DFE. This result indicates that government spending on environmental protection decreases as human development increases in the short and long run.

The European Union sought to develop its human resources through two main channels: the first is to increase awareness and social responsibility, which has shown effective results in protecting the environment, and to move towards the consumption of environmentally friendly products for environmental innovations. The issue of

environmental degradation has been extensively discussed in terms of its causes and causes at the global level. The researchers took the issue seriously in their study to find out the determinants of environmental pollution and environmental quality as well. Environmental consequences of spending on environmental protection and human capital development. Studies have shown the role of technical influence, which indicates human awareness and ability to develop clean technology. - The topic of development, environmental preservation, and use of Green energy. The Sustainable Development Goals sought to improve the well-being of individuals and increase their sense of belonging to society. As for economic companies that use Green energy in manufacturing processes, studies have proven that they do not produce hazardous waste or toxic gases such as carbon dioxide. Conversely, goods are environmentally beneficial and do not harm the user or the public. This policy has many advantages, as it provides a healthy environment, reduces the costs of basic goods, and preserves natural resources. As a result, long-term economic growth is achieved. European nations consider the process of environmental protection and sustainable development goals. When dealing with environmental issues, attention must be paid to the forms of energy used, the methods of using them, the amount of gas emissions harmful to the environment, as well as the volume of production and its benefits. She emphasized the role of social, environmental, and financial methods related to increasing production, employment, and transportation, which have a major role. Includes increasing and developing human resources. It does not constitute an obstacle to long-term development goals, expands the physical and mental energy to control the population, and maintains a high standard of living for the general public.

The environmental role of human capital through its skills and experience. In other words, human capital value includes education, knowledge, training, wisdom, and creative skills that employers value, such as loyalty and consistency. Responsible human resources must be competent enough to reduce CO2 emissions while performing economic operations across multiple organizational areas and departments. To be more effective, they must be aware of methods to reduce emissions of harmful gases to the environment such as carbon dioxide while maintaining the quality and quantity of the company’s goods and services, as shown in a study on energy consumption, which helps

governments reduce their spending on environmental protection and direct funds. Towards more effective investments and environmentally friendly production. The results in European nations confirm that when human resources are aware of environmental needs, have knowledge of environmentally friendly technology and resources, have experience in dealing with environmental issues, and can implement environmentally friendly procedures, technology, or resources, the situation improves. It is possible to reduce CO2 emissions while improving product and service quality by consciously implementing these measures. Both studies have proven this result **[Saud et al., 2020].**

Second: EU nations studied the association among the environment and innovation, green intellectual capital, green human resources management, environmental strategies, and environmental performance of companies. They discovered that green innovation and environmental strategies have a direct impact on the associated environmental performance and that companies with effective environmental strategies are better leveraged in terms of improving their environmental performance with better use of green innovation as a mediator, indicating the importance of green innovation. These results are consistent with Kraus et al. {2020} When green innovation and an effective environmental strategy are implemented. In addition, researchers support the idea that environmental performance can be improved more efficiently in a green context. The sustainable development undertaken by European nations combines economic development and environmental quality through the development of green financing, which imposes new requirements on project development and poses new challenges to strategic planning, from an economic and environmental perspective. Green finance focuses primarily on the regulation of corporate finance and financial markets. Which affects business operations and the extent of their development and expansion, as well as the absorption of social capital. The main idea behind green finance is to facilitate and stimulate the flow of financial resources from environmentally efficient companies to environmentally inefficient companies, leading to the reallocation of these funds and their effectiveness in serving the economy and the environment. [Y. Huang, Ahmad, et al., 2022] proved this result.

The results in Table [4.4] below indicated that the eco-innovation performance has a significant constructive and positive association with government spending on environmental protection in the three models MG, PMG, and DFE. This result indicates that government spending on environmental protection increases as eco-innovation performance increases in the short and long run.European governments attach great importance to environmental management and protection issues and have taken a series of relevant steps, measures, and policy formulation. Governments in the field of global environmental governance. Which respectively put forward the basic national policies for saving resources and protecting the environment, promoting the construction of ecological civilization, increasing environmental protection and ecological environment, and solving outstanding environmental problems. All of these policies came to bring about a radical change in the process of government spending on environmental protection. The prominent role played by governments was to reduce spending on environmental protection in exchange for making a radical change in practical innovations, which resulted in them spending huge amounts of money on environmentally friendly scientific innovations. In the past, Europe suffered from a high rate of environmental pollution as a result of the industrial movement and the rapid growth of the economy, which resulted in environmental deterioration. Addressing the problem of increasing environmental pollution by focusing on research and development activities, which represents an increase in spending on research and development.This prompted European nations to develop their policies on the environmental issue and the amount of spending on its protection. Policies, methods, and the latest technologies have been identified to deal with many environmental issues resulting from environmental pollution. This involves encouraging energy-efficient practices in both business and infrastructure layouts, for example, installing lighting occupancy sensors that turn lights on or off automatically, depending on use or occupancy. Moreover, there is an urgent need for well-designed R&D to research and control the harmful effects of environmental pollution. For example, strategies should be directed to encourage research in green technology across academic, technological, and industrial boundaries by providing funding for interdisciplinary and cross-disciplinary research of high scientific quality and high environmental relevance that meets aspects, such as

knowledge of the current environment. Needs, user preferences, regulations, controls. Moreover, given the dominant role of SMEs in the region, policies should also include SMEs to cooperate and co-finance innovative projects of high environmental importance by generating opportunities to enhance people's renewal and innovation potential. [Lee, K. H., & Kim, 2011] proved this result.

Table 5: PMG Test Result

Variable	MG		PMG		DFE	
	Sort term	Long Run	Sort term	Long Run	Sort term	Long Run
ECT	-----	-1.172 [0.00]	--------	-0.794 [0.00]	------	-0.644 [0.00]
FINANCIAL DEVELOPMENT INDEX	-1.33 [0.05]	-1.927 [0.025]	-0.852 [0.155	-0.078 [0.64]	-0.056 [0.043]	0.069 [0.87]
RE	0.004 [0.80]	0.013 [0.365]	-0.017 [0.03]	-0.0147 [0.00]	-0.005 [0.021]	0.007 [0.121]
FE	-0.010 [0.51]	0.0005 [0.06]	0.0003 [0.04]	0.008 [0.017]	0.001 [0.017]	0.002 [0.02]
HDI	-5.950 [0.06]	-5.630 [0.14]	-16.40 [0.00]	-14.98 [0.00]	-2.450 [0.01]	-3.80 [0.009]
LEI	-0.241 [0.67]	0.639 [0.50]	0.921 [0.21]	2.083 [0.005]	0.819 [0.005]	0.127 [0.59]
Constant	7.347 [0.019]		4.399 [0.004]		2.393 [0.003]	
Hausman	6.34 [0.2747]				0.03 [0.999]	
Observations	286		286		286	

Notes: ECT: Error Correction Term.
*,Denote statistical significance at, 5%. The value of the coefficient is out of brackets.

Dumitrescu-Hurlin Granger Causality Test Results

Table [4.5] represents both unidirectional and bidirectional causality test results for EU economies for government spending on environmental protection. there may be a two-way causal association among govermerment spending on enviromental protection and eco innovation , financial development and human development: on the one hand, eco

innovation , and human development are an important means used by the government for environmental protection, which has a direct impact on decreasing goverment spending. On the other hand, the more seriously polluted regions may be in need of increased environmental protection expenditure to achieve their emission reduction targets, such that theses variables are likely to have an impact on the scale of environmental protection expenditure. Therefore, in order to overcome the endogenous problems caused by two-way causality as much as possible local emission reduction is used to replace the emissions to further verify the governance spending effects of environmental protection expenditure. The robustness test results show that all kinds of pollution emissions have the characteristics of time duration, and local environmental protection expenditure has an environmental governance effect on all kinds of pollutant emissions.

The “Dumitrescu-Horlin Granger causality test” provides unbiased results in the case of “heterogeneous and unbalanced panel data”. Table [4.5] confirms that the results achieved from the causality test confirm the estimated PMG panel results; This indicates that they are complementary. The null hypothesis in the Dumitrescu-Horlin Causality Test proposes that each specific factor of financial and fuel energy development causes spending on environmental protection. The Z-stat and W-stat in Table [4.5] are significant, which means rejecting the null hypotheses, and we conclude that all withdrawal variables cause government spending on environmental protection.

Dumitrescu-Horlin Granger causality analysis showed that fuel energy used has a unidirectional causality with government spending on environmental protection that is supported by another study [Konuk et al., 2023]. The consumption of fuel energy means increased government spending on environmental protection due to increased pollution. Increasing pollution requires increased renewable inputs and thus more Green energy resources are used. Moreover, financial development has a unidirectional causal association with government expenditure on environmental protection that is in line with the results of other studies [Garrone & Grilli, 2010]. The development of financial coal strategies leads to government spending on environmental protection when this financial development causes economic activities that cause carbon dioxide emissions through

production and consumption activities. Financial awareness and compliance with regulations and laws supporting environmental sustainability also play an important role in trending pollution levels. In addition, the unidirectional causality extends from anti-pollution and environmentally friendly financial development. This result confirms the results of [Haseeb, M., Kot, S., Hussain, H. I., & Jermsittiparsert, 2019].

Table 6: Causality Test Result

Hypothesis	W-stat	Z-bar	Z-bar tilde	Result	Conclusion
FDI→ GE	1.9737	3.5108 [0.00]	1.309 [0.19]	Reject [H0]	Unidirectional Causality
RE□ GE	1.7994	2.882 [0.00]	0.952 [0.04]	Accept [H0]	Bidirectional Causality
FEC→ GE	1.5009	1.805 [0.07]	0.342 [0.73]	Reject [H0]	Unidirectional Causality
EI □ GE	2.9673	7.093 [0.00]	3.340 [0.00]	Accept [H0]	Bidirectional Causality
HDI□ GE	3.139	7.712 [0.00]	3.691 [0.00]	Accept [H0]	Bidirectional Causality
Notes: ** Refer significant at 1%.					

CHAPTER V

Conclusions and Policy Recommendations

Introduction

To develop sound and robust general policy recommendations for environmental sustainability, this chapter has used the findings presented and thus made general and practical strategic suggestions for the EEA.

Conclusions

This study examined the associations among government spending on environmental protection, human development, energy consumption, and environmental innovation in European Union nations among 2010 and 2020. Recent research has focused on whether economically large nations direct their economies toward environmental sustainability or not. The researcher used these variables to help identify the main problem that leads to controlling government spending rates on environmental protection. As well as exploring, the necessary measures that can help European nations further grow and develop in a green environment without the need for financial spending to protect their environment. The ARDL results showed that there is a strong negative association among each of the following variables: financial development, Green energy consumption, scientific innovations and activities, human capital, and the rate of government spending on environmental protection. The results confirmed the positive association with fossil energy consumption.

The impact of environmental protection spending on environmental quality was still statistically insignificant in the short and long term. This allowed for a reconsideration of the possibility of achieving the goals of 2030 and 2050. Spending on environmental protection should maintain a smaller share in general government expenditures due to its economic strategy of supporting innovations and directing investments in more environmentally friendly activities. This allows the government to direct its revenues into investments with effective sustainability in the short and long term, economically and environmentally. Government support for environmentally friendly economic activities. In addition, ineffective spending on environmental protection – which consists of components such as waste management, wastewater management, and environmental R&D activities – puts SDG 6, SDG 13, and SDG 15 at risk. Therefore, governments

should improve the role of environmental protection spending, as a fiscal policy tool in sustainable environmental policies, by allocating more resources to the budget.

The limit of this study is that it examined only EU-22 nations due to data constraints. Future studies should analyze all EU nations or other country groups for environmentally sound policies through comprehensive environmental indicators such as load capacity factor. In addition, this paper is the first to explore the environmental impacts of the environmental protection expenditure and the expenditure side of the fiscal policy by examining the load capacity factor. Further research on environmental protection expenditure in the environmental literature and making recommendations will guide to be more effective in addressing environmental market failures. The research gap regarding the environmental impact of expenditure types, especially environmental protection expenditure, provides opportunities for future research. Finally, future studies could examine the effect of different shocks in EU nations by adding environmental protection expenditure asymmetrically to the ARDL model. Thus, the effect of policy shocks in contemporary life can be explained with an econometric approach.

Recommendations

Given the above conclusions, several implications are apparent. First, local governments should take more responsibility for environmental governance and improve the efficiency of environmental protection expenditure. As an important means of environmental governance, local environmental expenditure should play a guiding role. For example, local governments can use fiscal subsidies, green procurement, and investment in pollution control to guide enterprises not only towards achieving cleaner production but also in actively reducing emissions and fully mobilizing the initiative of all sectors of society in pollution prevention and control. Further, local governments can use this approach in providing fiscal policy support to accelerate the construction of a greater resource-saving and environment-friendly society. Environmental protection expenditure should be appropriately positioned according to the situation of local pollution emissions, and an effective management mechanism should be realized according to local conditions. Doing so will improve the matching degree and governance efficiency of local environmental protection expenditure.

Second, local governments should support the cooperation model of “joint prevention and control and cross-regional governance” when dealing with pollutants with high spillover potential. The primary goal of cross-regional collaborative governance is to address the issue that local government’s implementation of optimal local environmental governance results in a loss of overall governance efficiency. As a result, local governments at all levels should refine relevant laws and regulations, in conjunction with the actual situation in their regions, and construct a multi-level government cooperation mechanism with three arms: decision-making, coordination, and implementation. Big data, cloud computing, and artificial intelligence are new information technology methods that can accurately understand not only the emission situation, but also the distribution characteristics, temporal and spatial changes, and diffusion laws of environmental pollution in various regions. This data should be effectively used to clarify responsibilities and develop differentiated and refined regional joint prevention and control plans.

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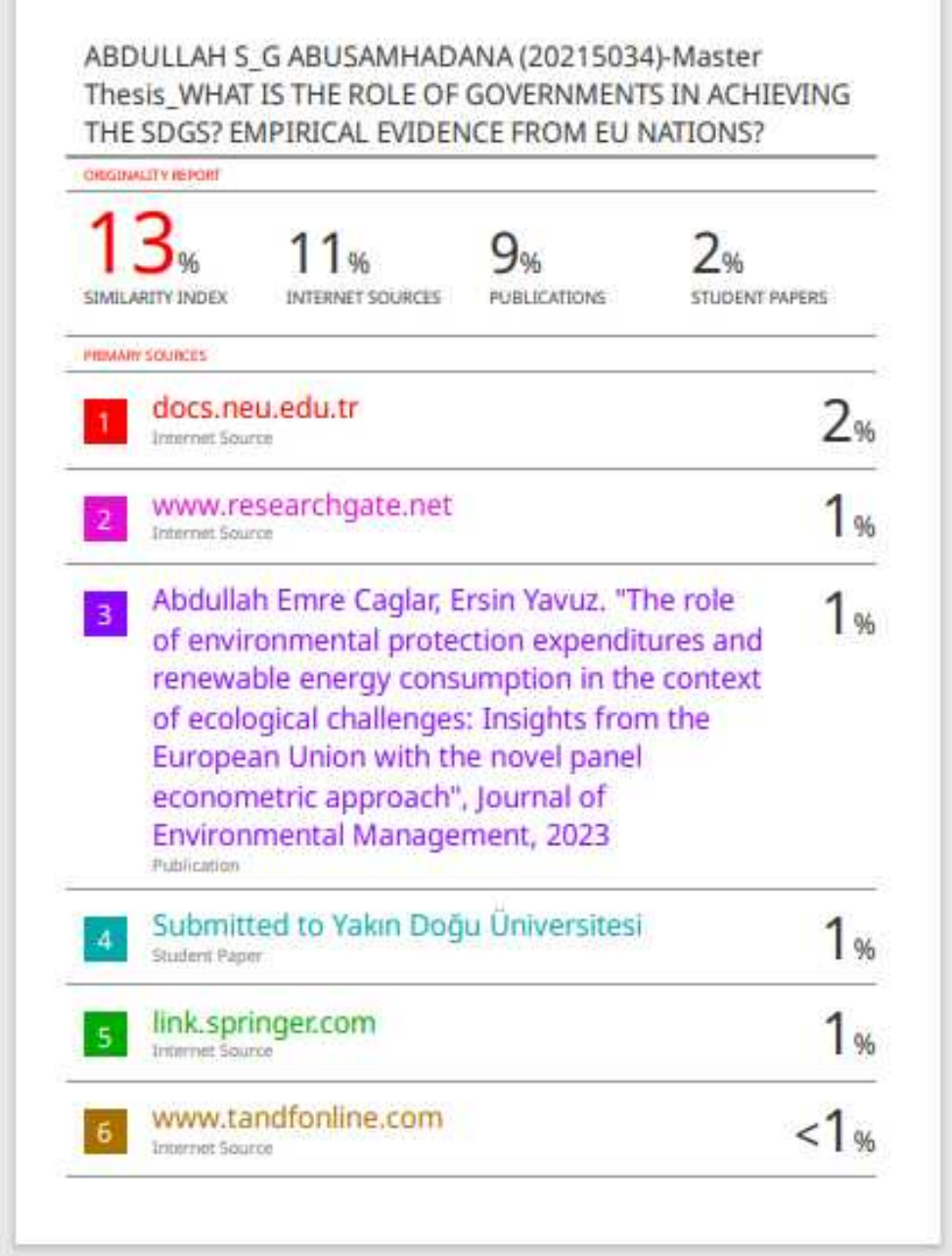
APPENDICES I

Similarity Report



ABDULLAH S_G ABUSAMHADANA (20215034)-Master Thesis_WHAT IS THE ROLE OF GOVERNMENTS IN ACHIEVING THE SDGS? EMPIRICAL EVIDENCE FROM EU NATIONS?

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APPENDICES II

Ethics Committee Report

NEAR EAST UNIVERSITY

SCIENTIFIC RESEARCH ETHICS COMMITTEE

29.01.2024

Dear Abdullah_S_G Abusamhadana

Your project **"What is the role of governments in achieving the SDGs: Empirical evidence from EU COUNTRIES?"** has been evaluated. Since only secondary data will be used the project does not need to go through the ethics committee. You can start your research on the condition that you will use only secondary data.

Prof. Dr. Aşkın KİRAZ

The Coordinator of the Scientific Research Ethics Committee