MODERN DIGITAL PRACTICES FOR SUSTAINABLE DEVELOPMENT: ANALYSIS OF WORLD EXPERIENCE

Inna Tiutiunyk [1], Olena Chygryn [2], Liliia Khomenko [3],

[1] *Dr. Sc., Professor, Department of Financial Technologies and Entrepreneurship, Sumy State University, Sumy, Ukraine*
[2] *Dr. Sc., Professor, Department of Marketing, Sumy State University, Sumy, Ukraine*
[3] *Ph. D., Department of Marketing, Sumy State University, Sumy, Ukraine*
* Corresponding author: Inna Tiutiunyk, e-mail: i.tiutiunyk@biem.sumdu.edu.ua

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Abstract: Digital technologies are critical in ensuring sustainable development, contributing to economic growth, social equality and environmental security. The article reviews modern digital practices and their impact on achieving the Sustainable Development Goals and also analyses international experience in applying innovative technologies in various spheres of society. The study assesses the role of artificial intelligence, big data, the Internet of Things, blockchain and financial technologies in shaping sustainable economic models and improving resource management. In particular, the impact of digital financial technologies on expanding access to banking services and lending for vulnerable population groups is highlighted, contributing to economic inclusion. The development of e-commerce and digital platforms allows small businesses to enter global markets, which positively impacts the competitiveness of economies. The environmental aspect of digitalisation includes the development of "smart" cities, the implementation of IoT solutions for environmental monitoring and efficient management of energy resources. Digital environmental platforms facilitate monitoring of air, water and soil pollution and help automate waste management processes. The use of blockchain in tracking supply chains allows for transparency of business processes, promoting enterprises' environmental responsibility. The social aspect of digital transformation includes improving access to quality education through online courses, digital platforms and adaptive learning based on artificial intelligence. Such technologies allow for personalisation of the educational process, making it more effective and accessible to the general public. An analysis of the European Union's financial investments in digital transformation indicates a significant level of funding for the development of artificial intelligence, quantum technologies, cloud computing and digital infrastructure. At the same time, the article considers key challenges of digitalisation, including the growth of digital inequality, cybersecurity issues, the need to regulate artificial intelligence and the problems of e-waste management. The article also presents recommendations for the effective use of digital technologies for sustainable development. The study results can shape digital transformation strategies that promote balanced economic growth, environmental sustainability, and social equality.
Keywords: digital technologies, artificial intelligence, sustainable development, digital transformation, financial technologies, Internet of Things, blockchain.

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1. Introduction. Digital technologies are central to achieving the Sustainable Development Goals (SDGs) as they contribute to economic growth, social well-being and environmental sustainability. Their potential is based on process automation, big data analytics, artificial intelligence, the Internet of Things (IoT) and other innovations that help to use resources efficiently and minimise the negative impact of human activities. In particular, financial technologies (FinTech) expand access to banking services for millions of people who do not have a traditional bank account, e-commerce and digital platforms create new opportunities for small businesses and entrepreneurs around the world, automation and digitalisation of production contribute to increased productivity and sustainable economic growth (Khalimonchuk et al., 2024; Li et al., 2024). All this contributes to the implementation of SDGs 1, 8, and 9 related to poverty eradication and economic development. Improving the quality of education and access to knowledge is ensured by the implementation of SDG 4, within the framework of which online education and digital platforms provide access to quality knowledge regardless of geographical location, interactive technologies (VR, AR) improve the assimilation of educational material, and adaptive learning based on artificial intelligence personalises the educational process, making it more effective. In turn, SDGs 6, 7, 11, 13, 14, and 15 ensure environmental sustainability and resource conservation by developing "smart" cities and IoT solutions that optimise energy consumption, transport management and waste disposal. Digital environmental monitoring systems help control water, air and soil pollution, and automated agricultural technologies contribute to the rational use of water and land. Social equality and digital inclusion (SDGs 5, 10) are ensured by the formation of digital platforms that contribute to the empowerment of women through access to knowledge, finance and entrepreneurship, the use of artificial intelligence and Big Data that help identify discrimination and improve social policy, access to the Internet and digital technologies, which allows eliminating the gap between urban and rural areas (Madon & Masiero, 2025). The article's purpose is to analyse modern digital practices that contribute to achieving sustainable development goals and to study the world experience of implementing innovative technologies in environmental, social, and economic sustainability

2. Literature Review.

A significant number of scholars have studied the implementation of digital practices for the implementation of sustainable development goals. Koebe P. (Koebe, 2025) examines the role of digital technologies and artificial intelligence in achieving the Sustainable Development Goals (SDGs) related to health. The article analyses the impact of big data and automated diagnostic systems on improving access to health services and the effectiveness of treatment. The author emphasises that implementing these technologies can reduce health inequalities and contribute to the sustainable development of the global health system. At the same time, Sun T., Di K., Hu J., Shi Q. & Irfan M. (Sun et al., 2025) investigate how digital technologies contribute to developing environmentally sustainable public services in regions vulnerable to environmental change. Using SEM-ANN analysis, the authors assess the impact of digital platforms on the effectiveness of environmental governance and increasing public awareness. The article highlights that digitalisation can minimise environmental risks and improve access to "green" public services, contributing to the sustainable development of regions. Maldonado-Canca L. A., Cabrera-Sánchez J. P., Gonzalez-Robles E. M. & Casado-Molina A. M. (Maldonado-Canca et al., 2024) analyze the impact of artificial intelligence (AI) on marketing management based on the perspectives of company executives. The study shows that AI optimises market segmentation, predicts consumer behaviour, and improves content personalisation, increasing marketing strategies' effectiveness. The authors emphasise that flexible management approaches and adaptation of business models are necessary for successfully integrating AI into marketing. Tatli H. S., Yavuz M. S. & Ongel G. (Tatli et al., 2023) investigate the impact of digital literacy on firm performance and the role of task performance as a mediator in this process. The authors find that high levels of digital literacy contribute to improved employee productivity, which positively impacts overall business performance. The paper highlights the importance of investing in employees' digital skills to enhance firms' competitiveness. Wang S. & Zhang H. (Wang & Zhang 2025) examine how digital transformation contributes to sustainable innovation and performance in small and medium-sized enterprises (SMEs), considering technological strategies, organisational dynamics, and adaptation to the external environment. The authors emphasise that integrating digital technologies improves businesses' competitiveness and environmental sustainability, allowing enterprises to respond more quickly to market challenges. The study confirms that successful digital transformation requires agile management and strategic planning. Yu T., Zhang Y., Jia S. & Cui X. (Yu et al., 2025) investigate the spatiotemporal evolution and factors of the relationship between digital infrastructure development and inclusive green growth. The authors use quantitative models to assess the level of coordination between digital technology and environmentally sustainable development, revealing regional differences. The study highlights that effective digital transformation can promote green economic growth, but adaptive management strategies are needed to achieve a sustainable balance. At the same time, it is important to research modern artificial intelligence practices that will contribute to implementing the principles and ideas of sustainable development.

3. Results.

Digital technologies allow for collecting, analysing and interpreting large amounts of data, which helps to make better decisions on resource use and process optimisation. In particular, data processing and tracking of its use in the production, transportation, and use of goods helps to detect excessive resource use and identify opportunities for its more efficient use. Data analytics allows for forecasting demand for goods and services, which allows local businesses to effectively plan production and manage inventories, reducing unsold goods and waste. The optimisation of recycling and reuse processes allows for identifying optimal ways to recycle waste and use secondary resources. Data analysis helps to identify potential markets for secondary materials and find ways to use them. Data processing can help create digital platforms for exchanging used materials and resources between different businesses. This creates circular material flows and reduces the need for new resources. At the same time, data processing can be used to model and optimise production and business processes to reduce waste and increase resource efficiency. This may include modelling different scenarios and identifying optimal solutions to improve production processes.

The last 5 years have seen significant progress in digital innovation and industrial policy, which have created a unique and dynamic European ecosystem. Based on connectivity, edge nodes, high-performance computing (HPC), quantum chips and start-ups, this ecosystem supports the EU's green transition and digital transformation, thereby increasing its competitiveness. Strengthening the EU's technological leadership is crucial to accelerate its progress towards the goals and objectives of the Digital Decade. The artificial intelligence market is projected to grow to $407 billion by 2027, exhibiting a compound annual growth rate of 37.3% between 2023 and 2030. Figure 1 shows the level of adoption of artificial intelligence (AI) and generative artificial intelligence (Generative AI) in business from 2017 to 2024.

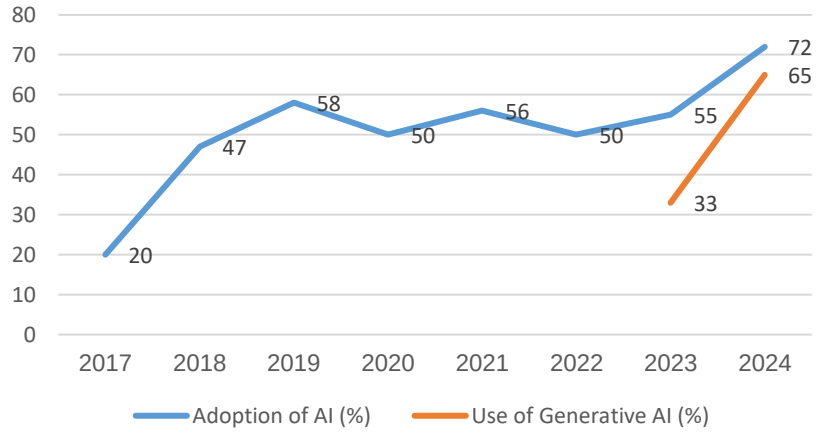

Figure 1. Implementation Level (AI) and Generative AI.
Source: created based on McKinsey (2024).

The blue line shows overall AI adoption (% of companies using AI for at least one business function). Since 2017, AI adoption has increased from 20% to 72% in 2024. The most considerable growth was observed in 2018 (47%), followed by 2024 (72%). In 2020-2022, there was some decline and stabilisation (fluctuations between 50-56%). The orange line represents the use of Generative AI, which actively appeared in 2023. In 2023, 33% of companies used Generative AI, and in 2024, this figure increased to 65%, indicating the rapid spread of this technology. As shown in Table 1, with global efforts estimated at €205 billion over the past few years, the EU has fully used its funding potential to support the Digital Decade.

Table 1. EU investments under the Digital Agenda.

Fund	Total	RRF* (2020-2026)	Cohesion (2021-2027)	DIGITAL (2021-2027)	Horizon (2021-2024)	CEF Digital (2021-2027)
Total funding	957 422	651 670	260 896	7 948	35 199	1 709
Digital funding	204 583	150 037	31 063	7 948	13 826	1 709
Digital funding %	21%	23%	12%	100%	39%	100%
Funding DD general objectives	27 488	14 129	4 392	1 275	7 320	373
Total target budget	177 096	135 909	26 672	6 673	6 506	1 336
Basic digital skills	15 405	14 294	950	128	34	0
ICT specialists	10 881	9 506	633	661	73	8

Fund	Total	RRF* (2020-2026)	Cohesion (2021-2027)	DIGITAL (2021-2027)	Horizon (2021-2024)	CEF Digital (2021-2027)
Gigabit networks	14 003	11 628	2 164	4	0	206
5G	3 362	1 967	115	4	396	879
Semiconductors	18 200	14 801	0	1 396	2 004	0
Edge nodes	609	0	0	220	355	35
Quantum computing	1 918	866	0	293	669	90
Cloud computing	8 373	6 019	1 584	370	337	63
Data analytics	7 552	4 718	1 584	546	678	26
Artificial intelligence	9 386	5 278	1 584	1 227	1 266	30
Digital late adopters	19 885	14 154	4 753	674	304	0
e-health	15 233	13 604	1 280	163	187	0

* - Recovery and Resilience Facility
Source: created based on European (2024).

Table 1 provides data on digital funding in different European programmes, showing the total funding amounts and the detailed distribution of funds between different funds and priorities. The total funding level is €957,422 million. Digital funding accounts for €204,583 million, which is 21% of the total budget. The percentage of digital funding varies from 12% (Cohesion Fund) to 100% in DIGITAL and CEF Digital. Funding Digital Decade's general objectives amounts to €27,488 million for general digital objectives. The primary sources are RRF (€14,129 million), Horizon (€7,320 million) and Cohesion (€4,392 million). Thus, the priority of funding for developing digitalisation is traced to where digital projects receive significant funding, especially within the RRF and Horizon programmes. At the same time, the focus on infrastructure and skills is maintained, with substantial investments in artificial intelligence, semiconductors, cloud computing and 5G. Another promising aspect is the development of digital government services, with funding for e-health and e-ID contributing to improved e-governance. Figure 2 shows the level of investment by industry in AI and Generative AI.

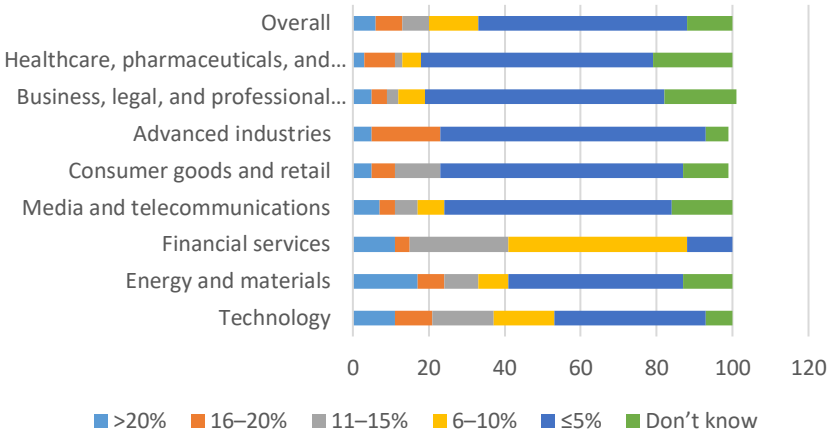

Figure 2. Investment in AI and Generative AI.
Source: created based on McKinsey (2024).

Analysing the figure, we can conclude that most industries invest ≤5% of their digital budget in Generative AI, with the largest share of respondents in each industry allocating less than 5% of their budget to Generative AI. This indicates a cautious approach to the implementation of Generative AI technologies. In turn, advanced industries and financial services have the most significant investments in Generative AI (over 11% of their digital budget). This is explained by the fact that these sectors actively use AI for automation, data analysis and improving customer service. At the same time, the legal and healthcare industries have a significant share of companies that are unsure about their investments in Generative AI, which may be due to regulatory restrictions and ethical issues surrounding the use of AI in these areas. Although the technology industry uses AI the most, a significant % of companies (40%) invest less than 5% of their digital budget in Generative AI. This indicates a cautious transition from analytical to generative AI.

Global banks are investing heavily in digital technologies to improve efficiency, enhance customer experience, and remain competitive in the digital transformation landscape. Key spending areas include AI, blockchain, Big Data, Cloud Computing, FinTech solutions, and cybersecurity. The established processes

are characterised by annual cost growth, with IT spending in the financial sector growing by 10–15% year-on-year in 2022. Banks are implementing intelligent chatbots, automated analytics, and AI for risk prediction. In addition, over 60% of global banks are already using or planning to implement cloud solutions to optimise costs and improve security. Due to the rise in cyber threats, banks spend up to 20% of their IT budget on cybersecurity and data protection. JP Morgan Chase invests about $15 billion annually in digital transformation, focusing on AI and cybersecurity (JPMorgan, 2023).

Figure 3 shows banks' spending on digital technologies.

A significant increase in spending occurred after 2019, as banks began to invest more actively in digital transformation to support customers and optimise business processes. There was an increase in investment in technology, in particular, the share of IT spending has been constantly increasing, reaching 20% in 2022 (Li et al., 2025).

Sustainable development is a global priority, aiming to balance economic growth, environmental protection, and social well-being. The United Nations' SDGs outline a roadmap for achieving sustainability by 2030. In this context, digital technologies play a transformative role, offering innovative solutions to address environmental, economic, and social challenges.

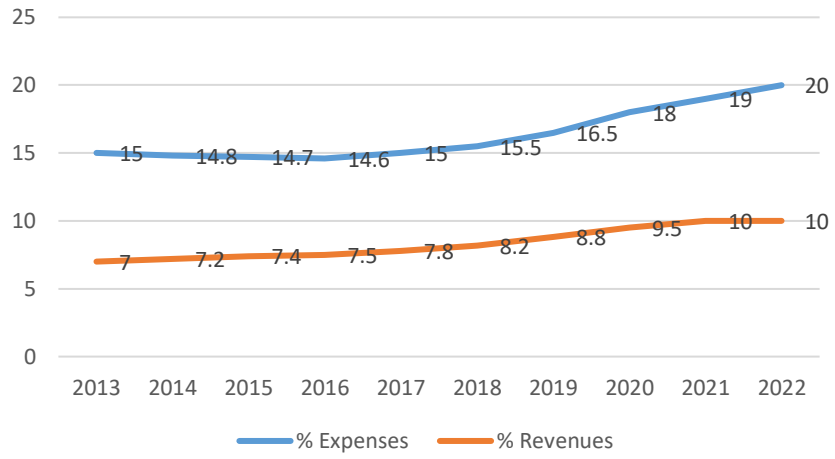

Figure 3. Banks' spending on digital technologies.
Source: created based on McKinsey (2024).

Key Digital Practices for Sustainable Development include:

– *big data and AI for environmental protection*, where artificial intelligence and big data analytics enable real-time monitoring and predictive modelling of environmental conditions. These technologies help in climate change analysis (AI-driven models predict extreme weather patterns, aiding disaster preparedness), air and water quality monitoring (IoT sensors collect and analyse pollution levels, supporting better regulatory measures), and biodiversity conservation (AI-powered image recognition tracks endangered species and detects illegal deforestation or poaching). An example could be Google's AI-powered Environmental Insights Explorer, which helps cities reduce carbon emissions by providing accurate data on energy consumption and air pollution (Figure 4).

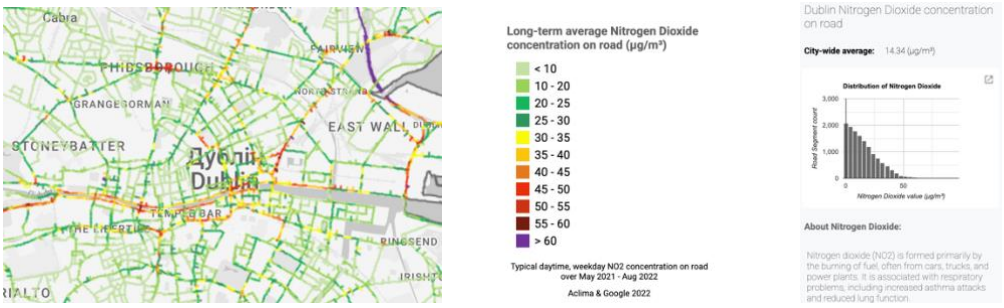

Figure 4. Google's AI-powered Environmental Insights Explorer: a case for Dublin.
Source: created based on the Environmental Insights Explorer

– *smart cities and sustainable urban development*, which leverage digital technologies to optimise urban infrastructure and reduce environmental impact**.** These approaches consist of energy-efficient buildings (AI-driven automation adjusts lighting, heating, and cooling to reduce energy consumption),

Intelligent transportation systems (real-time data helps improve traffic flow and reduce emissions), waste management solutions (IoT-enabled smart bins monitor waste levels and optimize collection routes). In that case, Barcelona illustrated a smart city initiative and implemented sensor-based traffic management and smart lighting, leading to 30% energy savings (Shao et al., 2025);

– *blockchain for transparency and sustainable supply chains* enhances traceability, accountability, and ethical sourcing across industries. It enables supply chain transparency, and consumers and businesses can verify the origins of products, ensuring ethical labour practices and sustainable sourcing (Wang & Zhang, 2025). Also, carbon credit trading based on blockchain carbon credit systems can prevent fraud and ensure accountability in emissions reduction. Simultaneously, the waste management tracking will ensure proper recycling and disposal of electronic and plastic waste. The advantages of using blockchain include ensuring data security and reliability, the absence of intermediaries, and the efficiency and transparency of transactions. Blockchain allows data to be stored securely and protected from manipulation and alteration through cryptographic methods. The absence of transaction intermediaries saves cost and time and reduces fraud and abuse risks. Blockchain provides transparency, as users can verify transactions and data in blocks (Xie & Wang, 2025). Thus, IBM Food Trust Blockchain helps reduce food waste by tracing products across the supply chain, improving efficiency and sustainability;

– *digital finance and green fintech* are vital in supporting sustainable projects and investments. Such innovations include green digital banking (banks offer sustainability-linked loans and investment portfolios focusing on eco-friendly projects), crowdfunding for renewable energy (platforms like SolarCoin incentivise solar energy production), and carbon footprint tracking apps (help individuals and businesses monitor and reduce their emissions) (Spaho et al., 2024). Ant Group's "Ant Forest" initiative uses a gamified app to encourage tree planting, resulting in over 122 million trees planted in China;

– *e-governance and digital public services* enhance transparency, efficiency, and citizen participation. In particular, modern e-governance solutions include paperless government services (digital IDs and online document verification reduce paper waste), open data platforms (citizens access real-time environmental and economic data for informed decision-making), and smart agriculture policies (governments use AI-driven insights to implement sustainable farming policies). As an example of e-government implementation, Estonia has significantly reduced bureaucracy and improved sustainability by digitising nearly all government services. Thus, Figure 5 illustrates government strategies covering open data initiatives in EU.

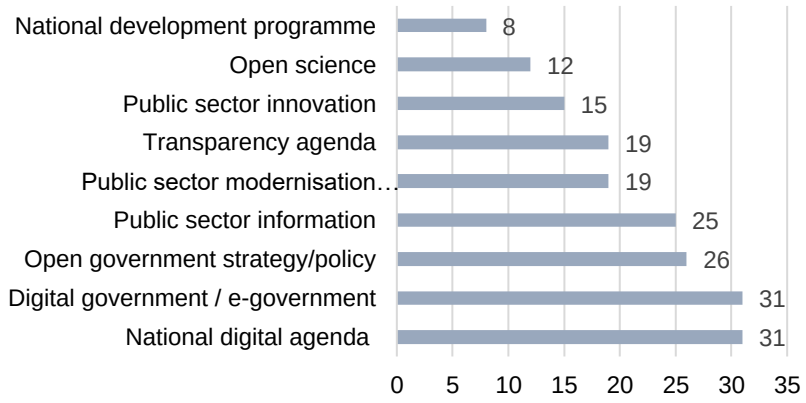

Figure 4. Government strategies covering open data initiatives in EU.
Source: created based on OECD (2018).

The chart (Figure 5) shows that EU governments are most likely to include open data in their digital and e-government initiatives, while integration into national development programs is less common.

The integration of digital technologies into sustainable development presents immense opportunities for addressing environmental, social, and economic challenges. From AI-powered environmental monitoring to blockchain-enabled transparent supply chains**,** digital solutions are reshaping sustainability efforts worldwide (Zhang et al., 2025).

4. Conclusions.

To fully leverage these advancements, investing in green computing by enhancing energy efficiency in data centres and adopting renewable energy sources is crucial to promote digital literacy to ensure equitable access to technology through education and training, strengthen regulatory frameworks for responsible AI use, e-waste management, and sustainable digital practices, foster cross-sector collaboration among governments, businesses, and civil society to drive innovation in digital sustainability. However, the transition to a digital-driven sustainable future must be accompanied by responsible implementation to mitigate risks

such as energy-intensive computing, increasing e-waste, and digital inequality. By embracing inclusive, transparent, and eco-conscious digital policies, societies can harness technology to create a more sustainable, resilient, and equitable world.

Digital technologies play a key role in achieving the SDGs, contributing to economic growth, social well-being and environmental sustainability. Analysis of global experience shows that the introduction of artificial intelligence, big data, the IoT and blockchain technologies helps to optimize resource use, increase management efficiency and reduce the negative impact of human activities on the environment. To maximize the potential of digitalization, it is necessary to: invest in "green" digital technologies, increasing the energy efficiency of data centers and introducing renewable energy sources; promote digital inclusion through equal access to technologies and educational programs; improve regulation in the areas of artificial intelligence, digital finance and e-waste management; strengthen intersectoral cooperation, involving governments, business and civil society in the development and implementation of digital solutions for sustainable development. Responsible adoption of digital technologies will enable society to create a more sustainable, innovative, and equitable future, where digitalization works for the benefit of people and the planet.

Conflicts of Interest: Authors declare no conflict of interest.

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СУЧАСНІ ЦИФРОВІ ПРАКТИКИ СТАЛОГО РОЗВИТКУ: АНАЛІЗ СВІТОВОГО ДОСВІДУ

Інна Тютюнник, д.е.н., кафедра фінансових технологій та підприємництва, Сумський державний університет, Суми, Україна
Олена Чигрин, д.е.н., кафедра маркетингу, Сумський державний університет, Суми, Україна
Лілія Хоменко, докт. філ., кафедра маркетингу, Сумський державний університет, Суми, Україна

Цифрові технології відіграють критично важливу роль у забезпеченні сталого розвитку, сприяючи економічному зростанню, соціальній рівності та екологічній безпеці. У статті розглянуто сучасні цифрові практики та їх вплив на досягнення Цілей сталого розвитку, а також проаналізовано міжнародний досвід застосування інноваційних технологій у різних сферах суспільства. Дослідження зосереджене на оцінці ролі штучного інтелекту, великих даних, Інтернету речей, блокчейну та фінансових технологій у формуванні сталих економічних моделей і покращенні управління ресурсами. Зокрема, висвітлено вплив цифрових фінансових технологій на розширення доступу до банківських послуг та кредитування для вразливих верств населення, що сприяє економічній інклюзії. Розвиток електронної комерції та цифрових платформ дозволяє малим підприємствам виходити на глобальні ринки, що позитивно позначається на конкурентоспроможності економік. Екологічний аспект цифровізації охоплює розробку "розумних" міст, впровадження IoT-рішень для моніторингу навколишнього середовища та ефективного управління енергетичними ресурсами. Цифрові екологічні платформи сприяють моніторингу забруднення повітря, води та ґрунтів, а також допомагають автоматизувати процеси управління відходами. Використання блокчейну у відстеженні постачальницьких ланцюгів дозволяє забезпечити прозорість бізнес-процесів, що сприяє екологічній відповідальності підприємств. Соціальний аспект цифрової трансформації охоплює покращення доступу до якісної освіти через онлайн-курси, цифрові платформи та адаптивне навчання на основі штучного інтелекту. Такі технології дозволяють персоналізувати навчальний процес, роблячи його ефективнішим і доступним для широкого загалу. Аналіз фінансових інвестицій Європейського Союзу у цифрову трансформацію свідчить про значний рівень фінансування розвитку штучного інтелекту, квантових технологій, хмарних обчислень та цифрової інфраструктури. Водночас у статті розглянуто ключові виклики цифровізації, серед яких зростання цифрової нерівності, питання кібербезпеки, необхідність регулювання штучного інтелекту та проблеми управління електронними відходами. У статті також представлено рекомендації щодо ефективного використання цифрових технологій для сталого розвитку. Результати дослідження можуть бути використані для формування стратегій цифрової трансформації, що сприятимуть збалансованому економічному зростанню, екологічній стійкості та соціальній рівності.

Ключові слова: цифрові технології, штучний інтелект, сталий розвиток, цифрова трансформація, фінансові технології, Інтернет речей, блокчейн.