

Integrating Digital and Green Economy Strategies for Sustainable Development

Turgunov Jasurbek Alimardon ugli

Independent researcher at Nordic International University

turgunov.jasurbek1123@gmail.com

Abstract: This article analyzes the impact of the integration of the digital economy and the green economy on the process of sustainable development. It discusses the role of digital technologies, particularly IoT, Big Data, blockchain, and artificial intelligence, in developing the green economy. During the study, the role of the digital economy in increasing environmental efficiency was studied based on foreign experience, analysis of economic indicators, and scientific articles. Also, this study is of scientific and practical importance in the digital transformation of the economy and ensuring environmental sustainability. The development directions of the green economy through digital technologies are clearly defined, and international experience in this direction is studied in depth.

Key words: digital economy, green economy, sustainable development, IoT, Big Data, blockchain, eco-efficiency, green investments.



This is an open-access article under the [CC-BY 4.0](https://creativecommons.org/licenses/by/4.0/) license

Introduction. The world is currently experiencing a transition in the digital and green economy. It is revolutionising business models, technology innovation and use, application consumption and offering, and knowledge sharing involving both human and machine spheres. Digital technologies and issues of environmental sustainability are becoming increasingly relevant. Modern technologies enable humanity to build highly efficient economic systems and provide the means to protect the environment.

According to the World Bank (2023), the digital economy contributes about 15.5% to global GDP and is growing two and a half times faster than global GDP over the past 15 years. The International Energy Agency (IEA, 2023) reports that digital technologies, especially smart grids, AI, and energy-efficient production, could help reduce 20% of global CO₂ emissions by 2030. The UNCTAD (2023) estimates that the global green economy will reach \$12 trillion by 2030, creating up to 395 million jobs, especially in renewable energy, sustainable transport, and eco-innovation.

Digital transformation - the impact of digital technologies and data and their use on existing and new activities - is accelerating worldwide, affecting all sectors. It offers immense opportunities for our economies and societies yet poses important risks that must be addressed to reap its benefits. Countries and stakeholders must collaborate in an evidence-based, whole-of-governance approach to advance a trusted, sustainable, inclusive digital future for all. (Organisation for Economic Co-operation and Development)

The concept of green economy, in the context of poverty eradication and sustainable development, will attract further attention as it will be one of two key themes at the United Nations Conference on Sustainable Development to be held in Rio in 2012 (Rio, 2012). A green economy can refer to sectors, topics, principles, and policies. It can also describe an underpinning strategy, such as mainstreaming environmental policies or a supportive economic structure.

Literature review. In recent years, the intersection of the digital economy and the green economy has received growing attention from scholars, policymakers, and international organizations. The digital economy, characterized by the widespread use of information and communication technologies (ICTs), artificial intelligence (AI), big data, blockchain, and the Internet of Things (IoT), is fundamentally transforming traditional economic structures (Bukht & Heeks, 2017). At the same time, the green economy seeks to achieve sustainable development while reducing environmental risks and ecological scarcities (UNEP, 2011). The interlink between these two paradigms has become a key driver of sustainable development in the 21st century. Digital Technologies energy consumption. Digital industry estimates that the sector consumes about 4% of global electricity demand and 1.4% of global GHG emissions (Malmodin & Lundén, 2018). The European Commission, using an NGO source, reports instead a consumption of 5-9% of the world's total electricity and more than 2% of global emissions (2020, p. 7).

Despite these promising developments, the literature also identifies several challenges. First, the energy consumption of data centers and digital infrastructures is significant and may counteract sustainability goals if not powered by renewable energy (IEA, 2023). Second, the digital divide, especially in developing countries, limits the widespread application of digital solutions for sustainable development (World Bank, 2023). Third, there is a lack of comprehensive policy frameworks that holistically integrate digital transformation and green growth strategies (UNCTAD, 2022).

Methodology. This study used various research methods to study the convergence processes of the digital and green economies.

Research methods. The study is based on the following main scientific methods:

Analytical Approach - studying the convergence process of the digital and green economies through analyzing scientific articles and international studies.

Comparative Analysis - comparing the experiences of different countries in using digital technologies in the green economy.

Data-driven Approach - formulating results based on the Green Growth Index, IMD World Digital Competitiveness Report, International Energy Agency (IEA), and other important economic reports.

The next section, using this methodology, will highlight the results of the impact of the digital economy on the green economy

The main objectives of this study are:

- ✓ To analyze the convergence processes of the digital and green economies.
- ✓ To study the role of digital technologies in developing the green economy.

✓ To analyze international experience

Results. The analysis shows that combining digital and green economies is becoming integral to sustainable development. However, this process is directly related to countries' levels of economic development, technological readiness, and public policy.

Advanced digital technologies are becoming key tools to help develop a green economy. In particular, Big Data, Artificial Intelligence (AI), the Internet of Things (IoT), blockchain, and cloud technologies are widely used to ensure environmental sustainability. These technologies create opportunities for increased energy efficiency, reduced carbon footprint, and more rational use of resources.

Table 1. Digital transformation driving green economy

Area	Contribution
Smart energy	Smart grids and IoT can reduce energy losses by up to 30%
Digital agriculture	Using AI, drones, and sensors, precision farming can improve crop yields by up to 25% while reducing resource use
Circular economy	Blockchain and digital platforms enable better tracking and recycling of materials, improving circularity rates
Sustainable mobility	AI and IoT-based traffic management systems reduce fuel consumption by up to 15% in urban areas

Table 2. The 2024 IMD World Digital Competitiveness Ranking (Top 5 countries)

№	Country	Score	Change
1	Singapore	100	↗
2	Switzerland	93.15	↗
3	Denmark	91.99	↗
4	USA	91.31	↘
5	Sweden	90.42	↗

The table presents the Top 5 countries according to the 2024 IMD World Digital Competitiveness Ranking, which assesses how well countries adopt and explore digital technologies to drive economic transformation and social well-being.

Table 3. Scores and ranks for Green Growth Index 2024 (Top 5 countries)

№	Country	Score	Level
1	Denmark	75.32	High
2	Sweden	75.09	High
3	Austria	72.32	High
4	Finland	71.69	High
5	Czech Republic	71.29	High

Sweden continues to be among the global frontrunners in digital economy development due to its strong Results and Interlink Between Digital Competitiveness and Green Growth Index. The analysis of the **2024 IMD World Digital Competitiveness Ranking** and the **Green Growth Index** reveals notable overlaps and patterns, highlighting the relationship between countries' digital transformation capacity and their commitment to green growth.

Denmark and Sweden are leading integrators. Both **Denmark** and **Sweden** appear in the **top 5** of both rankings:

Denmark ranks **third in digital competitiveness (91.99)** and **first in the Green Growth Index (75.32)**. Sweden ranks **fifth in digital competitiveness (90.42)** and **second** in the Green Growth Index (75.09).

This dual presence suggests that Denmark and Sweden are successful cases of integrating digital and green economy strategies. These countries have effectively combined advanced digital infrastructure, innovation systems, and environmental sustainability in their economic development models.

Finland's strong performance in sustainability. **While not listed in the digital top 5, Finland** secures **4th** position in the Green Growth Index (71.69) and is globally recognized for its digital readiness and sustainable development achievements. Finland may serve as an example of how environmental sustainability leads to digital transformation rather than vice versa.

Countries like **Denmark** and **Sweden**, which balance digitalization and sustainability, tend to lead digital competitiveness and green growth rankings. This supports the hypothesis that integrated digital-green economy strategies can yield stronger sustainable development outcomes than a singular focus on digitalization.

These countries' experiences show that combining digital technologies and a green economy can play a crucial role in increasing economic sustainability and reducing environmental problems.

Denmark and Sweden's green strategies are found to be similar, such as:

- ✓ Strong commitment to climate neutrality.
- ✓ Early adopters of carbon taxes.
- ✓ Leaders in renewable energy, especially wind (Denmark) and hydropower (Sweden).
- ✓ Promotion of circular economy.
- ✓ Policies designed to combine economic growth with sustainability (green economy models).

The results confirm that the synergy between digital and green transformations leads to environmental benefits and new economic and social opportunities, fostering sustainable innovation and competitiveness. Moreover, digitalization enables real-time monitoring, optimization of resource use, and the creation of intelligent systems capable of addressing complex sustainability challenges. (Table 4)

Table 4. Main directions of digital and green economy integration

Nº	Direction	Description	Examples
1	Efficient resource use	Optimization of water, energy, and raw material consumption through IoT and Big Data	Smart grids, smart water supply, digital irrigation systems
2	Development of digital and green infrastructure	Implementation of digital management systems in renewable energy and	Smart cities, digital electricity grids, and digital management of

		transport sectors	electric transport
3	Green digital finance	Financing of green projects through blockchain and digital payment systems	Green bonds, digital financial platforms, crowdfunding
4	Engagement of workforce and businesses	Providing the population and businesses with digital and ecological competencies	Training courses on digital and green skills, creation of green jobs
5	Political and institutional integration	Integrating digital and green strategies into unified national and regional policies	EU Twin Transition Strategy, smart governance

Digital technologies are key to sustainable development. In particular, artificial intelligence, IoT, and blockchain technologies optimize resource use, reduce waste, and increase transparency in green economy activities. These results indicate the need for increased collaboration between policymakers, businesses, and digital innovators. Future research should explore the long-term effectiveness of this integration and its adaptability to different economic systems.

Conclusion. Integrating digital and green economies provides a transformative pathway towards sustainable development. As demonstrated by the experiences of leading countries such as Denmark and Sweden, harmonizing advanced digital technologies with sustainable practices enables societies to drive economic growth and environmental protection simultaneously. Digital tools such as AI, IoT, big data, and blockchain provide unprecedented opportunities to enhance resource efficiency, reduce carbon emissions, promote renewable energy, and foster green innovations.

However, achieving effective integration is not without challenges. The digital divide, energy-intensive ICT infrastructures, and the lack of unified policy frameworks remain significant barriers, particularly for developing economies. Therefore, strategic planning, targeted investments, and institutional reforms are essential to ensure that digitalization supports rather than hinders green transitions. Countries must adopt comprehensive strategies combining digital transformation with green growth objectives. Such synergy improves economic resilience and competitiveness and is pivotal in addressing global climate change and promoting sustainable livelihoods. The future of sustainable development increasingly depends on the successful alignment of digital and green economy strategies at national, regional, and global levels.

Recommendations. Based on the analysis of the integration between the digital economy and the green economy, the following recommendations are proposed to enhance their harmonization and maximize their contribution to sustainable development:

1. Implement integrated policies promoting digital transformation and green economy development. Agenda plans should reflect the dual objectives of digitalization and environmental sustainability.
2. Invest in sustainable ICT infrastructure (energy-efficient data centers, smart grids, renewable-powered digital systems). Encourage the use of smart technologies in energy, transport, agriculture, and manufacturing sectors to improve resource efficiency and reduce environmental impacts.
3. **Enhance access to green digital finance:** Foster the development of digital financial platforms (blockchain-based green bonds, crowdfunding) to mobilize investments for sustainable projects. Ensure transparent and accountable mechanisms for financing green initiatives using digital tools.
4. **Encourage international cooperation:** Engage in regional and global initiatives to share knowledge, technologies, and best practices for digital and green economy integration. Align

national policies with global frameworks such as the UN SDGs, the Paris Agreement, and the Global Green Growth Agenda.

In summary, integrating digital and green economies presents considerable potential for sustainable development.

REFERENCES

1. Bukht, R., & Heeks, R. (2017). Defining, conceptualising and measuring the digital economy. *Development Informatics Working Paper*, (68).
2. European Commission. (2020). *Shaping Europe's digital future*. Brussels.
3. International Energy Agency (IEA). (2023). *Digitalization and Energy*. Retrieved from <https://www.iea.org>
4. Malmodin, J., & Lundén, D. (2018). The energy and carbon footprint of the global ICT and E&M sectors 2010–2015. *Sustainability*, 10(9), 3027.
5. UNCTAD. (2022). *Digital Economy Report 2022*. United Nations Conference on Trade and Development.
6. UNCTAD. (2023). *World Investment Report 2023: Investing in Sustainable Energy for All*. United Nations Conference on Trade and Development.
7. UNEP. (2011). *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*. United Nations Environment Programme.
8. World Bank. (2023). *World Development Report 2023: Migrants, Refugees, and Societies*. Washington, DC: World Bank.
9. IMD. (2024). *World Digital Competitiveness Ranking 2024*. International Institute for Management Development.
10. The IMD World Digital Competitiveness Ranking Report 2024
11. Green Growth Index Report 2024
12. Turg'unov, J. A. (2023). MAMLAKATIMIZDA YASHIL IQTISODIYOTNI JORIY ETISH HOLATI VA ASOSIY YO'NALISHLARI. QO'QON UNIVERSITETI XABARNOMASI, 9, 85-87. 16. <https://doi.org/10.54613/ku.v9i9.841>
13. Turgunov Jasurbek. (2024). SANOAT KORXONALARINING ATROF MUHITGA TA'SIRINI KAMAYTIRISH YO'LLARI. Yosh Tadqiqotchi Jurnali, 3(5), 15–24. Retrieved from <https://2ndsun.uz/index.php/yt/article/view/678>
14. Turgunov Jasurbek, (2024) Innovative methods for assessing the environmental impact of industrial enterprises' development based on the sustainable development goals, *Biznes-Ekspert*, "Biznes-Daily Media", 49-52
15. Turg'unov J. A, (2024) Barqaror rivojlanishni ta'minlash va atrof-muhitga ta'sirni kamaytirishda xalqaro kelishuvlarning ahamiyati, *Iqtisodiy taraqqiyot va tahlil ilmiy elektron jurnali*, Toshkent, 2024 9-son, 257-261 betlar.
16. Turg'unov J.A, Rustamov M.U, Sanoat korxonalarini yashil texnologiyalar orqali rivojlantirish yo'llari, Ta'limda yangicha yondashuv – innovatsiya sari qo'yilgan qadam xalqaro ilmiy-amaliy konferensiyasi, Qo'qon – 2024, 658-663 betlar.