

Green Economy Framework and Models: Combining Technological Innovation and Environmental Protection for Long-Term Growth

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ABSTRACT

Using advances in digital technology to support inclusive and sustainable economic growth in the long term, this research aims to create an environmentally friendly economic framework. The method used is literature review and uses qualitative and systematic methodologies with data sourced from websites, e-books, articles, scientific journals that discuss the green economy, technological advancements, and environmental protection that can be accessed such as on Google, Google Scholar, Scindirect, and Grey literature documentation studies, which are official documents published by various credible international organizations. This research shows that digital technology can improve resource utilization, reduce carbon emissions, and make more workplaces more environmentally friendly. The new focus of this research is the incorporation of digital technology advances into environmental and social policies related to Indonesia and Southeast Asia. Previous policies have not received enough attention. These results emphasize that a just and efficient green economic transformation requires collaboration between incentive policies, technology, and human resource improvement. Reducing deforestation in Indonesia and developing sustainable ecotourism are two strategies that combine technology and policy. This research makes an important contribution by presenting a comprehensive integration between digital technology and environmental policy as an adaptive strategy to face climate challenges and social change, so that it can be a reference for stakeholders in accelerating the transition to an innovative and sustainable green economy.

Keywords: green economy, technological innovation, environmental protection

BACKGROUND

The green economy is an economic framework that integrates environmental and sustainability considerations into economic growth. This framework aims to promote economic development and job creation, while ensuring that we do not deplete the planet's natural resources that are essential to our survival (UNEP, 2009).

In this case, the focus is on combining conservation policies such as sustainable water resource management and zero deforestation with new technologies to support long-term growth models. One of the strict rules used in this strategy is carbon tax, which encourages companies to act in a more environmentally friendly manner and protect important natural resources, such as tropical rainforests, which are major carbon sinks. Protecting the environment opens up new business opportunities such as ecotourism. Countries with strong environmental protection policies have higher rates of green Gross Domestic Product (GDP) growth. They also have lower risks of natural disasters related to climate change (UNEP, n.d.).

Global statistics indicate that countries with solid green economy implementation, such as Costa Rica with its net zero carbon target by 2050, have recorded green GDP growth of 4-5% per year, while reducing deforestation and increasing ecotourism, generating revenues of up to \$1 billion per year (UNEP, n.d.). In addition, the (FAO,

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2022) states that global food waste has fallen by up to 30% thanks to sustainable agricultural innovations such as the use of drones and artificial intelligence to optimize the use of air and agricultural fertilizers. This has also increased land efficiency. One of the most important ways to achieve this goal is through a green economy. This method includes AI to improve energy efficiency, blockchain technology to make supply chains more sustainable, and Internet of Things sensors to monitor emissions. It also includes environmental policies such as sustainable water resource management, forest conservation, and zero-waste policies.

A growing body of scientific evidence shows that climate change is a fact. The Intergovernmental Panel on Climate Change says droughts and rising sea levels could cost the global economy up to \$23 trillion per year if we do not adopt more sustainable and resilient economic models. Many people believe that green economic growth can help address issues such as deforestation, marine pollution, and climate change. The Earth's temperature has risen by 1.1°C since before the Industrial Revolution due to climate change (Intergovernmental Panel on Climate Change (IPCC, 2021)). According to this article, to achieve sustainable growth, it is essential to combine emerging technologies, such as blockchain for sustainable supply chains, with environmental conservation efforts, including carbon emission regulations (Organization for Economic Cooperation and Development (OECD, 2021)). AI can save up to twenty percent of energy. The COVID-19 pandemic has exposed the weaknesses of the linear economic model and promoted the green economy as a way for everyone to help the economy recover after a disaster. The International Labor Organization (ILO, 2021) estimates that by 2030, up to 24 million jobs could be created through smart investment in the environment. According to the (World Bank, 2025), environmental damage causes deaths, reduced productivity, and decreased life expectancy, and harms the economy.

The green economy relies on new technologies to better utilize resources and reduce their negative impact on the environment. Artificial intelligence (AI), electric cars, and solar panels are some of the waste management technologies that are essential for developing new concepts and protecting the environment. Since 2010, the price of solar power plants has fallen by 85% thanks to new innovations in renewable energy. This enables long-term growth by saving energy and creating new sectors (IEA, 2022). The rate of deforestation in Indonesia has decreased by 75% thanks to social forestry programs and forest moratoriums. In addition, these programs have promoted sustainable economic growth in the region (Ministry of Environment and Forestry of the Republic of Indonesia, 2020). This policy is driven by international initiatives such as the European Green Deal, which aims to accelerate the transition to a low-carbon European economy by combining mitigation and climate ecosystems (European Environment Agency, 2023).

Long-term benefits include sustainable economic growth, poverty reduction, and increased capacity to address climate change. In the long term, it is expected that initial investments in green technology will reduce costs and create more jobs. However,

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moving towards a green economy will require significant investment, but it will result in advances in technology, markets, and resource utilization. The green economy also has the potential to create new jobs in the expenditure sector. By providing equitable access to resources, it can help combat poverty and inequality and promote social justice (Adamowicz, 2022).

Research Objectives

The objective of this research is to develop and analyze green economy models that combine technological advancement with environmental protection. These models will promote inclusive, sustainable economic growth that is capable of addressing climate change in the long term. This study also seeks to describe the impact of green economy implementation in improving resource efficiency, reducing carbon emissions, and promoting social welfare through synchronized low-carbon economic policies and practices. With these objectives, this research can contribute to policy recommendations and practical green economy implementations that can be adopted by stakeholders to achieve environmentally friendly and sustainable economic development.

LITERATURE REVIEW**Theoretical Green Economy Theory**

An economic paradigm known as the “green economy” places a high priority on sustainable growth while taking into account social inclusion, environmental preservation, and resource efficiency (Korhonen et al., 2017). This idea emerged as a response to the tension between traditional economic expansion and environmental degradation, with the aim of balancing the two through innovative clean technologies and prudent resource use. Sustainable growth, resource efficiency, ecosystem preservation, clean technology innovation, cross-sector cooperation, and community participation are the basic principles of the green economy.

Technological Innovation for a Green Economy

Technological innovation is essential for creating a competitive and environmentally friendly green economy. Reducing carbon emissions and increasing resource productivity requires the use of environmentally friendly technologies, such as sustainable waste management, digital production processes, and renewable energy. The economic transformation enabled by these innovations promotes low-carbon development and reduces dependence on fossil fuels. For example, a report from the International Renewable Energy Agency (IRENA, 2023) states that since 2010, the cost of renewable energy has fallen by 85% thanks to the use of solar and wind energy. In addition, precision agriculture using technologies such as the Internet of Things (IoT) can optimize the use of fertilizers and water, reducing waste by up to 30%.

Environmental Conservation in the Context of the Green Economy

Within the framework of the green economy, environmental conservation includes the preservation of biodiversity, the restoration of environmental damage, and ensuring the sustainability of ecosystems. Methods based on the circular economy and life cycle approaches are also essential for reducing waste and increasing resource recycling. Long-term economic growth patterns that are resilient to the impacts of climate change and maintain ecological balance are supported by cooperation between

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environmental conservation and technological advancement. For example, the adoption of a circular economy by the European Union increased energy efficiency and reduced primary raw material use by 17% between 2000 and 2016 (Circular Economy Action Plan (CEAP, 2020)).

Green Economy Model Framework

To achieve equitable and sustainable economic growth, the green economy framework must integrate environmental regulations and technological innovation. To implement green economic policies, this model places a high priority on cooperation between the public and private sectors, academia, and the community (WRI Indonesia, 2024). This framework provides a strategic foundation for developing development policies that promote environmental restoration and accelerate technical innovation in various economic sectors.

Previous Research**This Green, circular, bio economy: A comparative analysis of sustainability avenues**

The objective of Green Circular and Bioeconomy: A Comparative Study of Green Economy Sustainability Strategies is to find the right way to harmonize ecosystem maintenance, wise resource use, and environmentally friendly economic development. (Korhonen et al., 2017) discuss how new environmentally friendly technologies can be integrated into conventional economic models. This research also shows that environmental degradation and linear growth are not compatible. The results indicate that this technique can reduce adverse effects by encouraging cross-sector collaboration. The development of new technologies shows an increase in resource efficiency of thirty to fifty percent in various fields. These results are very important because they help build a sustainable growth model that can address climate change, which is largely influenced by technological advances. Ways to improve the world and reduce poverty: using the green economy.

Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication

This study describes the green economy as a major shift from a linear model to a framework that incorporates conventional economic indicators that take social and environmental factors into account. The study shows that technological improvements such as renewable energy sources and increased energy efficiency can reduce greenhouse gas emissions by around twenty to forty percent. Through inclusive education programs and policies, these advances can also increase community participation. An international framework is needed to achieve sustainable growth that can address climate change. A study conducted by the United Nations Environment Programme (UNEP, n.d.) shows that maintaining healthy ecosystems while reducing poverty has been successful in developing countries.

Renewable Energy Statistics 2023

Renewable Energy Data shows that the cost of renewable energy will fall by 85 percent by 2023. Two new technologies to blame are solar panels and wind turbines. The study found that these green technologies will not only reduce fossil fuel use but will also help reduce the carbon footprint of the economy. In addition, these technologies have the potential to create millions of new jobs worldwide in the energy sector. According to the data, renewable energy will exceed 1,800 GW in 2010 and will exceed 3,000 GW in 2022. Therefore, carbon dioxide emissions will be reduced by 2.5 billion tons annually. (International Energy Agency for Renewable Energy (IRENA, 2023))
The European Union Green Deal and the Circular Economy Action Plan 2020

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The European Union Green Deal, the European Union Plan for a Green Economy, and the Circular Economy Action Plan for 2020 are discussed in this paper. By using new technologies and following the principles of the circular economy, one of the goals is to reduce the use of primary raw materials by 17%. As this study shows, progress in environmental conservation and economic progress can be well balanced. Especially through improved waste management and clean energy savings, this has the potential to generate €1 trillion in green investment. Manufacturing projects that reduce pollution and increase productivity are examples of its implementation. With the help of these projects, we can see how things are done differently around the world. Circular Economy Action Plan.

Green Economy in the Digital Age

The development approach known as the green economy prioritizes agriculture and addresses social, economic, and environmental issues. Digital technologies such as the Internet of Things (IoT), artificial intelligence (AI), big data, drones, and blockchain enable us to utilize natural resources more efficiently, work faster, and reduce their negative impact on ecosystems. For example, IoT enables farmers to make better use of fertilizers and water by combining soil and weather data in real time. In addition, drones can be used to track crops and pests. Digital technology makes production cheaper and greenhouse gas emissions lower. It also opens up new markets for organic and environmentally friendly agricultural products in the United States and around the world (Juanda et al., n.d.). Furthermore, this study found many important problems. These include a lack of technology used by farmers, difficulties in obtaining funding and infrastructure, difficulties in gaining internet access for rural communities, and a lack of public understanding of the importance of protecting the environment. The government, businesses, schools, and communities must work together to address these issues. Some things that could help are improved digital infrastructure in rural areas, more training and education programs for farmers, easier access to funding, and new policies, including assistance to farmers, making it easier for the public to purchase environmentally friendly goods, and establishing community collaboration forums. If Indonesia's agricultural sector is fully implemented and supported in the long term, it has greater potential to contribute to the achievement of sustainable development goals. In addition, this sector can help address partner changes, environmental damage, and climate change (Juanda et al., n.d.).

RESEARCH METHODS

This study uses a literature review or document analysis method in a qualitative approach. This methodology was chosen because it facilitates a comprehensive understanding of the development of green economy frameworks and models that integrate technological advances with environmental sustainability. A literature review allows for the assessment of relevant concepts, theories, and empirical findings from various academic sources, regardless of their publication date.

Data

The data used in this study was obtained from websites, e-books, articles, and scientific journals discussing green economy, technological advances, and environmental protection that are accessible on Google, Google Scholar, Scindirect, and grey literature studies, namely official documents published by various credible international organizations. In classical and contemporary literature, a total of articles (2), international organizations (11), and websites (1) underpin this research using

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keywords such as “green economy,” “technological innovation,” and “environmental protection.” This research has no publication year restrictions, allowing the author to provide a broader and more in-depth coverage. The author made this selection based on the following reasons: technological advancement, environmental protection, and green economy are topics discussed in journals and scientific articles.

Methods

The author used narrative and thematic synthesis methods to conduct the analysis. Narrative synthesis integrates various research findings into a unified narrative, while thematic analysis focuses on identifying patterns, themes, and interconnections between concepts in the selected literature. Through this approach, the study can reveal trends, challenges, and opportunities related to the development of an inclusive and sustainable green economy framework and model.

RESULTS AND DISCUSSION

Results

The green economy, which finds a balance between economic growth and environmental protection, is the primary approach to supporting sustainable development, according to the author's review of thirteen works. In addition, this technique encourages increased use of resources and technologies that are beneficial to the environment. This study shows that the use of a green economy is essential to promote sustainable development because it helps balance economic growth and environmental protection. Significant economic losses are caused by changes in land cover. Investment in the environmental sector has the potential to increase profits and yields.

Table 1. Data analysis matrix on articles used in the review literature

Year	Research Methods	Heading	Name/Organization of the Researcher	Research Results
2011	Literature review and data analysis	UNEP Green Economy Report: Towards a Green Economy	United Nations Environment Programme (UNEP)	Investing 2% of global GDP in 10 key sectors can drive green economic growth and the creation of new jobs in the green sector
2021	Literature review	Intergovernmental Panel on Climate Change	IPCC	Up-to-date scientific consensus on climate change, its impacts, risks, and mitigation strategies
2022	Empirical analysis	Social Aspects of Green Economy	Adamowicz	The green economy improves human well-being and social justice through innovation and

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				resource management
2022	Data and policy studies	Renewable Energy Market Report	International Energy Agency (IEA)	Renewable energy lowers energy costs and opens up significant investment opportunities
2025	Statistical and analytical data	World Bank Environmental Data	World Bank	Environmental damage causes significant economic losses and the need for sustainable management
2021	Policy studies and innovation	OECD Green Growth and Innovation	Organisation for Economic Co-operation and Development (OECD)	Technological innovation is important in improving resource efficiency and green growth
2021	Review of literature and data	Green Jobs Report	International Labour Organization (ILO)	The transition to a green economy creates new job opportunities in the renewable energy and waste management sectors
2011	Global research synthesis	FAO Green Economy Agriculture Report	Food and Agriculture Organization (FAO)	Sustainable farming practices increase yields and reduce food waste
2017	Policies and reporting	European Green Deal Policy Framework	European Environment Agency	Framework for reducing carbon emissions and ecosystem conservation in Europe
2020	National policy studies	Indonesian Forestry and Deforestation Policy	Ministry of Environment and Forestry of the Republic of Indonesia	Moratoriums and social forestry programs reduce deforestation rates by 75%
2018	Economic and social studies	Global Commission on	Global Commission on	Transition to a green economy could create 24 million

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		the Economy and Climate Report	the Economy and Climate	global jobs and reduce carbon emissions
2019	Policy and economic studies	OECD Land Use and Deforestation Economic Analysis	OECD	Land cover change causes huge economic losses, underscores the need for a green transition
2009	Literature Study and Multistakeholder Consultation	Global Green New Deal	United Nations Environment Programme (UNEP)	A green economy combines economic growth with environmental preservation and social justice, with the principles of resource efficiency, carbon emission reduction, and good governance.
2017	Bibliometric Analysis	Green, Circular, Bio Economics: A Comparative Analysis Of Sustainability Avenues	D'Amato et al	Technology can improve resource efficiency at the industrial level in a green economy supported by this research. However, this study does not look at how digital technology works in this regard.

Discussion

This According to the author's review of the thirteen literature reviews in the table above, the green economy is the main framework for supporting sustainable development by finding a balance between economic growth and environmental protection. In addition, advances in technology that are beneficial to employment and better resource utilization encourage resource utilization and significantly reduce carbon emissions. This study also shows how new environmentally friendly technologies can help communities and improve resource utilization. The green economy has great potential to reduce environmental damage and increase the economic competitiveness of countries through the use of sectors such as sustainable agriculture, waste management, and renewable energy.

In addition, this will create millions of environmentally friendly jobs, especially in areas such as renewable energy, sustainable agriculture, and proper waste disposal. This study shows that progress towards a greener economy must be made in an environmentally friendly manner. In other words, digital technologies such as drones,

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the Internet of Things (IoT), artificial intelligence (AI), and blockchain must continue to be updated. The study also investigates how these technologies can help Indonesia make better use of its resources and reduce its carbon emissions. This is important because digital transformation and limited access to finance are major issues for the country. Compared to other studies, this literature review provides a better understanding of how new technologies affect the green economy.

The statement by (Korhonen et al., 2017) that technology can improve resource efficiency at the industrial level in a green economy is supported by this study. However, this study does not examine how digital technology functions in this regard. Digital technologies such as the Internet of Things (IoT), artificial intelligence (AI), and blockchain can help build a green economy that utilizes resources more efficiently and protects the environment (OECD, 2021).

To support social forestry policies, the Indonesian government has developed digital information systems such as the Forest Product Management Information System (SIPUHH) and the Timber Legality Information System (SILK) (Ministry of Environment and Forestry of the Republic of Indonesia, 2020). In addition, to achieve greater economic benefits while preserving the environment, the forestry industry uses a multi-company approach (Organization for Economic Cooperation and Development (OECD, 2019)). However, issues such as the need to improve employee skills and unequal access to digital technology still exist to ensure a sustainable green economic transformation (World Bank, 2025). Therefore, to produce an inclusive and sustainable green economy, advances in digital technology, cohesive policies, and human resource development must work together.

This study uses sustainable development strategies and information from previous literature to investigate the relationship between advances in digital technology and the implementation of a green economy. Artificial intelligence, the Internet of Things (IoT), and blockchain are new technologies that have the potential to improve resource efficiency and reduce their negative impact on the environment (OECD, 2021). This study shows that strong environmental protection policies and incentives are essential to encourage investment and job creation in this field (United Nations Environment Programme (UNEP, n.d.)). The transition to a green economy will create many new jobs, particularly in the agriculture and renewable energy sectors (ILO, 2021). This is in line with the results of the Author's research.

It is important to find ways to create an economy that can cope with climate change because damaging the environment will be costly. To maximize the relationship between the green economy and new technologies, we need to stop the digital technology ecosystem and improve policy compliance to achieve inclusive, sustainable, and long-term development goals. One way to achieve sustainable development is through integration (ILO, 2021).

CONCLUSION

This study shows that the use of digital technologies such as artificial intelligence (AI), the Internet of Things, and blockchain can accelerate green economic growth, benefiting all parties involved. These technologies reduce resource use and carbon emissions, opening up new businesses and more environmentally friendly jobs. Other studies show that societies can become more sustainable through improvements in environmental and financial policies, particularly in terms of waste management and renewable energy use. In addition, the results of the study show that reducing digital pollution is an important component of the success and sustainability of the green

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economy. The increase in ecotourism and the decline in deforestation in Indonesia show that cooperation in the development of new technologies and environmental policies can benefit both the economy and the environment.

SUGGESTIONS AND RECOMMENDATIONS

Research indicates that businesses should focus on environmentally friendly digital technologies, which will make everything more efficient and reduce carbon footprints. In order for everyone to be able to use environmentally friendly technologies, especially in rural areas, governments must tighten regulations and provide public funding. Scientists should investigate how the green economy and digital technology interact, especially in the broader context of society and the economy. In addition, they should learn how to implement their plans, which may change due to technological advances and climate change. To accelerate the transition to an open, environmentally friendly, and planned-up economy for all, policy, technology, and education must work together.

REFERENCES

- Adamowicz, M. (2022). Green Deal , Green Growth and Green Economy as a Means of Support for Attaining the Sustainable Development Goals.
- CEAP. (2020). Circular Economy Action Plan (CEAP) 2020 summary for business Implications and next steps.
- European Environment Agency. (2023). European Environment Agency Environmental statement 2023. <https://doi.org/10.2800/7636500>
- FAO. (2022). FOOD AND AGRICULTURE.
- IEA. (2022). World Energy Outlook.
- ILO. (2021). Trends 2021.
- IPCC. (2021). Climate Change 2023 Synthesis Report. 35–115. <https://doi.org/10.59327/IPCC/AR6-9789291691647>
- IRENA. (2023). Global landscape of renewable energy finance 2023.
- Juanda, A., Rozaki, Z., Wulandari, R., & Ikbar, R. (n.d.). Ekonomi Hijau di Era Digital.
- Korhonen, J., Leskinen, P., Matthies, B. D., & Toppinen, A. (2017). Green , circular , bio economy : A comparative analysis of sustainability avenues. 168, 716–734. <https://doi.org/10.1016/j.jclepro.2017.09.053>
- OECD. (2019). OECD Green Growth Policy Review of Indonesia 2019.
- OECD. (2021). OECD Science, Technology and Innovation Outlook 2021.
- UNEP. (n.d.). Investing In Energy and Resource Efficiency.
- UNEP. (2009). Global green new deal. March.
- World Bank. (2025). WORLD DEVELOPMENT REPORT 2025.
- Kementrian Koordinator Bidang Perekonomian Republik Indonesia. Perintah Dorong Penerapan Ekonomi Hijau untuk Stabilkan Pertumbuhan Ekonomi Jangka Panjang. [internet]. [di akses 31 oktober 2025]. Tersedia pada <https://share.google/qNWJLWjppNOyPjUb9>
- WRI Indonesia. Meninjau Keadaan Ekonomi Hijau Indonesia: Bagaimana seharusnya strategi kita melangkah ke depan?. [internet]. [di akses 31 oktober 2025]. <https://share.google/8jotVCWcS4cuck4QD>