

Assessing the Impact of Green Taxation Policies on Sustainable Growth

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Abstract

The experience of implementing "green" taxation in the financial processes of developed countries in the European Union encourages advanced companies to actively adapt their business strategies to the requirements of environmental taxes. Modern business giants actively invest in renewable energy sources, which helps reduce their negative environmental impact. The article carefully examines how a "green" taxation system affects sustainable development during rapid globalisation from 2020 to 2024. We reviewed the environmental taxes introduced in the world's most developed regions, such as the European Union, the USA, and China. We evaluated the effectiveness of reducing greenhouse gas emissions during the study period. In particular, we describe the modernisation of the industrial sector of these countries and the introduction of carbon capture and storage technologies. The importance of legal regulation and government initiatives is also emphasised: the European Green Deal, the Green New Deal in the US and the actions of the Ministry of Environmental Ecology of China. In countries with a lower level of development, there are three barriers – lack of finance, legislative norms and limitations of technological capabilities. The article also analyses international cooperation to achieve sustainable development goals established by the Paris Climate Agreement. It highlights how the EU states adjust their tax systems to global environmental standards – in full compliance with the directives of the European Commission. The critical role of international organisations in supporting cooperation between countries to increase the efficiency of environmental taxation and the development of renewable energy is considered separately.

Keywords

Green taxation; Sustainable development; Environmental taxes; Renewable energy; Environmental sustainability; Global cooperation

Introduction

Environmental problems have become global, threatening natural resources, biodiversity and climate stability. Accelerating climate change has led to a 1.1°C increase in the global average temperature compared to pre-industrial levels (Ayodele, Mustapa and Ayodele, 2023). Warming causes natural disasters, droughts, floods and storms. According to the United Nations, more than 1 billion people live in areas affected by climate change. These developments underscore the importance of sustainable development, which aims to balance economic growth, social equity, and environmental preservation for future generations for future generations. This concept is crucial for the long-term sustainability of society and ecosystems (Soares, 2024). Australia's bushfires in 2019–2020, which destroyed more than 18 million hectares of forest, clearly demonstrate the scale of the environmental crisis. Similar ecological challenges observed between 2021 to 2023 further highlight the urgency of collective global efforts (Tomás *et al.*, 2023).

The "green tax" introduced by the G7 nations following their 2015 summit in Germany, has become vital in reducing carbon emissions (Farooq *et al.*, 2024). By imposing financial incentives to reduce greenhouse gas emissions, these taxes encourage the adoption of renewable energy and cleaner production processes. The carbon tax in Sweden is 137 euros per tonne of CO₂ and forces industrial enterprises to switch to renewable energy sources (Ayodele, Mustapa and Ayodele, 2023). As a result of an effective, sustainable development policy, this has reduced emissions by 25% since 1990. Green technologies include using renewable energy sources, the most popular of which are solar, wind and hydroelectric power. Energy-saving solutions are used for efficient operation by installing heat pumps and energy recovery systems. European companies are changing their policies by implementing energy-efficient projects. They are interested in improving their image and reducing waste (Dvigun *et al.*, 2022).

Digital technologies are essential in implementing and effectively managing green taxation by monitoring, tracking and calculating environmental indicators (Lemos, Dinis and Serra, 2023; Liu and Ge, 2023). One of the tools for sustainable development is emissions monitoring systems (EMS), which are used in industrial sectors to measure greenhouse gas emissions accurately. The e-PRTR (European Pollutant Release and Transfer Register) platform is widely used in the European Union. It automatically collects data from businesses and allows regulators to monitor compliance with environmental standards. In 2023, blockchain technologies will actively ensure emissions trading and carbon credit accounting transparency. In China, blockchain monitors emissions under the national emissions trading system (Farooq *et al.*, 2024).

Despite the relevance of the issue, there are several research gaps regarding the discussed aspects in the context of Ukraine. Among these gaps are the role of environmental taxes in promoting the transition to renewable energy sources, the potential for increasing environmental taxes, and their impact on sustainable development, accompanied by a detailed analysis of relevant legislative initiatives. This article examines the impact of environmental taxation on sustainable development in response to modern environmental challenges. It focuses on analyzing the legislative framework regulating

environmental taxes in leading countries worldwide and assessing the effectiveness of these taxes in reducing greenhouse gas emissions.

The primary objective is to study public policy and international cooperation, particularly the Paris Climate Agreement and the European Emissions Trading System, and to determine their impact on ensuring environmental sustainability.

Literature Review

Research on the impact of green taxation on sustainable development has become particularly relevant in recent years amid global climate change and environmental challenges. According to Cheng *et al.* (2024), the green tax is vital in reducing carbon emissions and transitioning to renewable energy sources. Tomás *et al.* (2023) emphasise that the European Union countries have achieved a 15% reduction in greenhouse gas emissions from 2010 to 2020. Using carbon storage technologies – CCS and investments in solar and wind energy help reduce emissions and improve the energy efficiency of enterprises.

Modernisation of industrial processes contributes to a more rational use of energy resources. A study by Ayodele, Mustapa and Ayodele (2023) focuses on the impact of environmental taxation on companies' business strategies. As the researchers note, introducing carbon taxes encourages companies to invest in "clean" technologies. Green taxation provides clear financial benefits for businesses. They note that companies adopting sustainable technologies see a 20% reduction in operational costs due to lower environmental and financial liabilities. This taxation model encourages investment in eco-friendly practices, aligning corporate goals with environmental sustainability. Fernandez and Haffner (2024) discuss the impact of the European Green Deal, aiming for carbon neutrality by 2050. The European Emissions Trading System (ETS) and standards like ISO 14064 help monitor emissions. Between 2010 and 2020, the EU saw a 15% reduction in CO₂ emissions, with €300 billion invested in renewable energy projects. Borrego and Carreira (2023) highlight that carbon taxes have become crucial for cutting emissions. Future reforms may expand these taxes to under-regulated sectors like aviation and shipping by 2025. The Clean Development Mechanism (CDM) under the UNFCCC is expected to play a significant role in global cooperation after 2025, driving progress towards the Paris Agreement targets.

Afshan and Yaqoob (2023) underscore the effectiveness of "green" taxes and subsidies in Scandinavian countries. According to the opinions of prominent scientists, this has led to a significant reduction in air pollution. They note that subsidies for renewable energy sources have significantly contributed to this progress. Scientific works emphasise the importance of "green" taxation as an effective mechanism for reducing the industry's negative environmental impact. Researchers agree that "environmental taxation" stimulates companies to improve production processes. In their study, Nchofoung, Fotio and Miamo (2023) show that tax incentives increase investment in renewable energy sources.

As a result, the process of greening the industry is accelerating. Tax incentives are used by the most developed companies in the world: Tesla, Vestas Wind Systems, and BYD.

They implement them to expand the production of renewable energy and develop environmental technologies. According to researchers, thanks to such benefits, enterprises reduce their operating costs by 20% due to implementing energy-efficient technologies (Nchofoung, Fotio and Miamo, 2023). Dong, Hou and Qin (2023) emphasise the importance of government programs supporting "green" innovation. They have become the driving force behind business strategies focused on sustainable development in the chemical and energy industries. This allows companies to remain competitive and promotes their transformation into environmentally conscious business entities (Dong, Hou and Qin, 2023).

Amores, Maier and Ricci (2023) note that the European Union has adopted several important pieces of legislation – regulating emissions trading and establishing a minimum rate of environmental taxes. These regulations allow member countries to coordinate their efforts and ensure a stable cash flow for environmental initiatives. Investing in clean technologies plays a critical role in reducing pollution. According to Amores, Maier and Ricci (2023), this shift towards sustainable practices has led to a 25% reduction in industrial emissions across multiple sectors. Soares (2024) argues that well-structured environmental taxation laws can lower emissions by an additional 10% within five years while boosting economic growth. Tax breaks for green technologies, implemented by various countries since 2018, have driven a significant rise in eco-friendly innovations. For example, Germany recorded a 15% rise in renewable energy investments, driven by such incentives. Soares (2024) also emphasises that regulatory frameworks must evolve to keep pace with technological advancements, encouraging further innovation in sustainable practices.

Several recent studies provide summaries of the main concepts of current scientific advancements on the studied topic and their correlation with the present research findings. Specifically, recent publications by Ullah *et al.* (2023) illustrate the contemporary context and confirm the relevance of the current work to prevailing trends in this field. Researchers Abbasi and Choukolaei (2023) examine the specifics of designing a green supply chain network design (GSCND) from 2010 to 2023, analysing the impact of carbon regulations on GSCND. They highlight three policy vectors: carbon restrictions, cap-and-trade, and carbon taxes. Additionally, Dogan, Hodžić, and Fatur Šikić (2022) argue that renewable energy should receive greater priority through research support, subsidies, and governmental incentives, while environmental taxes should be more widely implemented to discourage polluting activities. Contemporary researchers Sharif *et al.* (2023) confirm the role of "green" technologies, environmental taxes, and "green" energy in sustainable environments and discuss their policy implications. Their findings complement the conclusions of the present study.

Research Methods

Design and scope of the study: The study analyses the experience of developed countries in implementing "green" taxation, with a special emphasis on the countries of the European Union. Developed companies actively adapt their business strategies to meet the requirements of environmental taxes: Tesla and Vestas Wind Systems. They also actively invest in renewable energy sources, which helps reduce their negative impact on the environment.

Data collection and sources: The sample consisted of 27 EU member states as of 2024, which apply different models of legal regulation of environmental taxes, including carbon emissions, energy resources and water pollution. Four methods of statistical data processing were used: (i) including tax classification by category, (ii) analysis of the dynamics of tax revenues for 2013–2022, (iii) comparison of tax regimes in different EU countries, and (iv) comparative legal analysis methods, to identify differences in environmental taxation legislation between countries. Casual effect analysis revealed the relationship between environmental taxes and greenhouse gas emission reductions. Trend analysis was used to substantiate the conclusions.

Analytical framework and methods: Essential methods for establishing causal links between environmental taxes and reducing greenhouse gas emissions included analytical approaches, such as analysis, synthesis, generalisation, comparison, and abstraction. Induction was also used — a method of scientific inquiry aimed at identifying causal relationships between phenomena and generalising empirical data based on logical assumptions, moving from specific to general, from known to unknown.

Statistical methods in the context of achieving the research objectives enabled the systematisation and generalisation of all information about the studied objects and phenomena, including positive aspects and shortcomings. They also facilitated drawing parallels between the essence and purpose of the studied object or phenomenon and the results of its functioning.

To address the specific parameters for assessing the impact of green taxation policies on sustainable growth, the review involved a comprehensive analysis of scholarly articles published across various academic sources. The literature was selected from high-impact journals indexed in prominent databases such as Web of Science, Scopus, and Google Scholar to ensure the reliability and credibility of the findings. The papers covered a timeline from 2018 to 2023, focusing on recent developments and trends in green taxation and its influence on sustainable growth. This timeframe allowed for a detailed understanding of policies' evolution and long-term impacts. The analysis included studies from different geographical contexts, ensuring a diverse and holistic perspective on the effectiveness of green taxation across various regions and economies.

The article examines the strategic documents – the European Green Deal and the Paris Climate Agreement – that shape the climate leadership of the EU countries. Special attention is paid to government programs that promote the development of clean technologies and stimulate environmental innovation.

Evaluation criteria: The research is limited by the lack of access to comprehensive and up-to-date official data and the complexity of experimentally verifying theoretical conclusions. To study the approaches to green taxation, the authors analysed research papers focusing on environmental taxes' impact on sustainable development (*et al.*, 2024; Fernández, Haffner and Elsinga, 2024; Zhang *et al.*, 2023; Farooq). Particular attention was paid to studies that consider the role of tax mechanisms in ensuring environmental sustainability at the regional level and their impact on the transition to renewable energy sources. Special attention was paid to analysing legal regulations, such

as the EU Directives on the taxation of energy products and electricity, which play a crucial role in implementing environmental taxes.

The criteria for selecting the literature encompassed a range of factors, including the quality of the journal (targeting those within Q1 and Q2 quartiles based on the SJR index), relevance to central themes such as "green taxation," "sustainable growth," and "environmental policy," as well as the presence of peer-reviewed content. Furthermore, the methodology employed a systematic review approach, incorporating elements of meta-analysis where applicable, to quantify and evaluate the effects of these policies comprehensively.

Results

Green taxation has become a powerful tool for pushing businesses to minimise environmental impact. This approach gained momentum in the 1990s when organisations like the OECD and the European Union started exploring how tax systems could be reformed to address sustainability. The foundation of this idea can be traced back to the 1920s when economist Arthur Cécile Pigou suggested taxing industries for the damage they cause to the environment. These concepts evolved to tackle modern issues like climate change and pollution.

The European Union began to take significant steps toward green taxation in the 1990s. In 2003, the EU introduced Directive 2003/96/EC, which placed taxes on energy and electricity consumption to reflect their environmental impact (Dinis *et al.*, 2023). The primary objective was to decrease the use of fossil fuels and promote the adoption of cleaner energy sources. This system provided a structured approach for controlling emissions across EU member states. The signing of the Paris Climate Agreement in 2015 emphasised the need for green taxes to achieve global targets for reducing greenhouse gas emissions (Sharif *et al.*, 2023). All the main legislative acts and international agreements related to green taxation are presented in table 1.

As of 2024, "green" taxation has already become an important component of tax systems in many developed countries, including Germany, France, Sweden, and Denmark.

Green taxation aims to reduce the environmental impact of economic activity and finance environmental programmes. In 2019, the European Union collected more than €330 billion from environmental taxes, which amounted to 2.4% of EU GDP. Many of these funds are directed to developing environmentally friendly technologies and saving energy. In Sweden, carbon tax revenues subsidise electric vehicles and renewable energy sources. The green tax actively supports programmes to modernise buildings and energy infrastructure in Germany. As in Denmark, revenues from environmental taxes can be used to compensate for reducing the tax burden on labour resources.

The European Union has consistently pursued ensuring a sustainable environment by implementing strict regulations and programmes. According to the European Green Deal, adopted in 2019, EU member states will achieve climate neutrality by 2050 by reducing greenhouse gas emissions (Nazarkevych and Sych, 2023). Scientists predict an approximate level of 55% by 2030 compared to 1990. One of the critical tools for

achieving this goal is emissions trading under the European Emissions Trading System. It covers over 10,000 companies and helped reduce emissions by 35% between 2005 and 2020. EU countries are investing billions of euros in infrastructure development for renewable energy and environmental modernisation of industry (Redko *et al.*, 2023). The overall status of the green tax is shown in figure 1.

Table 1: Legislative Acts and International Conventions on Green Taxation 1992–2024

Year	Document	Countries and organisations	Provisions
1992	United Nations Framework Convention on Climate Change (UNFCCC)	UN	Recognition of the need to reduce greenhouse gas emissions at the international level
2003	Directive 2003/96/EC	European Union	Taxation of energy products and electricity to stimulate energy efficiency
2005	European Emissions Trading System (EU ETS)	European Union	Implementation of an emissions allowance system and emissions trading
2012	Kyoto Protocol (completion of the first phase and new commitments)	UN, member states	Commitments of countries to reduce emissions under the agreements
2015	Paris climate agreement	UN, member states	Setting emission reduction targets to limit global warming
2020	European Green Deal	European Union	Strategy for achieving climate neutrality and introducing additional environmental taxes
2021	Global minimum emissions tax (COP26 decision)	UN, member states	Establishing common standards for environmental taxation worldwide
2022	European climate law	European Union	Legal obligation to achieve climate neutrality by 2050, introduction of the CBAM mechanism
2023	Expansion of the European Emissions Trading System (EU ETS)	European Union	Expanding the system to new sectors of the economy, including maritime transport and construction
2024	Updated goals of the Paris Agreement and expansion of financing mechanisms	UN, member states	Setting new emission reduction targets by 2030 and boosting green finance

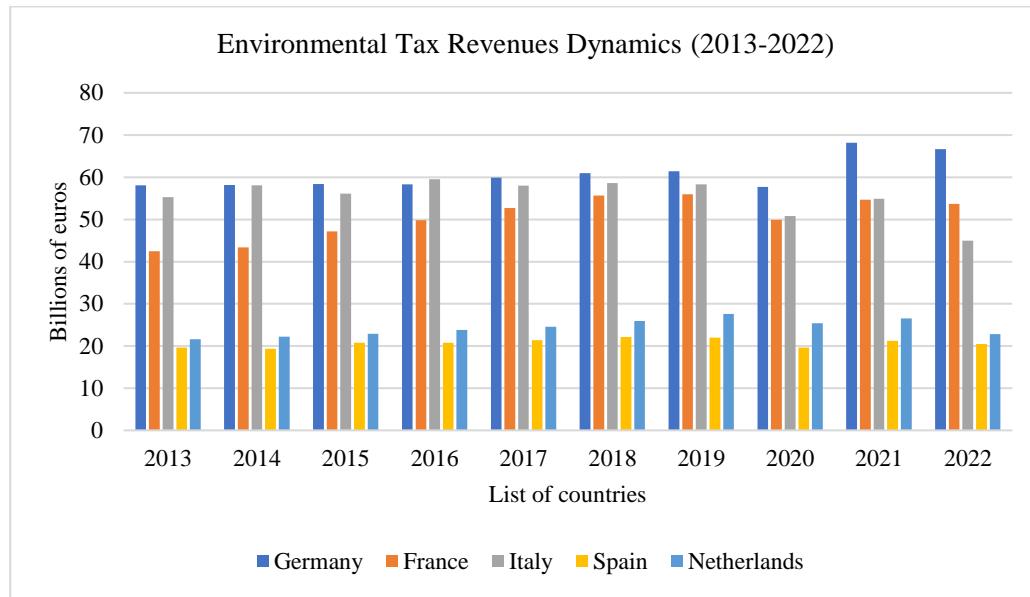


Figure 1: The Largest European Countries by the Amount of Green Tax Payments in 2013–2022, billion euros (Eurostat, 2024)

Green taxation is critical in ensuring sustainable development, as it creates financial incentives for economies to shift to greener models. The primary causal mechanism is to shift the burden to those industries and businesses that produce pollution. This forces companies to look for alternative ways to produce with a lower carbon footprint or to use environmentally friendly technologies (Balci *et al.*, 2024). Shell is investing heavily in hydrogen and solar energy to reduce its dependence on fossil fuels. International corporations Siemens and Vestas are actively implementing wind farms and other renewable energy sources, reducing their carbon footprint and adapting their business models to new environmental requirements.

A comparison of the legal features of green taxation regulation is provided in table 2.

Table 2: Regulation Legal Peculiarities of Green Taxation Worldwide

Country	The rate of “green” taxes	Regulatory authority	Title of the law
Germany	€30 per tonne of CO ₂ (carbon tax) from 2021, with plans to increase to €55 by 2026.	Federal Ministry of Finance	Law on trading in CO ₂ emission allowances (Brennstoff emissions handels gesetz, 2019)
France	€44.55 per tonne of CO ₂ since 2014, covering 35% of greenhouse gases.	Ministry of Environmental Transformation	Law on the Environmental Transition (Loi de transition énergétique, 2015)
Netherlands	€51.07 per tonne of CO ₂ from 2021, a tax	Ministry of Finance	Law on CO ₂ tax (Wet blasting op CO ₂ , 2020)

Country	The rate of "green" taxes	Regulatory authority	Title of the law
	on large industrial companies.		
China	Green tax on SO ₂ and PM emissions in different sectors, focus on industry and power plants.	State Administration of Taxation of China	Environmental Protection Tax Law, 2018
USA	Carbon tax in some states, the rate varies by state (e.g. California – \$20/tonne)	Environmental Protection Agency (EPA)	Market-Based Emissions Legislation (2017)

Global agreements and joint projects significantly strengthen international cooperation in sustainable development and green economy (Maina, 2023). The Paris Climate Agreement, signed in 2015 by 196 countries, has become a key instrument for coordinated action to reduce greenhouse gas emissions. The European Green Deal project was launched in 2019 and involves European countries and international partners in jointly developing renewable energy technologies, infrastructure modernisation and reducing dependence on fossil fuels (Soares, 2024). Cooperation between countries is manifested in creating funds to support decarbonisation projects, including the Green Climate Fund (GCF), which raised more than USD 10 billion in 2016–2020 to finance environmental projects in developing countries (Maina, 2023).

In Sweden, a carbon tax has been in place since 1991, which has made it possible to reduce CO₂ emissions by 25% by 2020. Funds received from environmental taxes are directed to the development of infrastructure projects: modernisation of public transport and critical infrastructure (Ullah *et al.*, 2023). In 2022, Volvo introduced electric buses in Swedish cities. Modernisation of buses has become an essential step toward reducing emissions in the transport sector. Nestlé took advantage of tax incentives in 2023 to invest in water treatment systems at its factories and significantly reduced the use of fresh water. Environmental taxes influence the behaviour of market participants by directing resources to environmental initiatives and strengthening economic resilience in response to environmental challenges (Soares, 2024). However, approaches to "green" taxation vary significantly in different countries depending on economic, social, and political factors. One feature of the United States is the lack of a national carbon tax policy, which has led to a fragmented approach (Ullah *et al.*, 2023).

California has implemented its own emissions tax and a trading system that directs funds to finance environmental projects at the state level. China, the world's largest producer of carbon dioxide emissions, launched a national emissions trading system in 2018, which currently only covers the energy sector (Dvigun *et al.*, 2022). Climate change leads to sea level rise, loss of biodiversity, and degradation of ecosystems. Given the complexity and importance of these issues, international organisations insist on developing common standards and goals in environmental taxation.

One of the essential tools is carbon taxes, which incentivise businesses to reduce emissions. However, different countries prefer their approaches depending on the level of economic development. The USA mainly implements regional initiatives. Europe focuses on pan-European programs, while China implements a centralised system. Coordination between different jurisdictions in the legal field remains challenging for several reasons: different standards, tax rates and compliance mechanisms. Despite these differences, the international community continues to develop new tools to address climate change through taxation and emission quotas.

The European Union countries are leading the way in implementing green taxation, as evidenced by the consistent growth in environmental tax revenues, which peaked in 2019 at EUR 330.85 billion. The overall dynamics are shown in figure 2. From 2013–2022, taxes increased yearly, except in 2020, when they declined to EUR 301.69 billion due to the COVID-19 pandemic and the economic slowdown. The LIFE programme was launched in 1992 and continues to finance innovative environmental projects, allocating €3.4 billion for environmental initiatives until 2024. Thanks to international coordination instruments, the European Union remains a leader in developing a green economy and taxation.

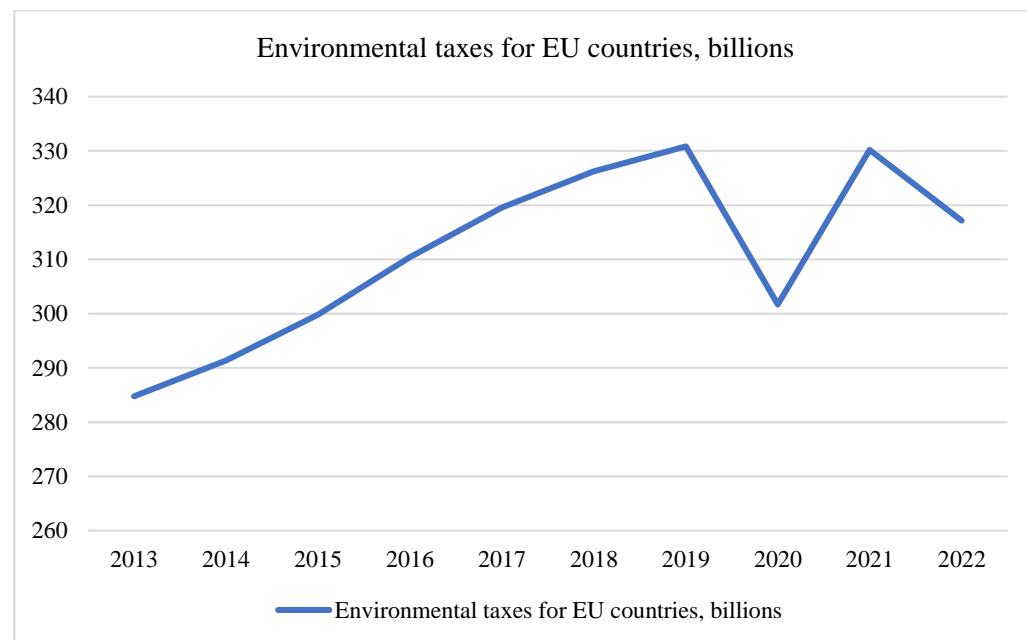


Figure 2: Total environmental taxes collected by EU countries, 2013–2022 (Eurostat, 2024)

Figure 2 presents current trends in environmental tax revenues over the past decade. Notably, the sharp downturn observed in 2020 due to the COVID-19 pandemic, underscores vulnerabilities in the tax system's dependency on economic stability. The consequences of this decline pose a substantial burden for future tax policy. Amid the shift in focus on sustainable development during the pandemic, there was some suspension of active processes in the greening of the tax system. However, this period

highlighted pressing issues in the researched area, which drew maximum attention to them in the post-COVID regeneration of societal processes.

The introduction of green taxation in Africa and developing countries has significant potential to advance environmental sustainability in these regions. South Africa, Kenya and Nigeria plan to introduce more structured environmental taxation systems by 2030 (Bala and Khatoon, 2024). South Africa has had a carbon tax in place since 2019, which has already contributed to a 2.6% reduction in emissions in its first year of operation. Nigeria plans to introduce taxes on fossil fuel extraction and water pollution by 2026, which should provide an additional \$500 million for environmental projects annually (Bala and Khatoon, 2024). The World Bank and the United Nations Environment Programme actively support developing countries by providing technical assistance and funding for developing a green economy. By 2030, Africa plans to raise more than \$1 trillion to finance renewable energy projects. Solar and wind farms will become critical factors in the fight against climate change and regional economic stability for all countries shortly (Maina, 2023).

In the EU countries, economic instruments, including tax policy, are primarily used to achieve environmental goals. Some countries implement a "tax punishment" policy or invest in environmental projects. The most effective system is in the Baltic countries, where environmental taxation focuses on increasing efficiency and protecting natural resources (Juškaitis, 2023).

There are about 500 types of environmental taxes globally, with goals and overall effectiveness varying wildly among countries. Transport taxes (72% of environmental taxes) and energy taxes (23%) are the most common in Europe. European countries primarily focus on taxing energy carriers, which significantly boosts the effectiveness of their environmental taxation (Zhao *et al.*, 2023). The strategies and outcomes of leading companies regarding "green" taxation differ considerably. Shell, for example, is transforming its business to focus on low-carbon solutions (LCS) to strengthen its operations in core sectors with low carbon emissions, such as transport and industry. LCS operations include hydrogen and other businesses aiming to decarbonise the transport and industrial sectors, though they do not include renewable energy businesses (Green Jiraffe Advisory, 2021).

Companies in the "green" economy, with a significant portion of their income from "green" businesses, include Tesla, Waste Management Inc., Microsoft, Siemens, and others. Siemens Gamesa (Spain) is one of the world's largest wind turbine manufacturers. This approach utilises a model where foreign turbine manufacturers provide technology, while local companies support with production capacity, impacting environmental taxation (Ullah *et al.*, 2023).

The Volvo Cars sustainability team celebrates its inclusion in the "Climate Change" category of CDP's 2023 report. As one of the first in the automotive industry, Volvo Cars has ended production of models with diesel engines, an announcement made during Climate Week in New York in September 2023. Volvo plans to fully transition to electric vehicles and create climate-neutral production to achieve net-zero greenhouse gas emissions by 2040 (Volvo, 2024).

Discussion

The primary aim of the study was to analyze public policy and international cooperation, particularly the Paris Climate Agreement and the European Emissions Trading System. The objective was to determine their impact on ensuring environmental sustainability. The research on the impact of environmental taxation on sustainable development in response to modern environmental challenges focuses on analyzing the legislative framework regulating environmental taxes in leading countries worldwide and evaluating the effectiveness of these taxes in reducing greenhouse gas emissions.

The results obtained on the impact of green taxation on sustainable development confirm its importance as an effective tool for reducing greenhouse gas emissions and promoting environmental sustainability. Our findings align with Bala and Khatoon (2024), who report that the introduction of a carbon tax in the EU led to a 15% reduction in CO₂ emissions over the past decade. Similar to the results of Singh and Gahlot (2023), who found that tax incentives promote the transition to renewable energy sources and reduce dependence on fossil fuels. Mia, Islam and Rahman (2023) further confirm our findings, showing that green taxation facilitates the modernisation of industrial enterprises.

Our study also supports the findings of Du and Li (2024), regarding regulating environmental taxation in different regions of the world. We observed that the implementation of the European Emissions Trading System – ETS contributed to a 35% reduction in emissions between 2005 and 2020, consistent with the data reported by Yao and Jin (2024). Additionally, our results support Mehboob *et al.*'s (2024) emphasis on the critical role of international coordination in achieving global environmental goals. Our collected data support the findings of Hu and Gu (2024) that environmental taxation stimulates innovation and promotes the growth of investment in clean technologies.

Analysing the study's results by Dinis *et al.* (2023), we also found that digital technologies significantly increase the transparency and efficiency of environmental tax management. This correlates with the study of Fang, Yang and Huang (2023), who highlight that digital tools are vital to monitoring tax revenues and supporting international emissions regulation systems. It is interesting to note that Nazarkevich and Sych (2023) indicate an additional advantage of "green" taxation – the creation of new jobs in the renewable energy sector, which once again emphasises the multiplier effect of this policy. Considering all the above conclusions, the green tax is a powerful tool: it stimulates the ecological modernisation of the economy, contributes to the reduction of emissions, the development of innovations and international cooperation in the fight against climate change.

The discussion on the economic, social, and political barriers to implementing a "green" taxation system allows for a balanced perspective on the development of the phenomenon under study. Specifically, in the work of Zhao *et al.* (2023), the practical impact of government subsidies and tax reductions on the efficiency of companies' investments in renewable energy is explored using panel data from Chinese companies in the renewable energy sector. The authors focus on the impact of pandemic-related factors and the resulting socio-economic and political aspects, which are seen as particularly relevant as determinants influencing the "green" taxation system in the future.

The Paris Agreement is a crucial foundational document for international climate change cooperation. However, for its successful implementation and tangible results, both effective motivational factors (including financial mechanisms) and significant sanctions or measures to monitor the fulfilment of declared commitments are necessary. Only then will the agreement truly function. The role of transport taxes (72%) and energy taxes (23%) in Europe is reflected in their contribution to reducing emissions. The multiplier effect of green taxation is also evident in job creation, which is particularly relevant in the context of developing countries. The differences between voluntary green taxation mechanisms and mandatory tax policies primarily lie in their effectiveness. Coercive policies have a relatively immediate impact, whereas voluntary taxation mechanisms have a prolonged positive influence and significant long-term potential. Notably, EU policy is characterized by voluntary mechanisms, motivation, and incentives. In contrast, the policies of developing countries are based on mandatory taxation and strict control.

The study is limited by the lack of access to complete and up-to-date official data and the challenges of experimentally verifying theoretical conclusions.

Conclusion

The "green" taxation has become an essential tool for stimulating environmental sustainability and the development of renewable energy sources. The European Union has demonstrated in practice how carbon taxes and quota trading systems reduce dependence on fossil resources and reduce CO₂ emissions. Legislative initiatives stimulate businesses to invest in ecologically "clean technologies". Strict legal regulation stimulates enterprise adaptation to global environmental needs. Developed countries have achieved significant results in implementing emissions taxes, but less well-off countries continue to face difficulties in this process. Achieving global environmental goals requires much greater international cooperation and financial assistance. According to the World Bank, using digital technologies to monitor emissions and tax revenues will reduce emissions by 25%. Future success depends on further improving legal mechanisms and implementing best practices of the green economy among the G7 countries by 2030. Thus, further research should focus on developing innovative digital monitoring technologies and creating flexible legal frameworks to better respond to global environmental challenges. In the context of the future scientific development of the researched topic, there is a clear need for expanded analysis of the dynamics of socio-economic and political vectors. As examined within the scope of the current study, these factors are considered to be determinants in shaping the outcomes of environmental taxation policy. In light of the conclusions reached, policymakers and managers should explore opportunities to encourage decarbonisation processes and prevent environmental degradation through fiscal policy tools in a "green" format. In this regard, particular importance should be given to a system of incentives and activating investment projects.

References

Abbasi, S. and Choukolaei, H.A. (2023). A systematic review of green supply chain network design literature focusing on carbon policy. *Decision Analytics Journal*, 6: 100189. DOI: <https://doi.org/10.1016/j.dajour.2023.100189>

Afshan, S. and Yaqoob, T. (2023). Unravelling the effectiveness of green innovation and taxation in promoting environmental quality: A dual-model assessment of testing the LCC theory in emerging economies. *Journal of Cleaner Production*, 416: 137850. DOI: <https://doi.org/10.1016/j.jclepro.2023.137850>

Amores, A.F., Maier, S. and Ricci, M. (2023). Taxing household energy consumption in the EU: The tax burden and its redistributive effect. *Energy Policy*, 182: 113721. DOI: <https://doi.org/10.1016/j.enpol.2023.113721>

Ayodele, F.O., Mustapa, S.I. and Ayodele, B.V. (2023). The Potential of Renewable Energy Green Financing through Carbon Taxation to Achieve Net-Zero Emissions Target. *International Journal of Energy Economics and Policy*, 13(6): 388–396. DOI: <https://doi.org/10.32479/ijep.14670>

Bala, H. and Khatoon, G. (2024). Effect of green taxation on renewable energy technologies: an analysis of commonwealth and non-commonwealth countries in Sub-Saharan Africa. *Environmental Science and Pollution Research*, 31(8): 11933–11949. DOI: <https://doi.org/10.1007/s11356-024-31879-0>

Balci, G., Phan, T.T.N., Surucu-Balci, E. and Iris, Ç. (2024). A roadmap to alternative fuels for decarbonising shipping: The case of green ammonia. *Research in Transportation Business and Management*, 53: 101100. DOI: <https://doi.org/10.1016/j.rtbm.2024.101100>

Borrego, A.C. and Carreira, F. (2023). *Green taxation*. In: *Encyclopedia of Sustainable Management*. (pp. 1783–1787). Springer International Publishing. DOI: https://doi.org/10.1007/978-3-031-25984-5_723

Cheng, Y., Zhao, G., Meng, W. and Wang, Q. (2024). Resources utilisation, taxation and green education: A path to sustainable power generation. *Resources Policy*, 88: 104389. DOI: <https://doi.org/10.1016/j.resourpol.2023.104389>

Dinis, A.A., David, F., Pereira, L. and Dias, S.L. (2023). *Taking on climate change through green taxation*. *Taking on Climate Change through Green Taxation*. IGI Global. 419 p. DOI: <https://doi.org/10.4018/978-1-6684-8592-7>

Dogan, E., Hodžić, S. and Fatur Šikić, T. (2022). A way forward in reducing carbon emissions in environmentally friendly countries: the role of green growth and environmental taxes. *Economic research-Ekonomska istraživanja*, 35(1): 5879–5894. <https://doi.org/10.1080/1331677X.2022.2039261>

Dong, W., Hou, X. and Qin, G. (2023). Research on the Carbon Emission Reduction Effect of Green Taxation under China's Fiscal Decentralisation. *Sustainability (Switzerland)*, 15(5): 4591. DOI: <https://doi.org/10.3390/su15054591>

Du, P. and Li, Q. (2024). Evaluating carbon tax impact on natural resource extraction in developing regions: Implicating green recovery. *Resources Policy*, 89: 104530. DOI: <https://doi.org/10.1016/j.resourpol.2023.104530>

Dvigun, A., Datsii, O., Levchenko, N., Shyshkanova, G., Platonov, O. and Zalizniuk, V. (2022). Increasing Ambition to Reduce the Carbon Trace of Multimodal Transportation in the Conditions of Ukraine's Economy Transformation towards Climate Neutrality. *Science and Innovation*, 18(1): 96–111. DOI: <https://doi.org/10.15407/scine18.01.096>

Eurostat (2024). Environmental taxes by economic activity. Available at: https://ec.europa.eu/eurostat/databrowser/view/env_ac_taxind2/default/table?lang=en [Accessed on 10 October 2024]

Fang, X., Yang, Y., and Huang, W.C. (2023). The impact of green taxation on green low-carbon development in the Yangtze River Delta region of China based on

mediating effect model and spatial Durbin model. *Environmental Science and Pollution Research*, 30(47): 103674–103689. DOI: <https://doi.org/10.1007/s11356-023-29670-8>

Farooq, U., Wen, J., Tabash, M.I. and Fadoul, M. (2024). Environmental regulations and capital investment: Does green innovation allow for growth? *International Review of Economics and Finance*, 89: 878–893. DOI: <https://doi.org/10.1016/j.iref.2023.08.010>

Fernández, A., Haffner, M. and Elsinga, M. (2024). Subsidies or green taxes? Evaluating the distributional effects of housing renovation policies among Dutch households. *Journal of Housing and the Built Environment*, 39: 1161–1188. DOI: <https://doi.org/10.1007/s10901-024-10118-5>

Hu, Q. and Gu, Y. (2024). Mineral resources and the green economy: A blueprint for sustainable development and innovation. *Resources Policy*, 88: 104461. DOI: <https://doi.org/10.1016/j.resourpol.2023.104461>

Juškaitis, R. (2023). Dormice (Gliridae) in the Diets of Predators in Europe: A Review Broadening Understanding of Dormouse Ecology. *Diversity*, 15(1): 52. DOI: <https://doi.org/10.3390/d15010052>

Lemos, K., Dinis, A. and Serra, S. (2023). Green taxation for SMEs' digital accounting transformation. In *Taking on Climate Change through Green Taxation*. (pp. 179–197). IGI Global. DOI: <https://doi.org/10.4018/978-1-6684-8592-7.ch007>

Liu, Y. and Ge, J. (2023). What kind of environmental fiscal and taxation policies can support the green production of ionic rare earths? A computable general equilibrium analysis. *Extractive Industries and Society*, 13: 101201. DOI: <https://doi.org/10.1016/j.exis.2022.101201>

Maina, J. (2023). The Challenges and Opportunities of Green Economy for Traditional Economic Policies. *Law and Economy*, 2(5): 40–45. DOI: <https://doi.org/10.56397/LE.2023.05.06>

Mehboob, M.Y., Ma, B., Mehboob, M.B. and Zhang, Y. (2024). Does green finance reduce environmental degradation? The role of green innovation, environmental tax, and geopolitical risk in China. *Journal of Cleaner Production*, 435: 140353. DOI: <https://doi.org/10.1016/j.jclepro.2023.140353>

Mia, M.F., Islam, M. and Rahman, N. (2023). Green taxation changes government revenue and its applicability in Bangladesh. *Journal of Asian Business Strategy*, 13(1): 42–59. DOI: <https://doi.org/10.55493/5006.v13i1.4788>

Nazarkevych, I. and Sych, O. (2023). Taxation as a tool of implementation of the EU Green Deal in Ukraine. *Regional Science Policy and Practice*, 15(1): 144–160. DOI: <https://doi.org/10.1111/rsp3.12596>

Nchofoung, T.N., Fotio, H.K. and Miamo, C.W. (2023). Green taxation and renewable energy technologies adoption: A global evidence. *Renewable Energy Focus*, 44: 334–343. DOI: <https://doi.org/10.1016/j.ref.2023.01.010>

Redko, K., Borychenko, O., Cherniavskyi, A., Saienko, V. and Dudnikov, S. (2023). Comparative analysis of innovative development strategies of fuel and energy complex of Ukraine and the EU countries: international experience. *International Journal of Energy Economics and Policy*, 13(2): 301–308. DOI: <https://doi.org/10.32479/ijEEP.14035>

Singh, K.D. and Gahlot, S. (2023). Policy Framework of Green Taxation on Motor Vehicles: A Comparative Perspective. *European Journal of Sustainable Development*, 12(3): 49–68. DOI: <https://doi.org/10.14207/ejsd.2023.v12n3p49>

Sharif, A., Kartal, M.T., Bekun, F.V., Pata, U.K., Foon, C.L. and Depren, S.K. (2023). Role of green technology, environmental taxes, and green energy towards sustainable environment: insights from sovereign Nordic countries by CS-ARDL approach. *Gondwana Research*, 117: 194-206. <https://doi.org/10.1016/j.gr.2023.01.009>

Soares, A.G. (2024). The European Green Deal. *Revista Jurídica Portucalense*, 35: 44–67. DOI: [https://doi.org/10.34625/issn.2183-2705\(35\)2024.ic-03](https://doi.org/10.34625/issn.2183-2705(35)2024.ic-03)

Tomás, M., García-Muros, X., Alonso-Epelde, E., Arto, I., Rodríguez-Zúñiga, A., Monge, C. and González-Eguino, M. (2023). Ensuring a just energy transition: A distributional analysis of diesel tax reform in Spain with stakeholder engagement. *Energy Policy*, 177: 113558. DOI: <https://doi.org/10.1016/j.enpol.2023.113558>

Ullah, S., Luo, R., Adebayo, T.S. and Kartal, M.T. (2023). Dynamics between environmental taxes and ecological sustainability: evidence from top-seven green economies by novel quantile approaches. *Sustainable Development*, 31(2): 825-839. <https://doi.org/10.1002/sd.2423>

Volvo (2024). *Sustainability*. Available at: <https://www.volvocars.com/intl/sustainability/governance/> [Accessed on 10 October 2024]

Green Giraffe Advisory (2021). What does the Shell carbon emissions ruling mean? Available at: <https://green-giraffe.com/publication/blog-post/what-does-shell-carbon-emissions-ruling-actually-mean/> [Accessed on 10 October 2024]

Yao, L. and Jin, M. (2024). Impacts of green taxation on the green transformation of manufacturing industry: an empirical analysis based on Chinese provincial panel data. *Economic Change and Restructuring*, 57: 4. DOI: <https://doi.org/10.1007/s10644-024-09615-y>

Zhang, Q., Zhang, Y., Liao, Q. and Guo, X. (2023). Effect of green taxation on pollution emissions under ESG concept. *Environmental Science and Pollution Research*, 30(21): 60196–60211. DOI: <https://doi.org/10.1007/s11356-023-26699-7>

Zhao, L., Zhang, Y., Sadiq, M., Hieu, V.M. and Ngo, T.Q. (2023). Testing green fiscal policies for green investment, innovation and green productivity amid the COVID-19 era. *Economic Change and Restructuring*, 56(5): 2943-2964. <https://doi.org/10.1007/s10644-021-09367-z>.

Authors' Declarations and Essential Ethical Compliances

Authors' Contributions (in accordance with ICMJE criteria for authorship)

Contribution	Author 1	Author 2	Author 3	Author 4	Author 5
Conceived and designed the research or analysis	Yes	No	Yes	Yes	No
Collected the data	Yes	No	Yes	No	No
Contributed to data analysis and interpretation	Yes	Yes	No	Yes	No
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