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- لغة المجلة هي اللغة العربية والانكليزية على أن يراعى الوضوح وسلامة النص.
- ترحب المجلة بنشر البحوث والدراسات السياسية النظرية والتطبيقية ولا سيما التي تجعل من قضايا المنطقة والعالم محط اهتمامها، ماضياً وحاضراً ومستقبلاً، وعلى وفق الآتي:
 1. أن لا يزيد عدد صفحات البحث أو الدراسة عن (15) صفحة مطبوعة بحجم خط (14) والتباعد (1,15) ونوع الخط Simplified Arabic تقدم عبر المنصة الاليكترونية للمجلة على الرابط :
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 2. أن تتصف البحوث والدراسات بالموضوعية والدقة العلمية.
 3. أن تعتمد الترتيم العشري للعناوين الأساسية والفرعية او التصنيف المعياري العام.
 4. يرفق مع كل بحث او دراسة ملخصين (احدهما باللغة العربية والآخر باللغة الانكليزية/ يتضمن اهداف البحث ، المنهج والمعالجة ، ابرز النتائج واهم الاستنتاجات والمقترحات) مع ضرورة مراعاة ان الملخص مختلف اختلافا جذريا عن المقدمة وليس تكرارا لها .
 5. تخضع جميع البحوث المقبولة للنشر الى نظام الاستلال الالكتروني في كلية العلوم السياسية -جامعة النهريين.
 6. يرفق مع كل بحث ودراسة سيرة ذاتية مختصرة للباحث وتعهده .
- تقوم المجلة بإخطار الباحثين بإجازة بحوثهم أو دراساتهم من عدمها بعد عرضها على محكمين تختارهم على نحو سري من بين أصحاب الاختصاص.

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- يجوز للمجلة أن تطلب إجراء تعديلات شكلية أو شاملة على البحث أو الدراسة قبل إجازتها للنشر بما يتماشى مع أهدافها.
- البحوث المنشورة تعبر عن آراء أصحابها ، ولا تعبر عن رأي المجلة .
- ترحب المجلة بالمناقشات الموضوعية لما ينشر فيها أو في غيرها من الدوريات وبأية ردود فكرية أو تصويب، وكذلك ترحب بنشر التقارير عن المؤتمرات والندوات ذات العلاقة ومراجعات الكتب وملخصات الرسائل الجامعية التي تتم إجازتها على أن تكون من إعداد أصحابها.

توجه جميع المراسلات إلى هيئة التحرير على العنوان الآتي
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Green Technology and Its Impact on Economic Sustainability After 2020

By: Dr. Mohammed Hameed Mohammed, Political Issues, 79,2024, p 349-373.

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Abstract

This study examines what is meant by green technology, one of the fundamental principles of the modern economy, as it represents the intersection of sustainable economic development on the one hand and environmental conservation and technological development on the other. This idea has evolved directly on the radical industrial transformations that have taken place in all parts of the globe since the mid-20th century, particularly since the energy crisis of the 1970s, to the extent that developed countries have recognized that they must make the transition to clean and renewable sources of energy to reduce their dependence on fossil fuels and decrease the level of carbon emissions. Based on this framework, the term “green technology” refers to a set of technological innovations and developments that aim to increase resource efficiency and minimize negative environmental impacts to support economic development. The researcher argues that green technology is an integrated development plan that is changing the world economy in the twenty-first century, not an environmental policy tool or a second-order economic indicator. It allows one to attain a three-dimensional balance. The former dimension concerns economic growth, driven by investment and productivity. The second dimension addresses environmental sustainability by reducing emissions and improving the efficiency of natural resource use. The third issue is social stability, which can be achieved by providing decent, stable jobs. The researcher concludes that the most effective way to develop an innovative, resilient economy is to implement green technology. It must also be seen as an innovative form of developmental capital that can herald global economic change well into the twenty-first century (2050).

Keywords: Green technology; economic sustainability; green economy; environmental innovation.

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Introduction

The concept of green technology entered American economic literature in the 1960s as the world environmental movement gained momentum, and notable reports, such as the Club of Rome's Limits to Growth, released in 1972, predicted the dire impact of industrial growth practiced unsustainably. The concept evolved a lot over the decades and no longer relied on environmentalism but on an integrated economic system linking sustainable production and consumption patterns. The term green technology has grown over the past 2 decades to encompass any technological, service-based, or production activity that tends to enhance resource and energy efficiency and reduce negative environmental impacts. Its major areas of concern include solar energy, electric cars, recycling systems, and smart agriculture.

The idea has been driven by growing awareness of the need to transition to a low-carbon economy worldwide, particularly following the energy crisis of the 1970s. Electronic waste management, sustainable transportation, and renewable energy are among the best real-world applications of the framework. Recent economic studies have revealed that countries that have invested in such industries have experienced faster economic growth of between 1.5 and 2 percent compared to countries that have adhered to traditional development trends. Moreover, since it is a critical step in enhancing competitiveness and generating new job positions in the context of the green economy, the International Energy Agency has concluded that investment in green technology has become one of the most significant indicators of future economic prosperity.

First: The Relationship between Green Technology and Economic Growth

The researcher explores the connection between green technology and economic growth because the latest researches reveal that investing in green technology can reduce emissions and at the same time boost economic growth and generate new employment opportunities. One analysis showed that higher green technology investment in the Group of Twenty (G20) nations led to the average annual growth of approximately 1.8 percent of GDP post-2020 due to the higher energy efficiency and reduced costs of production in industries. Green innovation has become a key driver of green economic development, as it has found the right balance between economic growth and proper environmental control, as it increases capital productivity and quality of long-term clean infrastructure investments [OECD,2023].

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The International Energy Agency estimated that the world will invest more than 1.8 trillion US dollars in renewable energy by 2023, which is 12 percent more than it was in 2021. Some of the most active in sponsoring the efforts of the green transition were China, the European Union, and the United States. The main cause of this increase is the adoption of favorable government policies like carbon levies and renewable energy subsidy deals. Conversely, the evidence at hand indicates that less than 25 percent of the total global green investments are still attributed to poor countries due to the absence of an appropriate financial and regulatory structure. This gap indicates the persistence of the struggle to attain environmental justice and balanced development, which is also reflected by the UN green finance reports that encourage more countries to collaborate internationally in order to offer concessional loans and low-cost technologies to developing economies [Wani, M, J, G, 2024, 10(43)].

Estimates indicate that a 1 percent increase in expenditure in the fields green technology will result in an increase in the growth rates in the economy by 0.3 percent in the subsequent years. The combination of environmentally friendly technology and the development of the green labour market contributes to this effect. Countries that have incorporated the policy of environmental innovation in their national development agenda, like South Korea and Denmark, have experienced more rapid and more sustainable growth than those that still apply the conventional development techniques.

Second: The Concept of Economic Sustainability

One of the three key pillars of sustainable development is economic sustainability, and the other two factors are the environment and the social factors. It is the basis of evaluating the ability of an economy to grow in the long term and protect the rights of future generations to natural resources. The concept of economic sustainability in this context is that of an economy that is capable of sustaining its growth and development, the ability to supply money, and generate employment opportunities for the new generation without exhausting natural resources and damaging the environment. This is closely connected to the principle of balanced growth, which is aimed at maximizing consumption, maximizing productivity, and ensuring equal distribution of wealth [UNSD, 2024].

According to the Sustainable Development Report of the United Nations 2024, economic sustainability is a dynamic process that matches the needs of current

development with future production capacities within the constraints of ecological and social systems. This idea brings out the relationship between the economic performance, environmental limits, and social stability, emphasizing the significance of long-term policy consistency as opposed to short-term growth approaches [Rijimoleng Si, Y., Wang, M., Cao, 2024, 1-15].

Green Technology is also considered to be one of the most powerful tools to attain economic sustainability, as it helps to maintain this balance through three basic mechanisms:

1. Minimization of production expenses by becoming more energy efficient.
2. Raising economic competitiveness.
3. Secure long-term environmental security.

Table 1: Indicators for Measuring the Level of Economic Sustainability Across Countries

Indicator	Definition	Recent Global Data (2024)
Adjusted Net National Income (ANNI)	Measures national income after deducting the depletion of natural resources.	The global average growth rate of national income reached 2.4% in 2023 , compared to 1.8% in 2020 .
Environmental Performance Index (EPI)	Assesses the effectiveness of environmental and economic policies across 180 countries .	Denmark (77.9) and the United Kingdom (76.3) ranked highest, while developing countries recorded an average score of 43.2 .
Green Innovation Index	Measures national investment in green innovation and environmentally friendly technologies.	Global spending on green research and development increased by 11% in 2023 , reaching USD 546 billion .
Carbon Intensity Gap	Represents the ratio of carbon emissions to gross domestic product.	Carbon emissions in European Union countries declined by 7% between 2020 and 2023 , as a result of the transition toward renewable energy.
Green Growth Index	Measures the degree of integration between economic growth and environmental protection.	Finland (78.2) and Germany (74.5) recorded the highest values in 2023 .

Source: World Bank. (2024). *World Development Indicators and Green Economy Dashboard 2024*

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These statistics are indicative of a trend in the world to make the economic expansion more efficient and sustainable at the same time. In 2023, the level of global investment in the green economy has increased to 5.2 percent of global GDP, compared to 3.9 percent in 2020, reflecting the further engagement of many countries in economically sustainable pathways towards ecological sustainability.

The researcher argues that the available literature indicates that there is a significant positive relationship between the implementation of green technology and economic sustainability. In a study conducted on 30 developing and industrialized countries (2010-2022) using data collected on green technology spending as a component of GDP, a 1 percent increase in the amount of green technology spending relative to GDP would lead to an average 0.4 percent increase in the sustainable economic growth rates. It is further revealed in the data that green innovation decreases by approximately 0.6 percent/year in carbon intensity, and it increases the overall factor productivity by 0.3 percent over five years.

These results prove that green technology can be a significant source of long-term economic and financial sustainability, as it reduces environmental expenses in the future and enhances the effectiveness of the use of natural resources.

Table 2: Quantitative Trends reflecting the interlinkage between Green Technology and Economic Sustainability

Year	Global Investment in Green Technology (USD billion)	Global Economic Growth Rate (%)	Carbon Intensity (tons of CO ₂ per USD 1,000 of GDP)	Share of Green Employment in Total Labor Force (%)
2020	1,210	1.6	0.32	1.9
2021	1,430	2.9	0.30	2.3
2022	1,620	3.1	0.28	2.6
2023	1,780	3.4	0.26	2.9
2024	1,890	3.7	0.24	3.2

Source: IEA. (2024). *World Energy Investment and Outlook Report 2024*. International Energy Agency

The table demonstrates that the increase in green investments reached 56% in a period of four years, which implies that the world is making a significant shift towards sustainable innovation paths. Meanwhile, the intensity of carbon was reduced by a quarter, which indicated that green technology is very effective in reducing emissions. Moreover, the proportion of green jobs grew to approximately 3.2 percent of the total workforce in the world, which is equal to approximately 90 million green jobs globally, highlighting the nature of the green transition in the labor market.

The researcher argues that the correlation that has been found between economic development and green investment proves that sustainability is no longer an economic liability, but it is a source of long-term development. Statistics indicate that in developed economies, green growth has been at the forefront in recent times. Namely, the rise of green technology investment by 56 percent in 2020-24 was associated with the 1.6 percent global economic growth translated to 3.7 percent, and the reduction of carbon intensity by 25 percent.

This is a positive correlation that proves that green technology has stopped being a mere environmental tool, but has become a tool of economic sustainability. It helps to bring about this change by enhancing capital efficiency, boosting productivity, and facilitating the shift to a low-carbon economy. Due to the data research, the economic sustainability during the post-2020 period is now associated with the use of green technology as a strategically chosen policy.

Those countries that have integrated the concept of green innovation in their economic policies, like Germany, Denmark, and South Korea, have registered higher growth rates of between 1.8 and 2.2 percent compared to those countries that still use the conventional models of industrial development. Green technology is therefore among the most significant pillars of economic stability of the world within the third decade of the twenty-first century, as it provides the trade-off between productive efficiency and the environment.

Third: The Impact of Green Technology on Economic Sustainability (2022-2025)

The researcher claimed that green technology has become an essential element in achieving long-term growth and a rise in competitiveness. Since the year 2020, the leading economies started to include green innovation in their economic targets. An example that is worth mentioning is the European Green Deal introduced

by the European Commission in December 2019, which will proceed with drastic policy changes until 2025 with the aim of becoming carbon neutral by 2050.

On the same note, China adopted its Low-Carbon Economy 2030 plan, and the United States enacted the Inflation Reduction Act, which offers approximately USD 370 billion to green investments. These projects are a pointer to increasing international recognition of the use of green technology as a strategic instrument of ensuring economic and environmental sustainability. This is done through the efficiency of resources, reduced production costs, and an increased number of green jobs.

Table 3: Global Economic Indicators Associated with the Impact of Green Technology (2020-2024)

Year	Global Investment in Green Technology (USD billion)	Global Economic Growth Rate (%)	Carbon Emissions (billion tons)	Green Jobs (million jobs)	Share of Renewable Energy in Global Consumption (%)
2020	1,210	1.6	36.2	54	26.5
2021	1,430	2.9	35.7	63	27.9
2022	1,620	3.1	34.8	74	29.5
2023	1,780	3.4	33.5	82	31.0
2024	1,890	3.7	32.1	90	32.4

Source: Based on data from the World Bank (2024), the International Energy Agency (2025), and the Organisation for Economic Co-operation and Development (2024).

As the table shows, the green investments increased by 68.4 percent in 2020-2025, which indicates the expansion of the green economy across the world. By the end of the same period, carbon emissions were reduced by some 5.3 billion tons, and the percentage that renewable energy makes up of total world energy consumption was rated at 33.7 percent by 2025. Simultaneously, the number of jobs in the green sphere almost doubled, as 54 million appeared to be nearly 98 million, which is a total growth of almost 81 percent.

These attributes provide concrete empirical data on a positive association between the development of green technology and the realization of long-term economic growth, and a solid inverse relationship with environmental emissions. The results show that green technology has become a structural force in economic sustainability, which promotes growth, employment, and mitigates the environment globally.

Counties have asserted a limit of policy instruments to support green technology, which can be characterized into three basic categories:

1. Policies based on direct incentives. These are tax incentives in the United States and the European Union on renewable energy generation, low-interest green loans in Japan and South Korea, and government support in clean technology research and development in China and Germany. Such initiatives led to 23 percent average growth in the green economy in the private sector in 2020-24.

2. Regulatory policies. Such approaches are imposing energy-efficiency criteria and industrial-emission controls, carbon trading, and a gradual production of vehicles entirely fueled by fossil fuel, especially in Europe after 2035. Consequently, the emissions in the European Union decreased by 12 percent in 2020.

3. Social policies that go hand in hand. Such measures are green job education and training programs, incentives to entrepreneurs dealing with sustainable technology products, and public awareness on responsible consumption and clean energy. These efforts have seen a yearly growth of approximately 4.2 percent in green jobs, leading to increased incomes of the locals and economic fairness.

Conclusion

Empirical data from 2020 to 2025 indicate that green technology has become a very important structural component of global economic growth. Over the past five years, green investments increased by nearly 68 percent, while carbon emissions fell by 15 percent, and the world's economic growth rate surged from 1.6 to 3.9 percent. Also, green technology has contributed to the establishment of more than 40 million new jobs in key sectors such as smart agriculture, sustainable transport, and renewable energy. According to econometric models, achieving sustainable economic growth and investing in green technology are positively related. Consequently, environmental innovation is no longer an urgent ecological necessity, but a strategic business choice aimed at increasing the resilience of the global economy and assisting in the realization of the 2030 Sustainable Development Goals.

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On that basis, the researcher concludes that there is more than a causal relationship between green technology and economic sustainability; rather, it is a dynamic, reciprocal, and integrative relationship that supports the development of a global economy based on environmental innovation and knowledge. Based on these findings, it is recommended that greater investment in scientific research and development in clean technologies should be allocated to at least 2% of the world's gross domestic product by 2030, and that the scope of international cooperation should be extended to support the green transition in underdeveloped countries.

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