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INSTITUTIONAL CONSTRAINTS ON THE DIGITAL TRANSFORMATION OF UKRAINIAN AGRICULTURAL SECTOR

This study investigates the theoretical and methodological foundations and tools of digital transformation in Ukraine's agricultural sector and develops scientific and methodological approaches to establishing a system of indicators for assessing agricultural digital maturity in the context of sustainable development and European integration. The hypothesis is put forward that the effectiveness of digital transformation is determined not so much by the level of implementation of individual digital technologies as by the coherence of organisational, economic, technological, and institutional tools that ensure their integration into the agricultural sector management system. The hypothesis was tested through the systematisation of scientific approaches to the digitalisation of agricultural production, comparative and structural-functional analysis, assessment of the relationships between digitalisation indicators, innovation potential, and sustainable development, and an examination of official statistical data, European Commission materials, and international indices, including the Global Innovation Index and the Digital Economy and Society Index. It was established that the digital transformation of the agricultural sector is a comprehensive process encompassing the use of precision agriculture technologies, sensor and satellite monitoring, the Internet of Things, Big Data, artificial intelligence, geographic information systems, unmanned technologies, and digital management platforms. Indicators for assessing

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ІНСТИТУЦІЙНІ ОБМЕЖЕННЯ ЦИФРОВОЇ ТРАНСФОРМАЦІЇ АГРАРНОГО СЕКТОРУ УКРАЇНИ

Досліджено теоретико-методологічні засади та інструментарій цифрової трансформації аграрного сектору України, а також розроблено науково-методичні підходи до формування системи показників оцінювання рівня цифрової зрілості аграрної сфери в контексті сталого розвитку та європейської інтеграції. Висунуто гіпотезу, що результативність цифрової трансформації визначається не стільки рівнем впровадження окремих цифрових технологій, скільки узгодженістю організаційних, економічних, технологічних та інституційних інструментів, що забезпечують їх інтеграцію у систему управління аграрним сектором. Перевірку гіпотези здійснено шляхом систематизації наукових підходів до цифровізації аграрного виробництва, порівняльного та структурно-функціонального аналізу, оцінювання взаємозв'язків між показниками цифровізації, інноваційного потенціалу та сталого розвитку, а також аналізу офіційних статистичних даних, матеріалів Європейської комісії та міжнародних індексів, зокрема Global Innovation Index і Digital Economy and Society Index. Встановлено, що цифрова трансформація аграрного сектору є комплексним процесом, який охоплює використання технологій точного землеробства, сенсорного та супутникового моніторингу, Internet of Things, Big Data, штучного інтелекту, геоінформаційних систем, безпілотних технологій і цифрових платформ управління. Систематизовано показники оцінювання цифрової



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digital transformation were systematised into technological, economic, environmental, social, and institutional blocks, enabling a comprehensive assessment of the level of digital maturity of the agricultural sector and the effectiveness of digital solutions implementation. Technological heterogeneity of the agricultural sector was identified, manifested in a significant gap between digitally mature large enterprises and small and medium-sized producers with limited access to digital infrastructure, financial resources, and modern digital competencies. Methods and tools for digital transformation were systematised according to organisational, economic, technological, and institutional criteria. The feasibility of their integrated application was substantiated to ensure the relationship between digital modernisation and increased efficiency of agricultural production. The proposed approach can be used to improve state digitalisation policy, substantiate priorities for supporting agricultural enterprises, and monitor the effectiveness of digital transformation in Ukraine's agricultural sector.

Keywords: digital transformation, agricultural sector, digital platforms, sustainable development, innovation system.

JEL Classification: Q16, O33, O32.

Introduction

Ukraine's agricultural sector is going through a massive digital shift. Right now, adopting new technology isn't just a trend; it's actually become essential for keeping farms profitable and making sure they can access European markets (Mamchur et al., 2025; Mamchur & Studinska, 2024). Digital transformation helps connect data that used to be isolated, bringing together things like field telemetry, weather patterns, and financial analytics. This integration allows farm managers to make decisions based on solid data instead of just going by gut feeling. However, national strategies still tend to treat digitalization as an extra tool rather than a main driver of economic growth, which keeps holding back long-term development (Mishchenko, 2024).

Changing the agricultural landscape is a bit of a balancing act. Policymakers have to align regional and national goals, protect food supply chains, and update domestic rules to meet strict European Union standards (Mamchur et al., 2025; Huyen et al., 2025; Ye, 2025). This brings up a major question: how do we actually measure the real impact of digital adoption? Right now, Ukraine's statistical framework only gives us a partial picture. It doesn't really capture the full depth of these digital shifts, and it's completely out of sync with EU evaluation standards like DESI or PMEF (Rudenko, 2019; Huyen et al., 2025). Without standardized metrics, it's impossible to compare progress

трансформації за технологічним, економічним, екологічним, соціальним та інституційним блоками, що дає змогу комплексно визначати рівень цифрової зрілості аграрного сектору та результативність впровадження цифрових рішень. Виявлено технологічну неоднорідність аграрного сектору, що проявляється у значному розриві між цифрово зрілими великими підприємствами та малими й середніми виробниками з обмеженим доступом до цифрової інфраструктури, фінансових ресурсів і сучасних цифрових компетентностей. Систематизовано методи та інструменти цифрової трансформації за організаційною, економічною, технологічною та інституційною ознаками. Доведено доцільність їх комплексного застосування для забезпечення взаємозв'язку між цифровою модернізацією, підвищенням ефективності аграрного виробництва. Запропонований підхід може бути використаний для вдосконалення державної політики цифровізації, обґрунтування пріоритетів підтримки аграрних підприємств і моніторингу результативності цифрової трансформації аграрного сектору України.

Ключові слова: цифрова трансформація, аграрний сектор, цифрові платформи, сталий розвиток, інноваційна система.

against EU benchmarks, which causes public policy to lose focus and makes foreign investors hesitant (Mamchur et al., 2025; Li et al., 2025). Because of this, updating these evaluation methods has become an urgent priority (AgroTimes, 2021; Aros et al., 2025; European Commission, n. d.).

Research into agricultural innovation and sustainability is built on a deep academic foundation. Scholars like B. M. Danylyshyn, M. I. Dolishniy, S. I. Dorohuntsov, M. F. Kropyvko, H. M. Kaletnik, S. V. Kozlovskyi, L. V. Melnyk, Ye. V. Mishenin, M. M. Palamarchuk, V. M. Trehobchuk, P. T. Sabluk, and O. H. Shpykuliak established the groundwork regarding sector dynamics, institutional capacity, and public policy. More recent studies build on this by showing how public institutions and regulatory frameworks drive agricultural progress (Mamchur et al., 2025; Mamchur & Studinska, 2024; Ministry of Agrarian Policy and Food of Ukraine, n. d.; Ye, 2025).

On an international level, experts see digitalization as much more than just upgrading software or machinery. It's viewed as a systemic institutional shift that changes how businesses operate and makes them more agile. Global studies look at how digital tools support sustainable growth (Bilochenko et al., 2020; European Commission, 2021; Ferla, et al., 2024; Huyen et al., 2025) and how they help shape policy monitoring tools within the EU (Rudenko, 2019; AgroTimes, 2021; Aros et al., 2025). Researchers are even creating composite indices to measure digital readiness while staying aligned with the Sustainable Development Goals and the European Green Deal (Bilochenko et al., 2020).

Even with all this theory, there's still a big gap in the Ukrainian literature. While local studies often talk about general digitalization strategies, very few actually look at how to practically align national metrics with EU benchmarks (Ivantsov, 2024). We're still missing comprehensive research that measures how efficient digital tools actually are using EU-compatible indicators that are specifically tailored to Ukraine's unique regional conditions (Mamchur et al., 2025).

The aim of this study is to theoretically ground the digital tools transforming Ukraine's agricultural sector while designing an indicator system to track digital progress against sustainability and EU integration benchmarks.

The study operates on the hypothesis that digital transformation's success isn't just about adopting new tech, but about how well organizational, economic, technological, and institutional tools are aligned. To test this, the research uses a mix of scholarly analysis, official statistics, European Commission data, and international indices through comparative and systems analysis.

The article is organized into three main parts. First, it looks at the theoretical foundations of agricultural digital transformation. Second, it discusses the key components of sustainable agricultural development in a

digital age. Third, it develops the methodological tools for this transformation. This third section specifically looks at the organizational and territorial hurdles to adopting digital tools, the economic and technological factors at play, priority areas for growth, and a comparison between digital strategies in the EU and Ukraine.

1. Theoretical and methodological foundations of agricultural digital transformation

Digitalization is changing the way agricultural enterprises organize production, manage resources, and interact with markets. These changes concern not only the introduction of new technologies but also the revision of established management practices, approaches to production planning, and relationships between participants in agricultural value chains (Ferla et al., 2024; Ivantsov, 2024). Precision farming, big data analytics, artificial intelligence, the Internet of Things (IoT), and digital management platforms are increasingly used to monitor agricultural operations, assess production conditions, and process information from different sources (Mamchur & Studinska, 2024). The availability of such information enables enterprises to assess the relationship between production costs, resource consumption, environmental conditions, and expected output when making management decisions. It also helps identify potential production risks at an earlier stage (Rudenko, 2019; Li et al., 2025). Previous technological developments in agriculture mainly involved the mechanization of physical operations and the computerization of specific management functions. In contrast, technologies associated with Industry 4.0 allow data from machinery, sensors, production records, and management systems to be processed and used together (Mamchur et al., 2025; Mishchenko, 2024; Huyen et al., 2025). Their application can improve the accuracy of production planning, reduce losses of materials and other inputs, and support more efficient use of labor, equipment, and agricultural resources. The extent of these improvements, however, depends on the compatibility of the technologies introduced, the quality of available data, and the capacity of enterprises to incorporate analytical results into their everyday operations.

1.1. Methods and tools of agricultural digitalisation in the context of European integration

Agricultural enterprises apply digital technologies in different ways. Much depends on the size of the farm, its financial capacity, technical equipment, and production needs. Some enterprises use digital systems to monitor field conditions. Others focus on production planning, cost control, or the management of agricultural machinery. The methods also differ in their

complexity and the amount of data required. Several approaches can be distinguished:

- monitoring methods involve collecting information from field sensors, satellite images, and unmanned aerial vehicles. These technologies are used to examine soil conditions, observe crop development, and monitor agricultural machinery. The collected data help farmers identify changes in field conditions and decide when specific operations are needed (Mamchur & Studinska, 2024; European Commission, n. d.);

- analytical methods rely on statistical models, machine learning, and artificial intelligence. They are used to estimate crop yields, examine weather-related risks, and compare possible farming decisions. The accuracy of such estimates depends on the quality of the input data. Incomplete records and differences between growing seasons may affect the results (Ivantsov, 2024; Ye, 2025);

- digital management platforms are used to organise information about farm activities. Production records, machinery schedules, logistics, and financial data can be maintained within the same system. This reduces the need to process information from several unrelated sources. It also makes it easier to compare planned activities with actual results (Mamchur et al., 2025);

- digital traceability methods are concerned with recording transactions and product movements. Blockchain is one of the technologies that can be used for this purpose. It allows information about individual operations to be stored in a form that can be checked by authorised participants. Such records are useful when agricultural products pass through several stages of processing and distribution (Pomirna, 2015).

The use of these methods does not produce identical results across agricultural enterprises. A large farm may have the resources to maintain its own digital infrastructure and employ specialists to analyse production data. A smaller producer may rely on basic software or services provided by external companies. Internet access, equipment costs, and employee qualifications also influence the choice of technologies. These differences are especially important when examining agricultural digitalisation in Ukraine. The country's closer economic cooperation with the European Union has increased the importance of agricultural data management, environmental reporting, and product traceability (European Commission, n. d.; Huyen et al., 2025).

Evaluating digitalisation requires more than identifying which technologies are available. The presence of specialised software does not necessarily mean that it is used regularly. The same applies to sensors, automated equipment, and digital platforms. An enterprise may purchase such tools but continue making most decisions through conventional procedures. For this reason, the assessment should consider both technology adoption and its actual use. Changes in production costs, labour requirements, resource consumption, and management practices are also relevant.

Several groups of indicators can be used for this purpose. Technological indicators describe the availability of equipment, communication networks, and digital services. Economic indicators concern investment costs, productivity, and the financial results of technology use. Environmental indicators may include water consumption, fertiliser application, and energy use. Social indicators describe employees' digital skills and access to technological services in rural communities. Institutional indicators concern public information systems, regulatory requirements, and the exchange of agricultural data. These groups should be examined together, although each measures a different aspect of digitalisation.

The European Union provides a useful reference for such an assessment. Agricultural Policy in EU member states is organised within the Common Agricultural Policy (CAP). Its objectives extend beyond increasing agricultural output. They also concern farm incomes, market competitiveness, environmental conditions, climate-related issues, and the development of rural communities. Digital technologies are relevant to several of these objectives, but they are not equally important in every area. Their role depends on the problems being addressed and the conditions under which agricultural enterprises operate (European Commission, n. d.; Huyen et al., 2025).

For instance, data collected through precision farming systems can be used to examine changes in fertiliser and water consumption. Digital accounting systems provide information about operating costs and financial performance. Electronic records of product movement can support traceability within food supply chains. These examples concern different aspects of agricultural activity. They cannot be evaluated using the same indicators alone. A reduction in resource consumption, for example, describes a different outcome from improved access to production records.

The EU uses established monitoring and evaluation procedures to examine the implementation of agricultural policy. The Common Monitoring and Evaluation Framework (CMEF) was developed for this purpose. For the 2023–2027 CAP period, the relevant system is the Performance Monitoring and Evaluation Framework (PMEF). These frameworks contain indicators covering different policy objectives and results. However, many of the indicators do not measure digital technology adoption directly. Instead, they describe changes in agricultural production, environmental conditions, or rural development. When analysing digitalisation, it is therefore necessary to distinguish between indicators of technology use and indicators of outcomes that may be influenced by that use. *Table 1* presents selected CAP indicators alongside the areas of agricultural digitalisation to which they are related.

Table 1

Relationships between EU Common Agricultural Policy indicators and agricultural digital transformation

CAP priority	Manifestations of digitalisation	Key digital indicators
Sustainable development and green practices	Precision farming systems; satellite and sensor monitoring	Share of farms using digital soil and yield monitoring systems
Innovation and knowledge	EIP-AGRI projects; digital innovation hubs	Number of digital innovation projects under the CAP
Competitiveness and efficiency	<i>Big data; IoT; automated resource accounting</i>	Labour productivity on digitally active farms
Social cohesion and rural development	Online platforms; digital advisory services	Share of farmers with high-speed internet access
Climate neutrality	<i>Copernicus; GIS technologies</i>	Extent of digital land-use monitoring

Source: systematised by the author based on European Commission (n. d.) and Huyen et al. (2025).

To examine agricultural digitalisation in relation to sustainable development and the EU Common Agricultural Policy, a set of indicators is proposed. The indicators cover five areas: technological, economic, environmental, social, and institutional. Each area addresses a different aspect of change in agricultural enterprises. Some indicators describe the availability and use of digital technologies. Others concern their economic results, environmental effects, or the conditions needed for their wider adoption. This distinction is important because the installation of digital equipment does not always lead to measurable improvements in farm performance.

The technological dimension concerns the extent to which digital tools are used in agricultural production and management. It includes the following indicators:

- the proportion of agricultural enterprises applying precision farming methods;
- the use of IoT devices, geographic information systems (GIS), large-scale data processing, and automated farm management software;
- the proportion of production and logistics operations supported by digital systems;
- the availability and quality of internet connections in rural areas.

The economic dimension focuses on the costs and results of introducing digital technologies. Particular attention is given to whether these technologies improve farm operations and justify the resources invested in them. The indicators include:

- labour productivity at farms that regularly use digital technologies;
- financial returns relative to the cost of digital equipment and software;
- the amount of private and public investment directed towards agricultural technologies;

- the proportion of agricultural exports covered by digital product traceability systems.

- the environmental dimension examines how digital technologies are used to manage natural resources and reduce the environmental effects of agricultural production. Four indicators are considered:

- the area of agricultural land monitored using digital mapping and observation systems;

- changes in fertiliser and pesticide consumption associated with precision application technologies;

- changes in CO₂ emissions resulting from adjustments to agricultural operations;

- the proportion of farms using electronic systems to monitor environmental conditions.

The social dimension concerns the people who use agricultural technologies and the opportunities available to rural communities. Purchasing new equipment is only one part of digitalisation. Farm employees also need the knowledge required to operate it, interpret the information collected, and apply the results in their work. The proposed indicators are:

- the level of digital skills among farmers and agricultural employees;
- the proportion of workers who have completed training in the use of digital technologies;

- the availability of high-speed internet services in rural settlements;

- the number of advisory services providing practical assistance with agricultural digital tools.

The institutional dimension addresses the regulatory and organisational conditions under which agricultural digitalisation takes place. This area is particularly relevant to Ukraine because national agricultural practices and information systems need to be considered in relation to EU requirements. The indicators include:

- the extent to which Ukrainian agricultural legislation corresponds to relevant EU regulations;

- participation in agricultural innovation and cooperation programmes, including EIP-AGRI and applicable CAP-related initiatives;

- the amount of government funding allocated to agricultural digitalisation;

- the adoption of data protection and cybersecurity measures in agricultural information systems.

The five groups of indicators provide different types of information. They should not be interpreted as interchangeable measures. For example, the number of farms using precision agriculture equipment describes technology adoption, whereas changes in fertiliser consumption may indicate one of its practical effects. Similarly, investment in agricultural software does not automatically demonstrate higher productivity. These relationships need to be examined using comparable data and, where possible, observations over several years.

The proposed indicators can be used to compare agricultural enterprises, regions, and changes over time. They can also help identify where digital development is uneven. One region may have relatively good internet coverage but limited use of farm management systems. Another may show substantial investment in agricultural technologies while having relatively few trained employees. Such differences are important for selecting public support measures and assessing their results. In the Ukrainian context, the indicators also provide a basis for examining the relationship between agricultural digitalisation, sustainable resource use, and the requirements associated with European integration.

1.2. The role of innovation potential in agricultural digitalisation

The Global Innovation Index (GII) can also be used when examining agricultural digitalisation. It provides information about the conditions that influence the development and use of new technologies in different countries. These include the quality of institutions, access to infrastructure, education, research activities, and investment. Such conditions matter for agriculture as well. Farms need reliable communication networks, skilled employees, and financial resources to introduce digital equipment and software. However, a country's position in the GII does not necessarily show how widely these technologies are used in its agricultural sector. The index describes the broader innovation environment, while sector-specific indicators are needed to examine what happens at the farm level. Comparing the two can help identify differences between national innovation capacity and the actual use of digital technologies in agriculture. *Table 2* presents the main groups of GII indicators and their relationships with agricultural digitalisation, including technical infrastructure, workforce skills, innovation activities, and public support.

Table 2

Relationships between Global Innovation Index indicators
and agricultural digitalisation

GII indicator group	Examples of GII indicators	Related indicators of agricultural digitalisation	Area of relationship
Infrastructure	ICT access; ICT use; e-government	Rural digital connectivity; use of GPS, IoT, and drones	Technological foundation of digitalisation
Human capital and research	Quality of education; number of researchers; education expenditure	Farmers' digital literacy; AgriTech programmes	Workforce training
Business sophistication	R&D investment; business–research collaboration	Joint projects between agricultural companies and IT start-ups	Innovation ecosystem
Market sophistication	Access to finance; venture capital	Investment in digital farms and AgriTech start-ups	Financial provision

GII indicator group	Examples of GII indicators	Related indicators of agricultural digitalisation	Area of relationship
Institutional environment	Government effectiveness; regulatory quality	Government programmes for agricultural digitalisation	Government support
Knowledge and technology outputs	Patents; high-technology exports	Precision farming developments	Effectiveness of digital innovation

Source: systematised by the author using data from Rudenko (2019) and Aros et al. (2025).

The adoption of digital technologies in agriculture depends on the technical and economic conditions in which farms operate. New software or equipment cannot always be introduced into existing production systems without additional investment. Farms may first need to improve their communication networks, replace outdated machinery, or train employees. The level of technological development can therefore be examined through several indicators. These include the automation of production processes, the use of ICT, precision farming equipment, ERP systems, and data analytics. Research expenditure, investment in AgriTech, broadband coverage, and access to digital management services are also relevant. Together, these indicators describe the resources available for digitalisation and the extent to which they are already used in agricultural activities (Mamchur & Studinska, 2024; Ferla, et al., 2024).

However, technological development differs considerably across the agricultural sector. Large agricultural holdings often have better access to capital, equipment, and technical expertise. Many already use satellite imagery to monitor fields, sensors to collect production data, and specialised software to coordinate machinery and logistics. Some have introduced digital systems across several stages of production, from field planning to product distribution. Smaller farms operate under different conditions. The cost of equipment may be too high relative to their production scale. Maintaining specialised software also requires money and qualified personnel. As a result, digital technologies may be used only for individual tasks, such as accounting, field mapping, or machinery monitoring. This does not mean that all small farms have low technological capacity. Their level of digitalisation varies according to specialisation, available resources, and management decisions.

These differences should be considered when assessing the technological development of agriculture as a whole. A sector-wide average can conceal substantial variation between enterprises. For example, a relatively small number of technologically advanced agricultural holdings may account for a considerable share of production, while many smaller producers continue to use conventional management methods. The resulting

average depends on whether enterprises are weighted by their number, agricultural area, output, or employment. The choice of measurement therefore matters. A low average level of digitalisation does not necessarily describe every farm. Equally, the presence of several highly automated enterprises does not indicate that similar technologies are widely available throughout the sector.

Differences in technological capacity also affect the pace of further digitalisation. Farms with existing information systems can often introduce additional applications without making major changes to their infrastructure. Enterprises that lack reliable internet access, compatible machinery, or digital records face more difficulties. They may need to address these basic requirements before adopting more complex technologies. For this reason, support measures should take account of the actual conditions in different groups of agricultural enterprises. Smaller producers may benefit from shared digital services, affordable equipment, training, and technical advice. Rural broadband development remains important, particularly in areas where limited connectivity restricts the use of online platforms and remote monitoring. Cooperation between agricultural producers, technology companies, and research institutions can also make specialised solutions more accessible (Rudenko, 2024; Aros et al., 2025; Ferla et al., 2024).

A uniform approach to agricultural digitalisation would overlook these differences. The same investment or support measure may produce different results depending on a farm's initial technological capacity. For some enterprises, the main requirement is access to basic digital infrastructure. Others need assistance with integrating existing systems or processing the data they already collect. Public policy should therefore distinguish between these needs. Such differentiation would allow resources to be directed towards specific technological constraints rather than treating the agricultural sector as a group of enterprises with similar levels of digital development.

2. Key components of sustainable agricultural development and prerequisites for digital transformation

Agricultural sustainability is shaped by the conditions under which farms produce, invest, and manage their resources. Higher output alone does not indicate that an enterprise is developing sustainably. A farm may increase production while facing rising operating costs, declining soil quality, or shortages of qualified employees. These problems require different responses. Digital technologies can help with some of them, particularly where decisions depend on accurate information about production, finances, and natural resources. Their usefulness should be judged by the results obtained in everyday farming activities.

For agricultural producers, economic stability largely depends on the relationship between production costs, output, and market prices. Investment in machinery and software may improve labour productivity or reduce unnecessary expenditure. Yet these benefits are not guaranteed. The costs of purchasing equipment, maintaining software, and training employees must also be considered. Environmental issues present another set of concerns. Soil degradation, inefficient water use, and excessive application of fertilisers can affect future production. Digital field monitoring and automated application systems allow farmers to adjust certain operations according to local conditions. This may reduce resource consumption, although the outcome depends on the technology selected and the way it is operated (Mamchur & Studinska, 2024; Ye, 2025).

Conditions in rural communities influence agricultural development as well. Modern equipment requires technical knowledge. Employees must be able to work with electronic records, understand information from monitoring systems, and respond to equipment faults. Such skills are not equally available across farms. Smaller enterprises may find it difficult to employ dedicated technical specialists or pay for additional training. Poor internet connectivity creates further limitations. In these circumstances, local advisory services can provide assistance with equipment selection, digital applications, and agricultural regulations. Their work is particularly useful when advice addresses specific problems faced by producers rather than offering general information about new technologies.

Agricultural investment also depends on the rules and financial arrangements within which enterprises operate. Access to credit, the availability of public support, and the clarity of regulatory requirements can influence whether farms decide to introduce new technologies. This is relevant to Ukraine as agricultural producers adjust to European standards. Compliance may require changes in record keeping, product documentation, and environmental reporting. Larger enterprises can often assign these tasks to specialised departments. Smaller farms may need external assistance. The availability of advisory organisations and accessible public information therefore has practical importance for the implementation of regulatory changes (Mamchur & Studinska, 2024).

The organisation of farm management is another factor. Digital equipment produces little benefit when the information it collects is not used. Field observations, machinery records, and financial data need to be reviewed and incorporated into production planning. This requires employees with suitable qualifications and managers willing to adjust established procedures. Cooperation with research institutions, software developers, and equipment suppliers can help farms solve technical problems. Joint projects involving public authorities and private enterprises may also support infrastructure development and professional training. Their

effectiveness depends on the needs of participating producers and the resources available for implementation (Ivantsov, 2024; Mamchur & Studinska, 2024; Ye, 2025).

The spread of new agricultural practices is also influenced by relationships between producers. Farmers exchange experience, discuss equipment performance, and obtain information through professional associations and local networks. These contacts can reduce uncertainty when an enterprise considers an unfamiliar technology. They are especially valuable in communities where access to specialised advice is limited. Regional differences in infrastructure, employment, education, and business cooperation therefore need to be considered when examining agricultural digitalisation. The same technological solution may be useful in one locality and difficult to apply in another. This makes local economic and social conditions an important part of assessing changes in agricultural production (Pomirna, 2015).

2.1. Components of sustainable agricultural development

Sustainable development in agriculture concerns three areas: environmental protection, economic stability, and social conditions. Each has its own priorities, although changes in one area often affect the others. Agricultural production depends on natural resources, financial opportunities, and the people involved in farming. For this reason, these three areas need to be considered together.

The environmental aspect concerns the condition of agricultural land, water resources, and surrounding ecosystems. Farming practices should limit soil degradation, unnecessary water consumption, and pollution without compromising production needs. Biodiversity conservation and adaptation to changing climatic conditions are also important. Digital technologies can assist with these tasks. For example, precision farming equipment allows fertilisers and water to be applied according to field conditions. Monitoring systems provide information about soil moisture, crop development, and resource consumption. Farmers can use these data to adjust their operations and avoid unnecessary expenditure on inputs.

The economic aspect concerns the ability of agricultural enterprises to maintain profitable production over time. This depends on operating costs, labour productivity, access to investment, and market conditions. Digital tools can be useful in managing these factors. Farm management software helps organise production records and financial information. Automated equipment may reduce the time required for certain operations. Data analysis can also support decisions about purchasing resources, scheduling agricultural work, and selling products. However, the financial results depend on the scale of production, initial investment, and the actual use of the technologies introduced.

The relationships between these three aspects are presented in *Figure 1*.

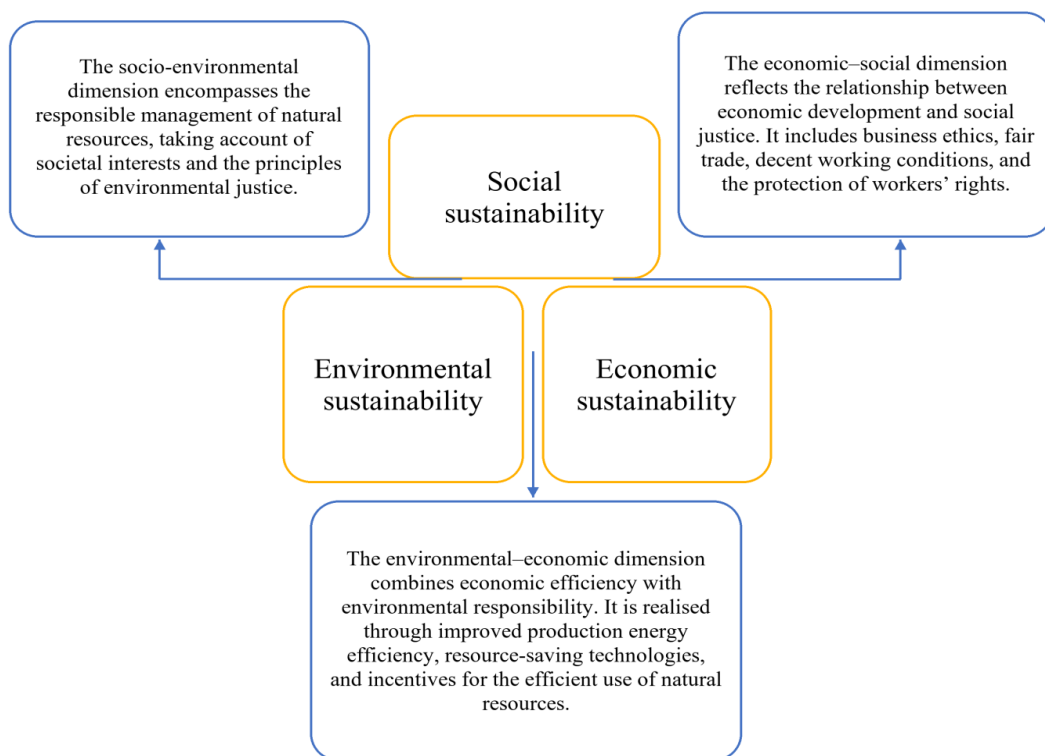


Figure 1. Structural interaction of sustainable agricultural development components

Source: compiled by the author based on Prokopenko (2024) and Olawale et al. (2024).

The social side of things involves jobs, professional skills, and what it is actually like to live in rural areas. As technology changes, the skills needed for agricultural work change too. Some jobs are being taken over by machines, while others now require a solid grasp of digital tools and information systems. Because of this, getting access to training is vital, especially for people working on smaller farms. On top of that, gaps in internet access and education can make inequalities between rural communities even worse. We really need to focus on groups that struggle to access jobs, technology, or basic public services. It also helps to involve local residents in development decisions so their needs are weighed alongside the economic goals of big agricultural businesses.

It is also worth noting that environmental, economic, and social goals don't always line up. For example, pushing for higher crop yields can put a lot of strain on soil and water. On the flip side, environmental regulations can drive up costs, which is especially hard on farms that don't have much extra cash. Even technology can be a double-edged sword; it might boost productivity, but it also changes what kind of jobs are available in the countryside. Since these goals often pull in different directions, it is hard to pursue all of them at once. Agricultural development requires making tough

calls that account for these trade-offs, the resources on hand, and the unique situation of each farm.

Digital tools can actually help farmers make better decisions by using data from their own production. Field monitoring can show exactly how soil and crops are doing, while management software makes it easy to track costs and resource use over time. These tools can point out where things are being wasted or where farming methods need to change. However, technology only helps with sustainability if that information actually leads to real-world changes. Just installing a new digital system isn't enough on its own.

There are still several big hurdles facing the future of agriculture. Soil degradation is lowering productivity, unpredictable weather makes planning a nightmare, and water shortages combined with rising costs are putting a lot of financial pressure on farmers. At the same time, uneven access to income, infrastructure, and technology means not all producers are starting from the same place. These issues are all linked, but there is no single solution that fixes everything. Their importance also changes depending on the region and the type of farming being done.

Moving forward, changes in farming should balance environmental needs with the economic reality of the producers. This could mean moving toward agroecological methods, better soil conservation, smarter water management, or practices that fit local climates. Small and medium-sized farms, in particular, might need better access to loans, technical advice, and shared services. Public support should also recognize that a tiny farm and a massive operation have very different needs. Digital systems can be great for monitoring results and managing records, but they work best when they are used to solve specific, practical problems rather than just being used for the sake of modernization.

2.2. Factors shaping the initiation of agricultural digital transformation

An examination of the fundamental factors shaping the initiation of agricultural digital transformation allows them to be grouped into four principal categories: the sector-specific characteristics of agricultural production, its territorial conditions, the development of the agricultural innovation system, and the specific features of the sector's information provision (*Figure 2*). A closer examination of these groups shows that:

- broadband internet coverage in rural areas is substantially lower than in urban areas because of the high cost of developing telecommunications infrastructure where farms are spatially dispersed and population density is low. This limits producers' integration into digital platforms and their access to cloud services and data analytics systems. These observations are consistent with the approaches to assessing digital development used in the Digital Economy and Society Index (DESI), where connectivity and digital skills are key determinants of economic digitalisation;

- the share of small and medium-sized farms using precision farming systems remains limited owing to the high capital intensity of digital solutions, long investment payback periods, and restricted access to finance. This creates a technological asymmetry between large agricultural holding companies and small producers, reflecting the imbalances in innovation development captured by the GII, particularly its "business sophistication" and "knowledge and technology outputs" pillars;

- agricultural R&D investment is unstable because of insufficient interaction between research institutions and businesses and the low commercialisation of research findings. This reduces the effectiveness of technology transfer and slows the adoption of innovations in production. These constraints are reflected in countries' positions on GII indicators that describe the innovation ecosystem and the effective use of research potential;

- the shortage of digital technology specialists in rural areas results from the migration of skilled workers, limited access to quality education, and an insufficiently developed AgriTech training system. This complicates both the adoption and the effective use of digital tools. Within DESI, this problem correlates with "human capital" indicators, which capture the population's digital skills as a key prerequisite for digital transformation.

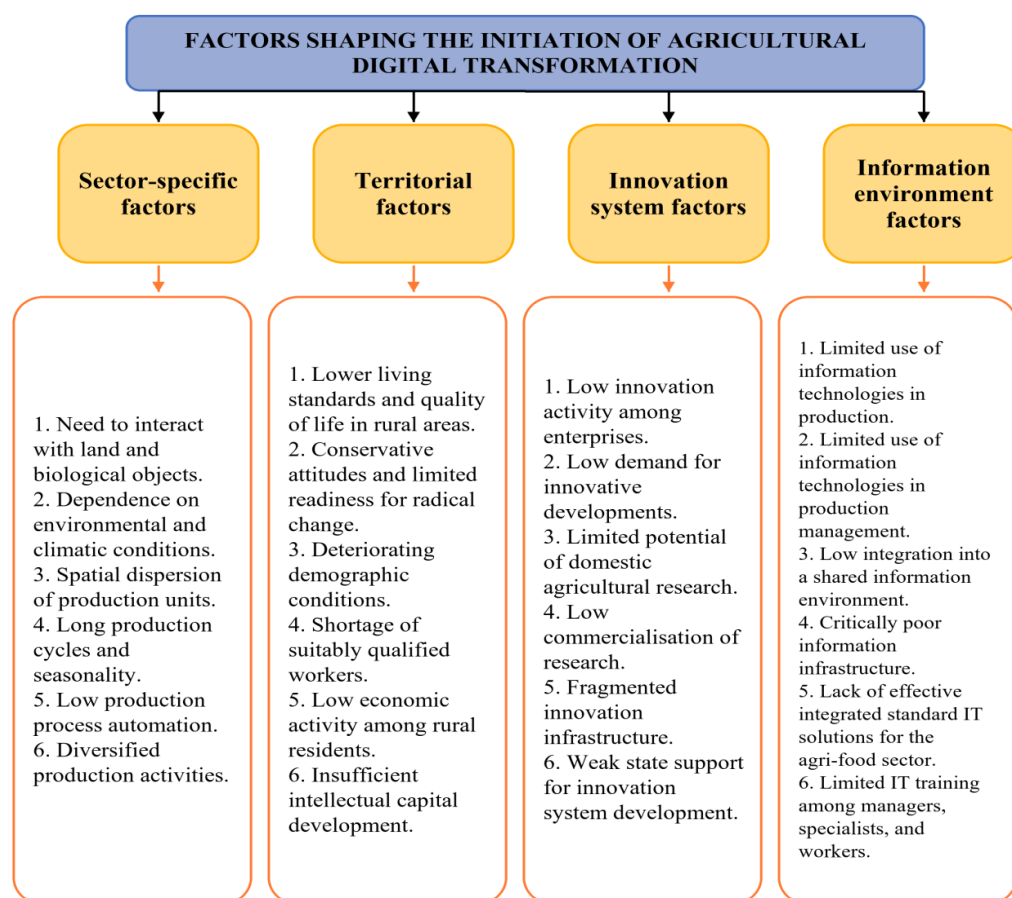


Figure 2. Factors shaping the initiation of agricultural digital transformation

Source: compiled by the author based on Mamchur et al. (2025) and Ivantsov (2024).

Agriculture's strong dependence on environmental and climatic factors, particularly temperature fluctuations, soil moisture, and seasonal production patterns, further increases the need for digital solutions. Real-time agrometeorological monitoring, digital yield forecasting, and automated risk management can reduce uncertainty in production processes, improve the adaptability of agricultural production, and enable more efficient resource use.

3. Methodological foundations and tools of agricultural digital transformation

The methods used in agricultural digitalisation differ in their purpose and practical application. For further analysis, they are divided into four groups: organisational, economic, technological, and institutional. Section 1.1 examined the main approaches to digitalisation and the indicators used to assess their application. The present section focuses on how these methods are introduced into agricultural activities and how they relate to sustainable development objectives and Ukraine's integration with the European Union. The proposed classification is presented in *Table 3* (Mamchur et al., 2024; Ivantsov, 2024).

Table 3

Classification of methods and tools of agricultural digital transformation

Category	Characteristics	Principal tools
Organisational	Transform management systems and the organisation of production processes	Business process re-engineering; digital farm management platforms; value chain integration; agricultural clusters
Economic	Provide financial and economic incentives and assess digitalisation effectiveness	Government support programmes; grants; subsidies; public-private partnerships; methods for assessing economic effects
Technological	Provide the technological foundation for digital transformation	Precision farming; IoT; big data; artificial intelligence; GIS; unmanned technologies; automated systems
Institutional	Create the regulatory and organisational environment for digitalisation	National digital development strategies; harmonisation with EU requirements; information and advisory centres; cybersecurity systems

Source: systematised by the author based on Mamchur et al. (2024) and Ivantsov (2024).

The results of applying different digitalisation methods can be examined using the indicators proposed earlier. Each group of methods concerns a particular area of agricultural activity. Technological methods are associated with the use of digital equipment, software, and automated production systems. Economic methods can be assessed through changes in labour productivity, operating costs, and returns on technological investment. Organisational methods concern how digital solutions are incorporated into farm management and everyday operations. Institutional methods relate to regulatory requirements, the adoption of European standards, and environmental obligations. Examining these relationships allows the proposed

indicators to be used not only to describe the level of digitalisation but also to assess changes associated with particular management decisions.

The classification also draws attention to the conditions under which agricultural enterprises introduce new technologies. The same method may produce different results depending on the type of production, farm size, and location. Agricultural activities are spread across large territories, often with uneven access to communication networks and technical services. Seasonal workloads and dependence on weather conditions create further difficulties. The availability of qualified employees also matters. Farms with established information systems and trained personnel can generally introduce additional digital applications more easily than enterprises that still rely on manual records and conventional equipment. These differences need to be considered when selecting digitalisation methods and evaluating their practical results.

3.1. Organisational and territorial constraints on digital tool adoption

The way agricultural production is spread out geographically makes digitalization quite a challenge. Fields, machinery, and storage sites are often far apart and frequently located in areas where internet coverage is spotty at best. Getting all these locations connected requires extra equipment and significant investment. This is especially tough for smaller farms, which usually have much tighter financial and technical resources to work with (Mamchur et al., 2024; Ivantsov, 2024).

Infrastructure needs also differ from one farm to the next. Some operations might need field sensors and satellite monitoring, while others are more focused on building communication networks or setting up independent power supplies. Ultimately, the costs depend on where the farm is located, how large it is, and what facilities are already in place. On top of that, limited access to technical support services makes things even harder (Rudenko, 2024; Aros et al., 2025; Ferla et al., 2024).

Data management is another major hurdle. Information like weather records, soil measurements, machinery logs, and transport schedules is often stored in separate silos. Because these different data formats don't always play well together, analyzing them as a whole is difficult. Even when the data is accessible, it might not be in a format that can be used right away for production planning.

Seasonal production also makes investment decisions a bit of a gamble. The real benefits of adopting new technology might not show up until after a harvest or even after several growing seasons have passed. Plus, unpredictable weather and shifting market prices can impact financial returns. For smaller producers, this level of uncertainty often leads to delays in buying digital equipment (Rudenko, 2024; Ferla et al., 2024).

Farm management platforms can help solve some of these issues by bringing production schedules, machinery records, and logistics into one place. They allow managers to spot delays and adjust their operations on the

fly. However, their actual usefulness depends on having high-quality data and using the system consistently. Because of this, choosing the right technology has to be a careful process that considers a farm's specific needs, its infrastructure, and its budget (Ivantsov, 2024; Mishchenko, 2024).

3.2. Technological and economic factors in digital transformation

Agricultural businesses often juggle several different production activities at once, and each one needs its own specific equipment and management tools. Because of this, trying to integrate all these technologies can drive up digitalization costs by anywhere from 20 to 40 percent, based on recent estimates (Mamchur et al., 2025; Mishchenko, 2024; Li et al., 2025; Ye, 2025). Smaller farms, in particular, deal with much higher costs per hectare. When it comes to precision farming systems, the cost gap between small farms and large producers can be as much as 1.5 to 2 times higher. One way to ease this financial pressure could be through shared equipment and digital services (Mamchur et al., 2025; Li et al., 2025).

The actual results also depend on how these technologies are rolled out. Research shows that when digital solutions are applied across several production stages, productivity gains can hit 10 to 25 percent. On the other hand, using these tools in isolation only yields about 5 to 7 percent in improvements (Li et al., 2025; Ye, 2025). Still, widespread adoption is being held back by a few key issues, like poor cooperation between researchers and agribusinesses, a lack of commercialized innovations, and not enough funding. High upfront costs are still a major worry for small-scale producers. Depending on the specific technology and the size of the operation, it typically takes between three and seven years to see a return on these investments (*Table 4*).

Table 4

Quantitative manifestations of technological and economic factors
in agricultural digital transformation

Factor	Quantitative manifestation	Economic consequences
Diversified production structure	Technology integration costs increase by 20–40%	Higher digitalisation costs and more complex implementation
Small farm scale	Costs per unit of area are 1.5–2 times higher	Reduced accessibility of digital technologies
Fragmented digitalisation	Productivity increases by only 5–7%	Limited effectiveness of isolated solutions
Comprehensive digitalisation	Productivity increases by 10–25%	Generation of systemic effects
Low commercialisation of innovation	Implementation lags by several years	Slower technological development
Financial constraints	More than 60% of producers cite high costs	Constrained investment
Long payback period	3–7 years	Reduced investment attractiveness

Source: systematised by the author based on Mishchenko (2024), Mamchur et al. (2025), Li et al. (2025), and Ye (2025).

Under these conditions, digital transformation requires both technological upgrading and effective economic mechanisms to reduce the costs of entering the digital environment. Particularly important are models for sharing digital technologies, platform-based solutions, expanded access to financial instruments, and incentives for public–private partnerships, consistent with European practices for supporting agricultural innovation.

3.3. Priority directions for agricultural digital transformation

The synthesis of the identified problems makes it possible to determine priority areas for agricultural digitalisation, which form the methodological foundation for the corresponding digital transformation methods and tools (Figure 3).

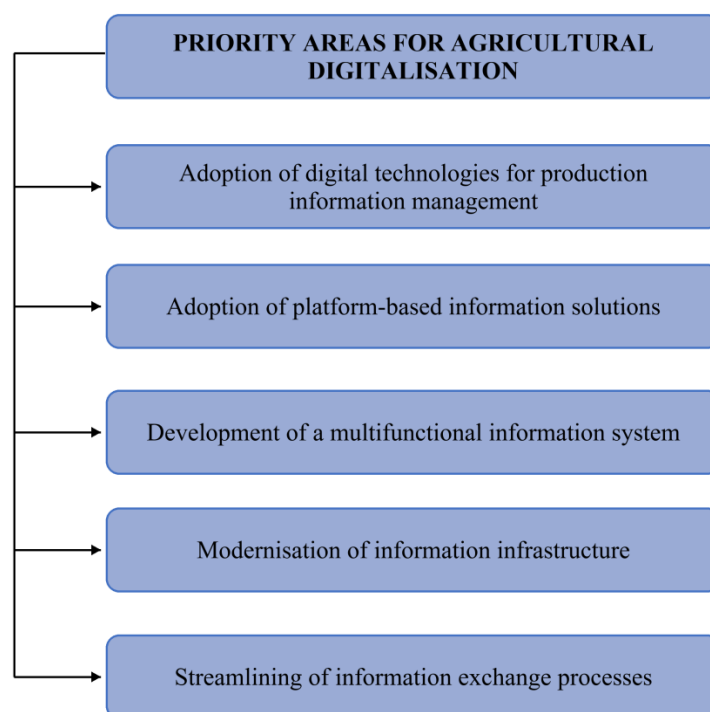


Figure 3. Key directions for agricultural digital transformation

Source: compiled by the author based on Mishchenko (2024) and Mamchur et al. (2025).

Priority directions for agricultural digital development include digital solutions for production information management; platform-based information tools for integrated agricultural production management; multifunctional information flow management systems; upgraded and expanded information infrastructure; and optimised information exchange between agricultural enterprises and their counterparties.

A fundamental prerequisite for initiating agricultural digital transformation is therefore the development of modern information infrastructure capable of integrating agricultural producers into a shared information

environment, providing access to relevant information resources, and enabling widespread adoption of proven and promising digital technologies. Together, these factors substantiate the integrated use of organisational, economic, technological, and institutional methods and tools for agricultural digital transformation.

3.4. Comparative analysis of the effectiveness of EU and Ukrainian digital strategies

The study compares the EU's and Ukraine's strategic digital development documents to assess the effectiveness of digitalisation methods and tools in agriculture. The analysis covers key European and national programmes aimed at digital skills, infrastructure, innovation, e-government, and the digital economy more broadly.

The comparative findings indicate substantial alignment between the EU's and Ukraine's strategic objectives, creating favourable conditions for digital policy integration and the adoption of modern agricultural technologies (*Table 5*).

Table 5

Comparative analysis of EU and Ukrainian digital strategies

Document / programme	Objectives and priorities	Key areas	Integration potential
Digital Decade Policy Programme 2030	Achieve full EU digital transformation by 2030	Digital skills; infrastructure; business digitalisation; public services	Establish shared objectives and mechanisms for cooperation with Ukraine
Digital Compass	Define the principal benchmarks for digital development	Skills; infrastructure; business; public services	Align strategies and exchange best practices
eGovernment Action Plan	Modernise public services	Single digital portal; register interoperability; once-only principle	Improve public service transparency and efficiency
Horizon Europe	Support research and innovation	Digital technologies; innovation; research and development	Enable Ukrainian researchers and enterprises to participate in joint projects
Concept for the Development of Ukraine's Digital Economy	Create conditions for digital economy development	Infrastructure; innovation; digital skills	Harmonise with European standards
Diia. Digital State	Ensure access to electronic services	Mobile application; electronic documents; online services	Integrate with European digital platforms
Digitalisation under the National Recovery Plan	Restore and modernise digital infrastructure	Broadband internet; startups; digital skills	Promote economic growth and social integration

Source: systematised by the author based on the Ministry of Digital Transformation of Ukraine (n. d.) and European Commission (n. d.).

When you look at the comparison, it is clear that European programs focus on a broad, systemic approach to digital development. They don't just look at one thing; they cover everything from human capital and infrastructure to innovation and governance. In the agricultural sector, this creates the right environment for things like precision farming, digital production management, satellite monitoring, and big data analytics to actually take root.

Ukraine is taking a similar path by rolling out digital services, electronic document management, and online access to public services, all while supporting innovative startups. The Diia platform and various electronic registers have been huge for agricultural businesses, helping to simplify administrative tasks, cut down on transaction costs, and make regulatory processes much more transparent.

On top of that, Ukraine's involvement in international research programs is a big factor in making digitalization more effective. By joining joint Horizon Europe projects, the country can facilitate technology transfers, spread innovative solutions, and build a modern scientific and technological base for agricultural production.

That said, the research also shows that how well digital tools are actually adopted in Ukraine depends a lot on a few key things: rural telecommunications infrastructure, access to funding, and how digitally literate agricultural workers are. Also, while the EU has a well-established system for monitoring and evaluating digital transformation, Ukraine's own mechanisms are still very much in the development stage.

Ultimately, the comparison shows that EU and Ukrainian digital strategies are built on the same core values and institutions, focusing on innovation, digital skills, and modern infrastructure. This shared foundation makes it much easier for Ukraine's agricultural sector to integrate into the European digital space.

By using these shared approaches to digitalization, Ukraine can see higher productivity, more efficient resource use, the growth of smart farming, and better competitiveness for its enterprises. In the long run, this will help speed up agricultural recovery after the war and lead to deeper integration with Europe.

Conclusions

The study examines digital transformation in Ukraine's agricultural sector in the context of sustainable development and European integration. The findings support the research hypothesis that digitalisation effectiveness depends not only on adopting individual technologies but also on coordinating technological, economic, organisational, and institutional measures.

The combined use of precision farming, artificial intelligence, IoT, GIS, and digital management platforms can increase productivity by 10–25%, reduce costs, and improve resource efficiency. However, small and medium-sized farms face considerable barriers. Their technology adoption costs per hectare may be 1.5–2 times higher than those of large enterprises, while complex organisational structures can increase integration costs by 20–40%.

The comparison with EU countries shows that European digitalisation relies on developed infrastructure, financial support, and cooperation between businesses, research institutions, and government. In Ukraine, digital development remains uneven, with large enterprises having better access to modern technologies.

The research hypothesis is supported by the finding that isolated digital solutions provide limited benefits, while coordinated implementation across production, logistics, and management offers greater potential for lasting improvements. Ukraine therefore needs better rural digital infrastructure, accessible financing, workforce training, and common digital maturity indicators.

Further research should focus on measuring digital transformation effectiveness and its impact on agricultural productivity and sustainable rural development.

REFERENCES / СПИСОК ВИКОРИСТАНИХ ДЖЕРЕЛ /

- | | |
|---|---|
| <i>AgroTimes</i> . (2021). Ministry of Agrarian Policy of Ukraine presented the Concept of digitalization of the agricultural sector. https://agrotimes.ua/tehnika/u-minagropolityky-predstavlyly-konczepczyu-didzhytalizacziyi-agrosektoru/ | <i>AgroTimes</i> . (2021). У Мінґрополітики представили Концепцію диджиталізації агросектору. https://agrotimes.ua/tehnika/u-minagropolityky-predstavlyly-konczepczyu-didzhytalizacziyi-agrosektoru/ |
| Aros, L., Mejia, A., Hernández, H., & Portela, F. (2025). Sustainability reporting in the construction sector: Trends, models, metrics and challenges towards achieving the SDGs. <i>Research in Globalization</i> , (11), 100300. https://doi.org/10.1016/j.resglo.2025.100300 | |
| Bilochenko, A., et al. (2020). Innovation as an important production factor and a factor in increasing the investment attractiveness of the agricultural sector. <i>Management Theory and Studies for Rural Business and Infrastructure Development</i> , 42(4), 458–465. https://doi.org/10.15544/mts.2020.47 | |
| European Commission. (2021). 2030 Digital Compass: The European way for the Digital Decade [COM(2021) 118 Final]. https://eurlex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021DC0118 | |
| European Commission. (n.d.). The common agricultural policy at a glance. https://agriculture.ec.europa.eu | |
| Ferla, G., Mura, B., Falasco, S., Caputo, P., & Matarazzo, A. (2024). Multi-criteria decision analysis (MCDA) for sustainability assessment in food sector: A systematic literature review on methods, indicators and tools. <i>Science of the Total Environment</i> , (946), 174235. https://doi.org/10.1016/j.scitotenv.2024.174235 | |
| Huyen, N., Thanh, T., & Ha, L. (2025). Developing sustainable and resilient agriculture systems of European countries. <i>Sustainable Futures</i> , (10), 101292. https://doi.org/10.1016/j.sftr.2025.101292 | |
| Ivantsov, S. V. (2024). Measures for the development of the digital economy in Ukraine in the context of European integration [in Ukrainian]. <i>Scientific Notes of Lviv University of Business and Law. Economic Series. Legal Series</i> , (43), 148–156. https://doi.org/10.5281/zenodo.14561288 | Іванцов, С. В. (2024). Заходи щодо розвитку цифрової економіки в Україні у контексті євроінтеграції. <i>Наукові записки Львівського університету бізнесу та права. Серія економічна. Серія юридична</i> , (43), 148–156. https://doi.org/10.5281/zenodo.14561288 |
| Li, Y., You, X., Fu, J., & Zhou, W. (2025). Mechanisms and effects of the digital economy on agricultural modernization: A sustainable development perspective. <i>Journal of Environmental Management</i> , (392), 126790. https://doi.org/10.1016/j.jenvman.2025.126790 | |
| Mamchur, V. V., & Studinska, H. Ya. (2024). Assessing the efficiency of technical innovations in the implementation of the modern model of the Ukrainian agricultural sector. <i>Economics of Agro-Industrial Complex</i> , 31(2), 32–40. https://doi.org/10.32317/2221-1055.202402032 | Мамчур, В. В., & Студінська Г. Я. (2024). Оцінювання ефективності технічних інновацій у реалізації сучасної моделі аграрного сектору України. <i>Економіка АПК</i> , 31(2), 32–40. https://doi.org/10.32317/2221-1055.202402032 |

Mamchur, V. V., Osetskyy, V. L., Bilyavska, Y. V., Umantsiv, H. V., & Bilyavskiy, V. V. (2025). Strategic vectors of agribusiness development in Ukraine. <i>Economics of Agro-Industrial Complex</i> , 32(1), 33–46. https://doi.org/10.32317/ekon.apk/1.2025.33	Мамчур, В. В., Осецький, В. Л., Білявська, Ю. В., Уманців, Г. В., & Білявський, В. В. (2025). Стратегічні вектори розвитку агробізнесу України. <i>Економіка АПК</i> , 32(1), 33–46. https://doi.org/10.32317/ekon.apk/1.2025.33
Ministry of Agrarian Policy and Food of Ukraine. (n. d.). Official website. https://minagro.gov.ua	Міністерство аграрної політики та продовольства України (б. д.). Офіційний вебсайт. https://minagro.gov.ua (дата звернення: 05.01.2026).
Ministry of Digital Transformation of Ukraine. (n. d.). Diia – The State in a Smartphone. https://plan2.diia.gov.ua/	Міністерство цифрової трансформації України. (б. д.). Дія – Держава у смартфоні. https://plan2.diia.gov.ua/ (дата звернення: 15.02.2026).
Mishchenko, V. V. (2024). Methods and tools of digital transformation in the agricultural sector. <i>AgroSvit</i> , (8), 103–110. https://doi.org/10.32702/2306-6792.2024.8.103	Мищенко, В. В. (2024). Методи та інструменти цифрової трансформації аграрного сектору. <i>Агросвіт</i> , (8), 103–110. https://doi.org/10.32702/2306-6792.2024.8.103
Olawale A. et al. (2024). A comprehensive review of redefining agricultural economics for sustainable development: overcoming challenges and seizing opportunities in a changing world. <i>World Journal of Advanced Research and Reviews</i> , 21(1), 2329–2341.	
Pomirna, O. M. (2015). The need to implement innovative activities as a driving force of economic development of business entities. <i>Global and National Economic Problems</i> , (5), 568–572. http://global-national.in.ua/issue-5-2015/13-vipusk-5-traven-2015-r/857-pomircha-o-m-neobkhidnist-vprovadzhennya-innovatsijnoi-diyalnosti-yak-rushijnoi-sili-ekonomichnogo-rozvitku-sub-ektiv-gospodaryuvannya	Помірна, О. М. (2015). Необхідність впровадження інноваційної діяльності як рушійної сили економічного розвитку суб'єктів господарювання. <i>Глобальні та національні проблеми економіки</i> , (5), 568–572. http://global-national.in.ua/issue-5-2015/13-vipusk-5-traven-2015-r/857-pomircha-o-m-neobkhidnist-vprovadzhennya-innovatsijnoi-diyalnosti-yak-rushijnoi-sili-ekonomichnogo-rozvitku-sub-ektiv-gospodaryuvannya (дата звернення: 15.02.2026).
Prokopenko, N. I. (2024). Sustainable development of the agricultural sector of the economy: Concept, essence, and conditions of implementation. <i>Economy and Society</i> , (64). https://doi.org/10.32782/2524-0072/2024-64-115	Прокопенко, Н. І. (2024). Сталий розвиток аграрного сектора економіки: поняття, сутність, умови реалізації. <i>Економіка та суспільство</i> , (64). https://doi.org/10.32782/2524-0072/2024-64-115
Rudenko, M. V. (2019). The impact of digital technologies on agricultural production: methodological aspect [in Ukrainian]. <i>Scientific Notes of V. I. Vernadsky Taurida National University. Series: Economics and Management</i> , 30(69), 30–37. https://doi.org/10.32838/2523-4803/69-6-28	Руденко, М. В. (2019). Вплив цифрових технологій на аграрне виробництво: методичний аспект. <i>Вчені записки ТНУ імені В. І. Вернадського. Серія: Економіка і управління</i> , 30(69), 30–37. https://doi.org/10.32838/2523-4803/69-6-28
Ye, L. (2025). Digital economy and high-quality agricultural development. <i>International Review of Economics & Finance</i> , (99), 104028. https://doi.org/10.1016/j.iref.2025.104028	

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