https://www.sworldjournal.com/index.php/swj/article/view/swj34-03-077
DOI: 10.30888/2663-5712.2025-34-03-077

**УДК 338.24:004.8:502.131**

# SYNERGY OF DIGITAL TRANSFORMATION AND THE GREEN TRANSITION AS A DRIVER OF EU COMPETITIVENESS: LESSONS FOR UKRAINE

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***Abstract.*** *This article explores the synergy between digital transformation and the green transition as a driver of EU economic competitiveness and draws lessons for Ukraine. The EU's "twin transition" integrates digital technologies—such as AI, smart grids, digital twins, and data platforms—into climate and energy policies, enhancing productivity, innovation, and resilience while supporting climate neutrality and circular value chains. For Ukraine, this dual transition is a strategic tool for post-war recovery, EU integration, and long-term economic security. Recent progress in digitalisation, participation in the Digital Europe Programme, and renewable-energy initiatives highlight Ukraine's potential for alignment with EU strategies. Key policy priorities include developing digital skills, strengthening cyber-resilience, supporting innovative ecosystems, promoting decentralised energy, and deepening EU partnerships. The study shows that the twin transition can serve as a powerful multiplier for sustainable competitiveness, innovation, and economic recovery.*

***Key words:*** *digital transformation, green transition, EU competitiveness, twin transition, economic security, Ukraine's post-war recovery.*

## Introduction.

The European digital transformation and green transition are key drivers of the European Union's competitiveness. The combination of digital and green transitions is economically justified and embedded in EU policy frameworks. In the Digital Decade Policy Programme 2030, digital transformation is identified as a key factor in achieving climate neutrality [1]. The European Green Deal [2] highlights the role of digitalisation in reducing emissions, optimising energy consumption and ensuring a circular

economy. The European Green Deal and the Fit for initiative underline that cutting emissions by 55% by 2030 requires digital solutions such as smart grids, digital twins, and IoT applications in transport and construction, among others [2; 3]. The REPowerEU Plan also provides for the digitalisation of the energy system to accelerate the shift to renewable sources and increase energy efficiency [4].

The main challenge lies in bridging digital skills gaps and introducing digital technologies across all sectors of the economy and society while simultaneously limiting the growth of the energy intensity of digital infrastructure. Rising energy consumption can offset climate benefits and therefore requires comprehensive energy-efficiency measures to sustain the digital sector. Ultimately, this calls for the close integration of the digital and green transitions.

For Ukraine, the combination of digital and green transformations is of strategic importance as an instrument for post-war recovery, integration into the EU, and strengthening economic resilience. Recent years have shown significant progress in digitalisation. Ukraine has entered the world's top five countries in terms of digital public services, while in 2018 it ranked 102nd [5]. Ukraine's inclusion in the Digital Europe Programme in 2022 opened up additional opportunities for integration into the EU single digital market [6]. This advances synergy with the EU's digital-green strategies.

**Research results**

**Impact of Digital Transformation and the Green Transition on EU Competitiveness and Sustainable Development**

Digital transformation and the Green Transition in the European Union are understood as a deep organisational shift that redefines business models, value chains and competitive strategies through the integrated use of digital and green technologies. Over the past decade, it has evolved from basic digitisation to a strategic redesign of value creation, customer experience and operating processes [7; 8]. The Digital Decade Policy Programme [1] sets measurable targets for this transition and is supported by substantial financial commitments, with EU Member States allocating over a quarter of Recovery and Resilience Facility [9] resources to digitalisation.

Progress is particularly visible among small and medium-sized enterprises: by 2024, nearly three-quarters of SMEs had reached at least a basic level of digital intensity, and the uptake of artificial intelligence, cloud computing and big-data solutions continues to grow [10]. Despite this positive dynamic, the EU still faces a structural shortage of digital skills, which remains one of the main barriers to achieving the 2030 objectives.

EU strategic documents consistently emphasise that digitalisation is indispensable for achieving climate goals. The European Green Deal, Fit for 55 and the REPowerEU Plan [2; 3; 4] all integrate digital technologies into their climate and energy frameworks. Modernising the energy system through digital tools enables the integration of renewable energy sources, improves demand-side flexibility and strengthens the resilience of critical infrastructure. Smart grids, IoT applications, digital monitoring tools and sector-specific energy data spaces all help reduce consumption and support decarbonisation. Initiatives such as the Destination Earth programme [11] – creating high-precision digital twins of the planet—strengthen climate modelling and adaptation planning.

The transport sector demonstrates similar transformation potential. The updated framework for Intelligent Transport Systems expands real-time mobility services and promotes multimodal transport. Digital route optimisation, automated traffic management and the development of the European Mobility Data Space are expected to reduce congestion and emissions while improving the sustainability of urban mobility.

The building sector, responsible for nearly 40% of the EU's energy consumption, is also undergoing rapid digital modernisation. Smart building management systems, sensors and digital twins improve heating, cooling and electricity efficiency, supporting the implementation of the revised Energy Performance of Buildings Directive and its Smart Readiness Indicator [12].

Digitalisation is also reshaping healthcare and industry. The European Health Data Space enables cross-border access to medical data, opening new opportunities for research, diagnostics and innovation. In industry, the Ecodesign for Sustainable

Products Regulation introduces Digital Product Passports [13], which ensure traceability across supply chains and support the shift to circular production models.

Overall, digital technologies enhance productivity, efficiency and resilience while creating the conditions for achieving climate neutrality. At the same time, the growing energy consumption of data centres and digital infrastructure poses a strategic challenge, highlighting the need for energy-efficient solutions to ensure that the digital transition complements – rather than undermines – the green transition.

The digital-green synergy also has a strong security dimension. Digital platforms, open data and artificial intelligence improve monitoring of emissions and resource flows, while the security of digital infrastructure becomes a prerequisite for the EU's ability to achieve climate and energy goals.

It follows that the synergy between digital transformation and the green transition consists in their mutual reinforcement: digital technologies make climate neutrality achievable, while the green transition stimulates demand for innovative digital solutions. Together, they form the basis for a competitive, sustainable and secure European economic model.

**Impact of Digital and Green Transformation on Ukraine's Recovery and Economic Security, and Recommendations for Ukraine**

For Ukraine, the combination of digital and green transformations is of priority importance. This synergy is part of post-war recovery and integration into the European Union and at the same time an instrument for strengthening economic resilience and energy independence. Ukraine has made significant progress in the digital sphere. In 2022, the country joined the Digital Europe Programme, gaining access to the EU single digital market and to joint projects in cybersecurity, digital innovation and skills development [14]. A notable example is the Diia platform, used by more than 22 million citizens and providing over 140 electronic services. This tool has ensured not only convenience but also the resilience of public administration during wartime, confirming Ukraine's potential as a digital partner of the EU [15].

At the same time, the country is actively developing the green transition despite the devastating consequences of the war. The share of renewable energy in total energy

consumption increased from 3.9% in 2014 to 9.2% in 2020 [16]. National companies are shaping large-scale investment strategies. In particular, the "30 GW by 2030" strategy provides for large private investments in renewable energy of around €35–40 billion [17].

The combination of digital and green innovations creates not only domestic opportunities for Ukraine but also enhances its foreign-policy role. Digital transformation builds the infrastructure for integration into the EU's digital and green space. It enables transparent resource management, monitoring of reconstruction and control of financial flows. During the war, data from unmanned systems, artificial intelligence and cybersecurity became a strategic competitive advantage, turning Ukraine into an important digital partner of the West. Thus, the "twin transition" in Ukraine is not only a technological or energy strategy but also a comprehensive model of recovery and integration based on economic resilience, climate responsibility and innovation.

Therefore, sustainable competitiveness has become a strategic priority for the EU, shaping the logic of digital and green transformation. The synergy of digital and green transitions provides the EU with a unique opportunity to combine economic development with climate objectives, making innovation an instrument of resilience. For Ukraine, this experience is of critical importance, as the twin green and digital transition becomes not only a condition for integration into the EU but also a model for recovery and long-term economic security.

Integration into European policies in the field of digital and green transformation is not only a strategic objective for Ukraine, but also an opportunity to take advantage of recovery prospects. Accession to the Digital Europe Programme and the implementation of large-scale renewable energy projects demonstrate the country's ambition to synchronise with the EU and at the same time enhance its own resilience. To maximise the benefits of the digital and green transition, Ukraine needs to invest in the development of digital skills, which are the foundation for innovative growth; ensure the cyber-resilience of critical sectors; support innovative ecosystems that bring together business, science and the state; and strengthen partnership with the EU in the

sphere of the "twin transition". Only a comprehensive implementation of these areas can ensure sustainable, secure and competitive development for both the EU and Ukraine. The EU's experience shows that the combination of digital technologies and the green economy creates a powerful multiplier effect, simultaneously increasing productivity, energy efficiency and innovation capacity [2; 4].

First, it is necessary to invest in the development of digital skills and digital education. As of 2023, only about 54% of Ukrainian citizens had basic digital skills, while the EU average exceeded 70 per cent [10]. This gap may become a barrier to full integration into the European digital space; therefore, state policy should include large-scale educational programmes and support for reskilling initiatives.

Second, strengthening the cyber-resilience of critical infrastructure must be a priority. Ukraine's participation in the Digital Europe Programme and the EU Cybersecurity Reserve [18] should be complemented by the creation of its own Security Operations Centres (SOC), certification mechanisms and integration into the European system for incident data exchange. This will help reduce the vulnerability of the economy to external threats.

Third, the green transition should become the basis for energy independence and the reduction of dependence on fossil fuel imports. Ukraine already has an ambitious "30 GW by 2030" strategy, but its implementation requires access to EU investment instruments, in particular InvestEU and the Just Transition Mechanism. The development of decentralised energy, including rooftop photovoltaic installations, is of particular importance.

Fourth, it is necessary to support innovative ecosystems that unite business, science and government institutions. The integration of Ukrainian companies and start-ups into Horizon Europe and EIT Digital programmes creates opportunities for the development of solutions at the intersection of digital and green technologies, from smart-grid systems to AI-based production optimisation.

Finally, strategic partnership with the EU is of critical importance. Participation in digital and climate initiatives should be complemented by political dialogue on Ukraine's integration into the EU internal market in the areas of energy, digital services

and data protection. This will not only strengthen resilience but also ensure Ukraine an active role in shaping the future model of European economic security.

**Conclusion.**

The synergy of digitalisation and the green transition shapes a new model of European competitiveness. Digital technologies are becoming a necessary condition for achieving climate goals, while the green course creates incentives for the development of innovative solutions in energy, transport and industry. This green and digital transition strengthens economic resilience, ensures control over strategic resources and reduces dependence on external suppliers.

For Ukraine, integration into European policies in the field of digital and green transformation is not only a strategic objective but also an opportunity to take advantage of recovery prospects. To maximise the benefits of the dual transformation, Ukraine should focus on several key policy directions:

- Investing in digital skills and human capital.
- Strengthening cyber-resilience in critical sectors.
- Using the green transition as a foundation for energy independence.
- Supporting innovative ecosystems.
- Deepening strategic partnership with the EU.

Thus, the digital-green transformation should become a key driver of Ukraine's post-war recovery, integration into the EU and the strengthening of economic security and sustainable competitiveness.

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***Аннотація***. *У статті досліджується синергія цифрової трансформації та «зеленої» трансформації як драйвера конкурентоспроможності Європейського Союзу та її значення для України. В ЄС цифрові технології інтегровані у політики щодо клімату, енергетики, «зеленого переходу» та інші, що забезпечує підвищення продуктивності, інноваційності та економічної стійкості, сприяє досягненню кліматичної нейтральності та впровадженню циркулярної економіки. Показано, що в ключових секторах: енергетиці, будівництві, охороні здоров’я та промисловості, цифрові рішення забезпечують оптимізацію споживання ресурсів, зменшення викидів і підвищення ефективності.*

*Для України синергія цифрової і «зеленої» трансформацій є стратегічним інструментом післявоєнного відновлення, інтеграції в ЄС та зміцнення економічної безпеки. Оцінено прогрес країни у цифровізації та реалізації «зеленої» політики, включно з участю в Digital Europe Programme та розвитком відновлюваної енергетики. Виокремлено ключові напрями політики: розвиток цифрових компетенцій, зміцнення кіберстійкості критичних секторів, підтримка інноваційних екосистем, розвиток децентралізованої енергетики та поглиблення стратегічного партнерства з ЄС. Обгрунтовано, що синергія цифрових і «зелених» трансформацій здатна створювати мультиплікатор економічного розвитку, інновацій та сталої конкурентоспроможності, забезпечуючи одночасно економічну стабільність і інтеграцію України у європейський простір.*

***Ключові слова:*** *цифрова трансформація, зелений перехід, конкурентоспроможність ЄС, подвійний перехід, економічна безпека, післявоєнне відновлення України.*

Статтю надіслано: 20.11.2025 г.