**Література**

1. Цілі сталого розвитку в Україні. URL: https://www.undp.org/uk/ukraine/tsili-staloho-rozvytku.
2. United Nations Industrial Development Organization. *Industrial Development Report 2024: Structural Change for Inclusive and Sustainable Industrial Development.* Vienna: UNIDO, 2024. URL: https://www.unido.org/resources-publications
3. United Nations Conference on Trade and Development. *Trade and Development Report 2024: Development Prospects in a Fragmented World.* Geneva: UNCTAD, 2024. URL: https://unctad.org/publications
4. Organisation for Economic Co-operation and Development. *OECD Business and Finance Outlook 2023: Sustainable Resilience in Global Trade.* Paris: OECD Publishing, 2023. URL: https://www.oecd.org/publications.
5. European Parliament and Council. Regulation EU 2023/956 of the European Parliament and of the Council. 10 May 2023 Establishing a carbon border adjustment mechanism. Brussels: Official Journal of the European Union, 2023. URL: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32023R0956.

UDC 631.1(71)

**Natalia HRETSKA,** Candidate of Economic Sciences State Organization «Institute for Economics and Forecasting of the National Academy of Sciences of Ukraine», Kyiv Ukraine

**Ihor HRETSKYI,** Candidate of Biological Sciences Kyiv National University of Technologies and Design, Kyiv Ukraine

## DIGITAL TECHNOLOGIES AND THE EUROPEAN GREEN DEAL: STRATEGIC PATHWAYS FOR SUSTAINABLE ENTERPRISE DEVELOPMENT

The digital transformation of the agricultural sector has become one of the key preconditions for achieving the environmental, climate and economic objectives of the European Green Deal. Under conditions of resource constraints, climate instability, biodiversity loss and increasing pressure on food systems, digital technologies should be considered not only as instruments of technological modernization, but also as

strategic tools of sustainable management [1, 2]. Their relevance is especially evident for enterprises operating under global turbulence, stricter ecological regulation and the need for post-crisis adaptation. For this reason, digitalization should be analyzed within the broader framework of strategic management of socio-economic development, where ecological efficiency, resilience and competitiveness are closely interrelated [3].

The European Green Deal established a new development paradigm based on climate neutrality, resource efficiency, circularity and reduced environmental pressure. In agriculture, these priorities are implemented through the Farm to Fork Strategy, biodiversity protection measures and the renewed Common Agricultural Policy. In this context, digital technologies perform a systemic function, since they enable environmental monitoring, support evidence-based managerial decision-making and improve compliance with ecological standards [1, 4]. The experience of the European Union demonstrates that digital monitoring tools have become an integral component of contemporary agro-environmental governance, combining productivity goals with ecological responsibility [1].

From an economic perspective, digital technologies contribute to the achievement of Green Deal objectives through several interrelated channels. First, they increase resource efficiency by reducing excessive use of water, fertilizers, pesticides, fuel and energy. Internet of Things sensors, automated control systems, satellite monitoring and data-driven platforms allow enterprises to manage production processes with much higher precision. This decreases production costs while simultaneously lowering negative impacts on soils, water resources and air quality [2, 5]. Second, digital tools improve the quality of managerial decisions by providing real-time data on soil moisture, vegetation health, nutrient balance and environmental risks. In this way, digitalization supports a shift from reactive management to predictive and preventive management [6].

A particularly important role belongs to remote sensing technologies, including Copernicus services, Sentinel satellites, unmanned aerial vehicles and geographic information systems. These instruments allow enterprises and regulators to monitor land use, detect signs of erosion, assess vegetation indices and identify environmental stress zones with a high degree of spatial precision [5, 6]. The economic significance of these technologies lies in their ability to optimize land-use practices, improve yield forecasting and reduce uncertainty in strategic planning. Thus, digital monitoring transforms ecological data into a strategic managerial asset that strengthens both environmental and economic performance [5].

Artificial intelligence and analytical digital platforms further deepen this

transformation. By integrating heterogeneous data flows, they make it possible to model production scenarios, forecast environmental risks and optimize input application at the field level. For enterprises, this means better cost control, lower waste and improved operational efficiency. For public policy, it means a stronger evidence base for implementing Green Deal instruments, assessing eco-schemes and verifying compliance with environmental commitments [1, 3]. Research on EU experience confirms that the highest effectiveness is achieved when individual digital tools are integrated into a coherent ecosystem of environmental management rather than applied in isolation [1, 6].

The diffusion of digital technologies, however, is not free from constraints. High investment costs, uneven digital infrastructure, insufficient digital competencies, weak interoperability of data systems and unresolved issues of data ownership remain substantial barriers [3, 6]. For many enterprises, especially small and medium-sized ones, the economic benefits of digitalization may be limited by initial capital shortages and lack of institutional support. Therefore, the contribution of digital technologies to Green Deal implementation depends not only on technological progress itself, but also on the quality of policy design, advisory support, training systems and access to digital public goods [3, 4].

For countries pursuing European integration and economic recovery, this experience is particularly important. In the case of Ukraine, digital technologies can become a strategic instrument of agricultural modernization and ecological reconstruction. Their adoption could support more efficient resource use, higher enterprise resilience, improved access to European markets and harmonization with EU environmental standards. From the viewpoint of enterprise management, digitalization should therefore be incorporated into long-term development strategies not as an auxiliary technical innovation, but as a core component of sustainable competitiveness [1, 2].

In conclusion, digital technologies should be interpreted as a strategic instrument for achieving the objectives of the European Green Deal because they simultaneously improve ecological performance, resource efficiency, managerial quality and institutional transparency. Their impact goes far beyond technological upgrading and directly affects the socio-economic development of enterprises under conditions of climate pressure, regulatory transformation and global uncertainty. Further research should focus on measuring the economic returns of digital environmental monitoring, evaluating the payback of digital investments for different types of enterprises and adapting the EU model of green digital transformation to the conditions of national

recovery and sustainable development [1, 3].

## References

1. Garske B., Bau A., Ekardt F. Digitalization and AI in European Agriculture: A Strategy for Achieving Climate and Biodiversity Targets? *Sustainability*. 2021. Vol. 13/ No. 9. Art. 4652. DOI: https://doi.org/10.3390/su13094652

2. Kalatzis N., Paraskevopoulos M., Routis G., Liampotis N. Smart Farming Data and IoT in Support of Agricultural Policy Monitoring. *International Conference on Omni-layer Intelligent Systems* (COINS). 2024. P. 1–8. DOI: https://doi.org/10.1109/COINS61597.2024.10622371

3. Kubata K., Galba A., Šilerová E., et al. Practical Use of Agriculture 4.0 Digital Technologies to Meet the EU's Strategic Goals in Czech Agriculture. *AGRIS on-line Papers in Economics and Informatics.* 2024. Vol. 16. No. 2. P. 51–61. DOI: https://doi.org/10.7160/aol.2024.160205

4. Bellon-Maurel V., Piot-Lepetit I., Lachia N., Tisseyre B. Digital agriculture in Europe and in France: which organisations can boost adoption levels? *Crop & Pasture Science.* 2023. Vol. 74, No. 3. P. 241–254. DOI: https://doi.org/10.1071/CP22065

5. Klerkx L., Jakku E., Labarthe P. A review of social science on digital agriculture, smart farming and agriculture 4.0: New contributions and a future research agenda. *NJAS: Wageningen Journal of Life Sciences*. 2019. Vol. 90–91. Art. 100315. DOI: https://doi.org/10.1016/j.njas.2019.100315

6. Wolfert S., Ge L., Verdouw C., Bogaardt M.-J. Big Data in Smart Farming – A Review. *Agricultural Systems.* 2017. Vol. 153. P. 69–80. DOI: https://doi.org/10.1016/j.agsy.2017.01.023