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## Management of sustainable land use projects in accordance with EU requirements

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**Abstract.** The purpose of the study was to conduct a comparative analysis of the management of sustainable land use development projects in Ukraine and the EU countries and to develop recommendations for improving Ukrainian practices in accordance with the requirements of the European Union. The methodology was based on a systematic approach and included the analysis of statistical data, an expert survey, and the calculation of an integral index of compliance with EU requirements. The study focused on three key aspects: restoration of degraded land,

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introduction of organic farming, and water management. The results revealed that Ukraine is lagging behind in all the parameters under study. In the area of restoration of degraded land, it was found that the area of restored land in Ukraine (8.4% of the total area of degraded land) is almost twice less than the average of the EU countries studied (16.8%). Investments in land restoration in Ukraine (310 EUR/ha) are only 39% of the EU average (792 EUR/ha). The analysis of the development of organic farming showed that the share of organic land in Ukraine (1.1% of the total agricultural area) is almost 6 times lower than the average for the EU countries under study (6.7%). The number of certified organic producers in Ukraine (3.2 per 100,000 population) is 6.4 times lower than the average for EU countries. In the field of water management, it was found that the irrigation efficiency in Ukraine (60%) is significantly lower than the EU average (77.4%), and the share of land with drip irrigation in Ukraine (5.2%) is 3.5 times lower than the EU average (18%). The calculation of the integral index of compliance with EU requirements showed that Ukraine (56 points) significantly lags behind the average of the EU countries studied (82.4 points). Based on the identified differences and successful practices of EU countries, a set of recommendations has been developed to improve the management of sustainable land use projects in Ukraine. Key recommendations include the development of a comprehensive national strategy, the creation of specialised financing funds, the introduction of economic incentives, the modernisation of monitoring systems, the harmonisation of standards with the EU, and large-scale educational campaigns. The study emphasises the need to significantly improve approaches to managing sustainable land use projects in Ukraine to bring them closer to EU standards and ensure efficient use of land resources

**Keywords:** environmental efficiency; institutional capacity; integral index; economic incentives; adaptation of legislation; innovative technologies

## INTRODUCTION

Sustainable development of land use is one of the priorities of the European Union (EU) policy aimed at ensuring the rational use of land resources, preserving ecosystems, and improving the quality of life of the population. In the context of Ukraine's European integration aspirations, the issue of adapting Ukrainian approaches to land management in accordance with EU requirements and standards is becoming particularly relevant. The problem of managing sustainable land use development projects attracts the attention of many researchers. Theoretical aspects of sustainable land use were considered by W.C. Adinugroho *et al.* (2024). The researchers emphasised the need to integrate environmental, economic, and social factors in land use planning. Project management issues in the context of sustainable development were investigated by R. Sweeney *et al.* (2023). The researchers emphasised the importance of considering the principles of sustainability at all stages of the project life cycle, emphasising the need to integrate economic, environmental, and social aspects into project management processes.

The specifics of implementing the principles of sustainable land use in the EU countries are the subject of active research. V. Maliene *et al.* (2024) analysed the positive impact of European directives and programmes on the development of sustainable land use practices. In particular, the study by P. Borrelli *et al.* (2020) was devoted to the analysis of soil erosion risks in EU countries and the development of strategies for adapting land use to climate change. These studies were of particular importance for Ukraine, given its significant agricultural potential and vulnerability to climate change, and can serve as a basis for developing

its own sustainable land use strategies using the European experience.

An important aspect of the study was also the analysis of modern technological solutions used in the EU to manage sustainable land use projects. A. Vitale and C. Salvo (2024) considered the prospects for using Geographic Information Systems (GIS), remote sensing technologies, and artificial intelligence to monitor land resources and support management decision-making. L. Kong *et al.* (2020) focused on the potential of using big data technologies to optimise land use in EU urban agglomerations. Special attention should be paid to the issue of involving stakeholders in the management of sustainable land use projects. The EU experience demonstrates the importance of active participation of the public, business and scientific community in land policy planning and implementation processes. The study by J. Newig *et al.* (2023), S. Yudina *et al.* (2024) showed that effective interaction between different stakeholder groups contributes to improving the quality of management decisions and reducing land-use conflicts.

In the context of Ukraine, T.V. Lisova (2024) analysed the current state of land reform and challenges associated with the implementation of European land use standards. The researcher noted the need to improve the regulatory framework, develop institutional capacity and effectively control land resources. However, the specific mechanisms for adapting successful European practices to Ukrainian conditions remain understudied. To deepen our understanding of sustainable land use issues in the context of Ukraine's European integration, attention should be paid to the research by M.I. Semych (2019). The researchers considered the issue of

harmonisation of the Ukrainian land management system with European standards. They stressed the need for an integrated approach to implementing changes that considers both legislative and institutional aspects.

The issues of digitalisation of land management and the introduction of innovative technologies in land use processes were considered by U. Sakthi *et al.* (2023). The researchers analysed the potential of using blockchain technologies and the Internet of Things to increase the transparency and efficiency of land transactions in the EU, which can be a useful experience for Ukraine in the context of land market development. The study by D. Stober *et al.* (2021) focused on spatial planning and the integration of sustainable development principles into territorial governance processes in EU countries. The researchers proposed innovative approaches to balancing economic, social and environmental interests in land use planning, which can be adapted to Ukrainian realities. An important aspect is also the study of economic mechanisms for promoting sustainable land use. In this context, the study by B. Bartkowski *et al.* (2020) was devoted to the analysis of the effectiveness of various instruments of economic regulation in the field of land use in the EU, including tax incentives, subsidies, and market mechanisms. These studies can be useful for developing economic incentives for sustainable land use in Ukraine.

Issues of land management in the context of rural development were considered by G. Pe'er *et al.* (2020). The researchers analysed the experience of EU countries in implementing integrated approaches to rural development that combine the tasks of landscape conservation, maintaining biodiversity and ensuring the economic viability of rural communities. The fundamental impact of sustainable land use policies on the socio-economic development of EU regions was investigated by L. Scheurer and A. Vranken (2024). It concerned the analysis of the impact of sustainable land use policies on the socio-economic development of EU regions. The researchers proposed a methodology for evaluating the effectiveness of sustainable land use projects, which can be adapted for monitoring and evaluating such initiatives in Ukraine.

The purpose of this study was to conduct a comparative analysis of the management of sustainable land use development projects in Ukraine and the EU countries and develop recommendations for improving Ukrainian practices in accordance with the EU requirements.

## MATERIALS AND METHODS

A comprehensive approach was used to conduct the study, including an analysis of statistical data, the regulatory framework, and an expert survey. The study was conducted in the period from January to June 2024 and covered five member states of the European Union – Poland, Romania, Bulgaria, Greece, Spain, and Ukraine. Official sources Eurostat (2024) and State Service of

Ukraine for Geodesy, were used for analysis. In particular, the following indicators were analysed:

- area of restored land (% of the total area of degraded land);
- land restoration investment (EUR/ha);
- share of organic land (% of total agricultural area);
- number of certified organic producers (per 100,000 population);
- organic products market (EUR per capita);
- irrigation efficiency;
- share of land with drip irrigation;
- water reuse (million m<sup>3</sup>/year);
- water stress index.

The SPSS Statistics 28.0 software suite was used for processing statistical data. Descriptive statistics, correlation analysis (Pearson correlation coefficient), and regression analysis were used. The statistical significance of the results was evaluated using the Student's t-test at the significance level of  $p < 0.05$ . The analysis of the regulatory framework included the study of key EU documents on sustainable land use development, in particular: European Green Deal (2021), Common Agricultural Policy for 2023-2027 (2022), and EU Biodiversity Strategy for 2030 (2020), Directorate-General for Environment (2021), European Environment Agency (2024). The relevant Ukrainian regulations and strategic documents were also analysed to assess their compliance with EU requirements.

To obtain expert assessments, an anonymous online survey of 30 specialists in the field of land administration and sustainable development from the EU and Ukraine was conducted in the period from May 15 to June 30, 2023. The sample was formed by the snowball method with the initial selection of experts according to the following criteria: the presence of a specialised higher education (Master's or Doctor of Science in the field of land management, ecology, or sustainable development), at least 5 years of experience in the relevant field, the presence of at least three peer-reviewed publications on the research topic over the past 5 years. Distribution of respondents: 25 experts from EU countries (5 each from Poland, Romania, Bulgaria, Greece, and Spain) and 5 experts from Ukraine. The questionnaires were sent out by email with a link to the Google Form survey. Prior to the survey, all participants provided informed consent to the processing of their data in accordance with the requirements of the GDPR and national legislation. The survey was conducted in English, with the possibility of providing answers in Ukrainian for experts from Ukraine. The study was approved by the Ethics Committee of the National University "Kyiv-Mohyla Academy" (protocol No. 5 of 31 March 2016) and was conducted in compliance with ethical standards, including voluntary participation, data confidentiality, and the ability to withdraw at any stage of the survey. The questionnaire contained 20 closed-ended

questions on a 5-point Likert scale and 5 open-ended questions. Questions related to assessment:

- effectiveness of existing mechanisms for managing sustainable land use development projects;
- compliance of national policies with EU requirements;
- major challenges and obstacles to implementing sustainable land use principles;
- promising areas for improving project management.

Methods of descriptive statistics, factor analysis, and content analysis of answers to open-ended questions were used to analyse the survey results. Based on the data obtained, an integral index of compliance of the management of sustainable land use development projects with EU requirements was developed. The index was calculated using the equation (1):

$$I = 0.3A + 0.3B + 0.2C + 0.2D, \quad (1)$$

where I – integral index; A – indicator of regulatory compliance (0-100 points); B – indicator of institutional capacity (0-100 points); C – indicator of resource provision (0-100 points); D – indicator of project performance (0-100 points). The weight coefficients were determined based on expert assessments.

## RESULTS

The study focused on three key aspects of managing sustainable land use projects in line with EU requirements: restoration of degraded land, introduction of organic farming and water management in the context of agricultural production. A comparative analysis of the situation in Ukraine and five EU countries (Poland, Romania, Bulgaria, Greece, and Spain) revealed significant differences in approaches and effectiveness of sustainable land use development projects. The results were based on the analysis of statistical data, an expert survey, and calculation of the integral index of compliance with EU requirements. The overall picture indicates a significant lag of Ukraine from the studied EU countries in all the aspects considered. Differences in investment volumes, the effectiveness of implemented measures, and the development of appropriate infrastructure are particularly noticeable. The analysis of successful practices of EU countries helped to identify key success factors and develop recommendations for bridging the existing gap.

**Restoration of degraded land.** The restoration of degraded land is a key aspect of sustainable land use development, which is an integrated approach to land

management and use. This approach is aimed at ensuring long-term land productivity, maintaining its ecological integrity and promoting the socio-economic sustainability of regions. In the context of global challenges such as climate change, population growth and increased food security, the restoration of degraded land is of particular importance. It not only facilitates productive use of areas that have lost their fertility due to erosion, pollution, or overexploitation, but also contributes to the conservation of biodiversity, improving water and air quality, and mitigating the effects of climate change (Skydan *et al.*, 2021).

A comparative analysis of approaches to the restoration of degraded land in the countries of the European Union and Ukraine revealed significant differences in methodologies, investments, and the effectiveness of implemented measures. EU countries, guided by the principles of EU Soil Strategy for 2030 (2021), implement comprehensive strategies that combine innovative technologies with traditional land use methods. In particular, the following advanced approaches are widely used: phytoremediation – the use of specially selected plants to remove pollutants from the soil; bioremediation – the use of microorganisms to decompose toxic substances; agroforestry – the creation of protective forest belts to prevent soil erosion (Melnychenko, 2024; Skliar *et al.*, 2024). In addition, considerable attention is paid to the introduction of crop rotations and the cultivation of cover crops that contribute to the restoration of the structure and increase soil fertility. These methods not only effectively restore degraded land, but also ensure the long-term sustainability of agroecosystems.

In contrast, approaches to the restoration of degraded land in Ukraine are characterised by a certain limitation and predominance of traditional methods. In particular, simple reclamation is often used by filling with a fertile layer of soil, which does not always ensure sustainable restoration of the ecosystem. The use of modern remediation technologies and biological recovery methods remains limited, due to both insufficient funding and the lack of a comprehensive national strategy in this area (Fedoniuk *et al.*, 2024). The introduction of agroecological practices that would promote natural soil restoration is also slow, due to a lack of awareness among farmers and a lack of appropriate incentives. To quantify the effectiveness of measures to restore degraded land, a comparative analysis of key indicators was conducted between the EU countries and Ukraine (Table 1).

**Table 1.** Comparison of indicators of restoration of degraded land (2024)

Country	Area of restored land (% of the total area of degraded land)	Recovery investment (EUR/ha)	Recovery efficiency (points*)
Poland	18.5	850	7.2
Romania	15.3	720	6.8
Bulgaria	14.1	680	6.5

Table 1. Continued

Country	Area of restored land (% of the total area of degraded land)	Recovery investment (EUR/ha)	Recovery efficiency (points*)
Greece	16.7	790	7.0
Spain	19.2	920	7.5
Ukraine	8.4	310	4.3

**Note:** recovery efficiency was evaluated by experts on a 10-point scale

**Source:** created by the authors based on D. Verhoeven *et al.* (2024) and the State Service of Ukraine for Geodesy

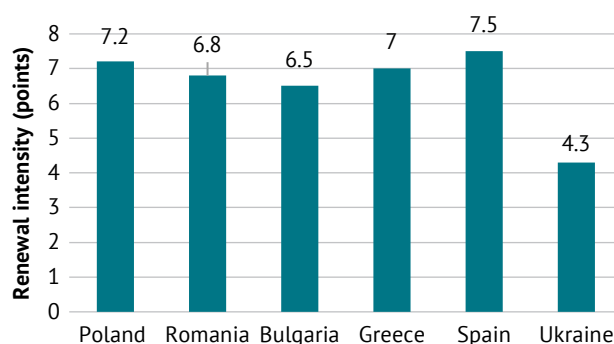
An analysis of the data presented in Table 1 revealed significant differences between approaches to the restoration of degraded land in Ukraine and the EU countries. Comparison of Ukraine's indicators with the average values for the EU countries under study showed a significant lag in Ukraine in all key parameters. The difference in investment in land restoration is particularly noticeable, which directly affects the effectiveness of these measures. Such low indicators of Ukraine indicate the presence of serious systemic problems in the approach to the restoration of degraded land and the need for drastic changes in this area.

An expert survey conducted as part of the study revealed key success factors that contribute to the effective restoration of degraded land in the EU countries. Among them, the implementation of comprehensive national soil restoration programmes, significant investments in research and innovative restoration technologies, and the active involvement of local communities and the private sector in restoration projects stand out. Notable examples of such successful initiatives are the Land Restitution (2024) in Spain and the Land from Scratch (2024) in Poland. These programmes are distinguished by their integrated approach, which provides not only direct financing of land restoration work, but also a wide range of related activities. In particular, they include systematic training of farmers in modern methods of restoring and preserving soil fertility, the introduction of advanced soil monitoring systems using satellite technologies and drones, and the development and implementation of economic incentives to promote sustainable land use practices. The effectiveness of these programmes is confirmed by impressive results: over the past 5 years, significant areas of degraded land have been successfully restored. The LIFE programme, which aims to finance innovative environmental projects, provides significant support for initiatives to restore degraded land and preserve biodiversity. The Common Agricultural Policy for 2023-2027 (2022) also plays an important role, which encourages farmers to adopt sustainable land use practices through a system of subsidies and economic incentives. These initiatives create a strong institutional and financial framework for implementing effective measures to restore degraded land in EU countries. These achievements not only reflect the quantitative aspect of restoration, but also indicate qualitative changes in approaches to land management, the development of a new culture of land use,

and an increase in environmental awareness among farmers and landowners.

In contrast to the successful experience of the EU countries, the situation in Ukraine is characterised by the presence of significant obstacles to the effective restoration of degraded land (Bragina *et al.*, 2018). According to experts, the main problems are chronic underfunding of restoration projects, the use of outdated technologies and methods, and imperfect legislative framework in the field of soil protection and restoration. The lack of a clear national strategy for the restoration of degraded land that sets out long-term goals, funding mechanisms and criteria for evaluating the effectiveness of rehabilitation measures is particularly acute. Limited budget resources allocated for this purpose lead to the fact that most restoration projects in Ukraine are fragmented, cover small areas and do not have a long-term effect. The experts also noted the serious problem of insufficient coordination between different departments and levels of government, which often leads to duplication of efforts, inefficient use of already limited resources, and a lack of a systematic approach to solving the problem of land degradation.

A diagram was created to visually represent the identified differences in the efficiency of restoring degraded land between the EU countries and Ukraine (Fig. 1). It shows a significant lag in Ukraine in terms of the effectiveness of restoring degraded land compared to European countries. The diagram not only illustrates the current state of affairs, but also highlights the scale of challenges facing Ukraine in the field of restoring degraded land, and the need for drastic changes in approaches to land management.



**Figure 1.** Comparison of the efficiency of degraded land restoration

**Source:** created by the authors

Considering the identified problems and the significant lag of Ukraine in the restoration of degraded land, experts have developed a number of recommendations to bridge this gap. The key recommendation was the development and implementation of a comprehensive national programme for the restoration of degraded land, which should be coordinated with the EU Soil Strategy for 2030 (2021). Such a programme should include clearly defined objectives and indicators of success, detailed funding mechanisms (with a particular focus on attracting private investment through public-private partnership mechanisms), and an effective monitoring and evaluation system. Experts emphasise the need for a significant increase in investment in land restoration, suggesting the use of various sources of funding, including the state budget, funds from international financial organisations, and the creation of a specialised fund for the restoration of degraded land. Special attention is paid to the importance of implementing a modern system for monitoring and evaluating the efficiency of recovery projects, similar to that used in the EU. Such a system will not only track progress in real time, but also provide the ability to quickly adjust the land restoration strategy based on the data obtained and analyse the effectiveness of implemented measures.

The implementation of these recommendations will require significant efforts and resources, but it is critical for ensuring the sustainable development of

agriculture and the conservation of natural resources in Ukraine. Successful implementation of best practices in restoring degraded land will not only increase agricultural productivity and improve the environmental situation, but also bring Ukraine closer to European standards of land management, which is an important step towards European integration.

**Introduction of organic farming.** The introduction of organic farming is another key aspect of sustainable land use development, which plays a crucial role in ensuring long-term agricultural land productivity and maintaining ecological balance. Organic farming involves moving to crop cultivation methods that minimise the use of synthetic pesticides and fertilisers, thereby reducing the chemical load on the soil and water resources. This approach not only helps restore natural soil fertility and preserve biodiversity, but also ensures the production of safe and nutritious food. In the context of growing global concerns about food security, climate change and environmental degradation, organic farming is becoming increasingly important as a strategic area for the development of the agricultural sector. A comparative analysis of the development of organic farming in the European Union and Ukraine reveals significant differences in the approaches, scale of implementation, and efficiency of this sector. To quantify these differences, a detailed study of key indicators of organic sector development in selected countries was conducted (Table 2).

**Table 2.** Comparison of organic farming development indicators (2024)

Country	Share of organic land (% of total agricultural area)	Number of certified organic producers (per 100,000 population)	Organic products market (EUR per capita)
Poland	5.8	18.3	62
Romania	4.2	12.7	41
Bulgaria	3.5	10.9	35
Greece	10.3	32.1	95
Spain	9.7	28.6	87
Ukraine	1.1	3.2	8

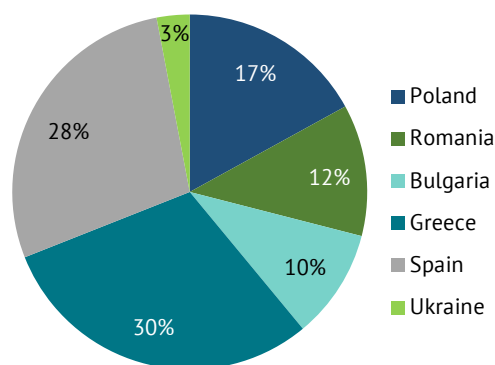
**Source:** created by the authors based on Eurostat (2024)

The analysis of the data presented in Table 2 revealed a significant lag in the development of the organic sector in comparison with the EU countries studied. Ukraine is significantly inferior in all key indicators. The share of organic land in Ukraine is almost 6 times less than the average indicator of the studied EU countries. The number of certified organic producers per 100,000 population in Ukraine is significantly lower than in the EU countries. The organic market in Ukraine also remains underdeveloped: the cost of organic products per capita in Ukraine is 7-12 times less than in the EU countries under study. These data clearly illustrate the significant potential for the development of the organic sector in Ukraine and the need to step up efforts in this line.

An expert survey conducted as part of the study revealed key success factors for the introduction of organic farming in the EU countries. Central to this process is the effective implementation of the EU's organic production action plan, which is part of the broader Farm to Fork Strategy (2020). This plan provides for a comprehensive approach to stimulating both demand and supply of organic products, including financial support for producers, infrastructure development, and raising consumer awareness. Significant financial support for farmers in the transition to organic production plays an important role. For example, Spain has a subsidy programme that covers up to 70% of certification costs and up to 50% of necessary equipment costs during the first three years of switch-

ing to organic production. This support allows farmers to overcome initial financial difficulties and achieve profitability faster. In addition, the EU has a well-developed system of certification and quality control of organic products, which ensures a high level of consumer confidence. Active consumer awareness is also an important element of success. A striking example of such activities is the Greek national programme Organic Food in Schools (Malissiova *et al.*, 2022), which not only provides students with organic products, but also conducts regular educational events for children and their parents about the benefits of organic food. This initiative contributes to the development of sustainable demand for organic products in the long term and educates a new generation of conscious consumers. As part of the EU's Green Course policy, innovative projects aimed at supporting organic farming are also being actively implemented. For example, the Organic Farm Knowledge Platform (2021) project provides farmers with access to the most up-to-date knowledge and practices in the field of organic production, and the European Innovation Partnership initiative "Agricultural Productivity and Sustainability" (2023) promotes collaboration between scientists, farmers, and agribusiness to develop innovative solutions in the field of sustainable agriculture.

In contrast to the successful experience of the EU countries, the situation with the development of organic farming in Ukraine is characterised by the presence of significant obstacles. The main problem, according to experts, is insufficient state support for the organic sector. Unlike the EU countries, Ukraine does not have systematic programmes to subsidise farmers who switch to organic production (Borko & Jammal, 2024). This leads to the fact that the cost of transition falls entirely on the shoulders of producers, which in conditions of limited financial resources becomes a significant barrier. Another important problem is the difficulty of certifying products according to EU standards. The cost of certification for an average farm can reach EUR 5,000-7,000, which is a significant financial burden for Ukrainian farmers. In addition, the certification procedure is often lengthy and bureaucratically complex, which further discourages potential producers of organic products. Experts also noted the problem of low purchasing power of the population and insufficient consumer awareness of the benefits of organic products. This leads to low domestic demand for organic products: about 70% of Ukrainian organic products are exported, while the domestic market remains underdeveloped. The lack of a well-developed infrastructure for storing, processing, and distributing organic products is also a significant constraint on the development of the sector. To visually represent the difference in the share of organic land between the EU countries and Ukraine, a comparative chart was created (Fig. 2).



**Figure 2.** Comparison of the share of organic land  
**Source:** created by the authors

This chart clearly demonstrates Ukraine's significant lag in the share of organic land from the leading EU countries, which underlines the need to step up efforts in this area and implement comprehensive measures to stimulate the development of the organic sector. Considering the identified problems and the significant lag of Ukraine in the field of organic farming, experts have developed a number of recommendations to bridge this gap. The key recommendation is the development and implementation of a comprehensive national strategy for the development of organic production, coordinated with the Action Plan for the Development of Organic Production in the EU (2022). This strategy should include a number of interrelated activities. First, it is necessary to create an effective system of financial support for farmers in the transition to organic production, which may include subsidies, soft loans, and tax preferences. This support should be sufficient to cover the additional costs associated with the transition to organic farming methods and ensure a stable income for farmers during the transition period. Second, it is important to simplify the certification procedure for organic products and harmonise Ukrainian standards with European ones. This will reduce producers' certification costs and facilitate access of Ukrainian organic products to EU markets. The creation of a national certification system that is internationally recognised can be an important step in this line. Third, it is necessary to stimulate the development of the domestic market for organic products. This can be achieved through the introduction of public procurement of organic products for schools, hospitals, and other government agencies, and through the support of local producers and the creation of specialised markets for organic products. An important aspect is also the development of infrastructure for the storage, processing, and distribution of organic products, which can be implemented through public-private partnerships.

Experts stressed the importance of conducting large-scale educational campaigns to raise consumer awareness of the benefits of organic products. These

campaigns should reach different segments of the population and use a variety of communication channels, including social media, television, schools, and community organisations. In addition, it is recommended to introduce specialised educational programmes for farmers who want to switch to organic production, in order to improve their competencies in the field of organic technologies and management methods. Ultimately, an important aspect is the promotion of scientific research and innovation in organic farming. The creation of specialised research centres, support for cooperation between scientists and farmers, and the implementation of pilot projects on testing innovative organic technologies can be key factors for improving the efficiency and competitiveness of the Ukrainian organic sector.

The implementation of recommendations for the development of organic production in Ukraine will require significant efforts and resources, but it is necessary to ensure the sustainable development of agriculture, approach European standards, and obtain broad positive effects. Successful implementation of these measures will contribute to the development of the organic sector, have a positive impact on the economy, environment, and public health. The development of organic farming also opens up new opportunities for the export of Ukrainian products to the markets of the EU and other countries, which can become an important factor in economic growth and integration of Ukraine into the global value chains of sustainable agriculture.

**Water resources management.** Studies have shown significant differences between the approaches of Ukraine and EU countries to water resources management. In particular, it is important to implement the Water Framework Directive (2000), which introduces an integrated approach to water management at the river basin level. This directive promotes integrated water management by combining quantitative and qualitative aspects. Similar approaches are being implemented in Ukraine, but much more slowly than in the European Union countries. Data analysis showed that EU countries have made significant strides in implementing water-saving technologies in agriculture. For example, in Spain and Greece, drip irrigation systems are widely used, which can save up to 50% of water compared to conventional methods. In Ukraine, the share of land with drip irrigation remains low, due to insufficient funding and low awareness of farmers about the benefits of this technology. Experts note that the introduction of modern irrigation systems could significantly increase the efficiency of water resources use in Ukrainian agriculture.

Water reuse is also an important aspect of water management. In EU countries, especially in regions with limited water resources, technologies for wastewater treatment and reuse for irrigation are actively developing. For example, in Spain, more than 100 million m<sup>3</sup> of water is reused annually, which significantly reduces the load on natural water sources. In Ukraine, this practice has not yet become widespread, which is reflected in the following data (Table 3).

**Table 3.** Comparison of water management performance indicators (2024)

Country	Irrigation efficiency (%)	Share of land with drip irrigation (%)	Water reuse (million m <sup>3</sup> /year)	Water stress index*
Poland	78	15.3	42	1.8
Romania	72	12.7	35	2.1
Bulgaria	70	11.9	28	2.3
Greece	82	22.6	89	3.5
Spain	85	27.4	124	3.8
Ukraine	60	5.2	12	2.7

**Note:** water stress index: ratio of total water intake to available renewable water resources

**Source:** created by the authors based on C. McLennan et al. (2024), Eurostat (2024) and State Service of Ukraine for Geodesy

The expert survey revealed the key factors that determine the higher efficiency of water resources management in the EU countries: consistent implementation of the EU Water Framework Directive, significant investments in the introduction of innovative irrigation and water conservation technologies, a developed system for monitoring the state of water resources, active involvement of farmers in programmes to improve water use efficiency. But in Ukraine, experts noted a number of significant problems: the obsolescence of irrigation systems (up to 70% require modernisation

or replacement), the slow introduction of water-saving technologies due to the lack of financial resources, an inefficient system for monitoring water resources, and a low level of awareness of farmers about modern methods of efficient water use.

Based on the analysis of the situation and recommendations of experts, a set of measures was developed to overcome the backlog of Ukraine in the field of water resources management: development and implementation of a national water resources management strategy, a large-scale programme for the



modernisation of irrigation systems, the creation of a system of economic incentives for farmers, improving the system of monitoring and management of water resources. To assess the overall level of compliance of sustainable land use project management with EU requirements, an integral index was developed and

calculated for each of the countries under study (Table 4). This index considers four key components: regulatory compliance, institutional capacity, resource support, and project performance. Each component was evaluated on a scale from 0 to 100 points based on statistical analysis and expert assessments.

**Table 4. Integrated EU compliance index (2024)**

Country	Regulatory compliance (A)	Institutional capacity (B)	Resource provision (C)	Project performance (D)	Integral index (I)
Poland	92	85	78	83	85.3
Romania	88	79	72	76	79.5
Bulgaria	85	76	68	72	76.1
Greece	90	82	75	80	82.4
Spain	95	88	82	87	88.7
Ukraine	65	58	45	52	56.0

**Source:** created by the authors based on Schillaci et al. (2023), State Service of Ukraine for Geodesy

The integral index was calculated by equation (1). The results showed that Ukraine lags significantly behind the EU countries in all components of the index. The greatest lag is observed in terms of resource provision and project performance. This indicates the need not only to harmonise legislation and develop institutional capacity, but also to significantly increase investment in sustainable land use development projects and improve the efficiency of their implementation in Ukraine.

**Recommendations for improving project management.** Based on the identified differences and successful practices of the EU countries, it is possible to develop a comprehensive set of recommendations for improving the management of sustainable land use development projects in Ukraine in accordance with EU requirements. The key element should be the development and implementation of a comprehensive national strategy for sustainable land use development, which would cover all three aspects under study: the restoration of degraded land, the development of organic farming, and water resources management. This strategy should be consistent with relevant EU directives and initiatives, in particular the EU Soil Strategy for 2030 (2021), Organic Action Plan, and Water Framework Directive (2000).

In the field of restoration of degraded land, it is recommended to create a specialised fund to finance restoration projects, which would combine funds from the state budget, international financial organisations, and private investors. It is important to introduce a system of economic incentives for landowners who are actively engaged in the restoration of degraded land, including tax incentives and subsidies. It is also necessary to develop and implement a modern soil monitoring system that would allow rapid identification of problem areas and assessment of the effectiveness of restoration measures. For the development of organic farming, the key recommendation is to create an effective system of financial support for farmers during

the transition to organic production. This system may include subsidies to cover certification costs, soft loans to purchase necessary equipment, and compensation for possible temporary crop declines during the transition period. It is also important to simplify the certification procedure for organic products and harmonise Ukrainian standards with European ones. It is recommended to develop and implement a national infrastructure development programme for the storage, processing, and distribution of organic products, which can be implemented through public-private partnership mechanisms. It is equally important to conduct large-scale information and educational campaigns to raise consumer awareness of the benefits of organic products and stimulate domestic demand.

In the field of water resources management, the key recommendation is the development and implementation of a national programme for the modernisation of irrigation systems, with a focus on the introduction of water-saving technologies such as drip irrigation. It is important to create a system of economic incentives for farmers who implement efficient water use methods, including grants for the purchase of modern equipment and preferential tariffs for irrigation water. It is also recommended to develop technologies for wastewater treatment and reuse for irrigation, especially in regions with limited water resources. To enhance institutional capacity, it is important to establish an interagency coordinating body that ensures the coordinated implementation of sustainable land use policies at all levels. It is also necessary to develop and implement a comprehensive professional development programme for specialists in the field of land and water management, which would consider the best practices of EU countries.

An important aspect is to develop cooperation with research institutions and universities to encourage innovation and transfer knowledge to practical land use.

To improve monitoring and evaluation of the effectiveness of projects, it is recommended to implement a single information system that would allow real-time monitoring of progress in the implementation of sustainable land use development projects and assess their impact on environmental and socio-economic indicators. This system should be integrated with the relevant European databases to ensure comparability of indicators. The implementation of these recommendations will require significant efforts and resources, but it is critical for ensuring the sustainable development of the agricultural sector of Ukraine and approaching European standards of land management. The successful implementation of these measures will not only contribute to solving environmental problems and improving agricultural efficiency, but also create new opportunities for economic growth and integration of Ukraine into the European space.

## DISCUSSION

The results of the study indicate a significant lag between Ukraine and the EU countries in the field of managing sustainable land use development projects. This lag is observed in all three key aspects: the restoration of degraded land, the introduction of organic farming, and water management. Such results are important for understanding the current state and prospects for the development of sustainable land use in Ukraine in the context of European integration processes.

In the field of restoration of degraded land, Ukraine shows significantly lower indicators compared to the EU countries under study. The share of restored land in Ukraine (8.4%) is almost half that of the EU countries (14.1-19.2%), and the volume of investment in restoration (310 EUR/ha) is 2-3 times lower. These findings are consistent with the study by P. Borrelli *et al.* (2020), which identified high risks of soil erosion in Eastern European countries, including Ukraine, and stressed the need to step up efforts to restore degraded land. The results also support the findings of T.V. Lisova (2024) on the need to improve the regulatory framework and increase the institutional capacity of Ukraine in the field of land management. It is important to note that the low efficiency of restoring degraded land in Ukraine (4.3 points out of 10) compared to the EU countries (6.5-7.5 points) can be associated not only with insufficient funding, but also with the use of outdated technologies and methods. This confirms the arguments of A. Vitale and C. Salvo (2024) on the importance of implementing modern geoinformation systems and remote sensing technologies for effective land management.

In the field of organic farming, the results of the study show an even more significant lag in Ukraine. The share of organic land in Ukraine (1.1%) is significantly lower than in the EU countries (3.5-10.3%), and the number of certified organic producers per 100,000 population in Ukraine (3.2) is 3-10 times less than in

the EU countries under study. These data are consistent with conclusions of I. Soares *et al.* (2024) on the importance of integrating sustainability principles into all aspects of project management in the agricultural sector. Especially important is the significant lag of Ukraine in terms of Organic Market Development (EUR 8 per capita compared to EUR 35-95 in the EU countries). This confirms the arguments of E. Butenko and Y. Loshakova (2019) on the need for an integrated approach to the development of the organic sector, which would include not only supporting producers, but also stimulating demand for organic products.

In the field of water resources management, the results of the study also indicate a significant lag in Ukraine. Low irrigation efficiency (60% compared to 70-85% in the EU) and a small share of land with drip irrigation (5.2% compared to 11.9-27.4% in the EU) indicate the need to modernise irrigation systems in Ukraine. These results support the conclusions of P.A. Schulte *et al.* (2022) on the importance of introducing innovative technologies to improve the efficiency of water resources use in agriculture. It is important to note that the low level of water reuse in Ukraine (12 million m<sup>3</sup>/year compared to 28-124 million m<sup>3</sup>/year in the EU countries) indicates the need to develop technologies for wastewater treatment and reuse for irrigation. This is consistent with recommendation of D. Stober *et al.* (2021) on the integration of sustainable development principles into water management processes. The analysis of the integral index of compliance with EU requirements shows that Ukraine significantly lags behind the countries under study in all components: regulatory compliance, institutional capacity, resource support, and project performance. Particularly low indicators of Ukraine in terms of resource provision components (45 points compared to 68-82 in the EU countries) and project performance (52 points compared to 72-87 in the EU countries) confirm the conclusions of I. Fazey *et al.* (2020) on the need for an integrated approach to implementing sustainable development principles in land use.

It is important to note that the identified problems in the field of managing sustainable land use development projects in Ukraine are systemic in nature and require a comprehensive solution. This is consistent with the conclusions of J. Newig *et al.* (2023) on the importance of effective interaction between different groups of stakeholders to improve the quality of management decisions in the field of land use. The results of the study also support arguments of F. Terribile *et al.* (2024) on the positive impact of European directives and programmes on the development of sustainable land use practices. Significantly higher indicators of EU countries in all the studied aspects indicate the effectiveness of the European policy in the field of sustainable land use development. An important aspect identified in the course of the study is the significant lag of

Ukraine in the implementation of innovative technologies for land and water resources management. This the findings of L. Kong *et al.* (2020) on the importance of using big data and artificial intelligence technologies to optimise land use. The results of the study also indicate the need to develop economic mechanisms for stimulating sustainable land use in Ukraine. Low investment rates in the restoration of degraded land and the development of organic farming support arguments of B. Bartkowski *et al.* (2020) on the importance of effective economic regulatory instruments in the field of land use.

Special attention should be paid to the significant lag of Ukraine in the development of organic farming. This confirms the conclusions of R.M. Petrescu-Mag *et al.* (2019) on the need to implement integrated approaches to rural development that would simultaneously address the challenges of landscape conservation, maintaining biodiversity, and ensuring the economic viability of rural communities. It is important to continue studying the impact of sustainable land use policies on the socio-economic development of regions. The results of the study are also consistent with the findings of L. Scheurer and A. Vranken (2024) on the need to develop a methodology for evaluating the effectiveness of sustainable land use projects that would consider both environmental and socio-economic aspects. The analysis of the results of the study also highlights the need to develop a system for monitoring and evaluating the effectiveness of sustainable land use projects in Ukraine. This is in line with recommendations of U. Sakthi *et al.* (2023) on the use of blockchain technologies and the Internet of Things to improve transparency and efficiency of land management. Special attention should be paid to problems in the field of water resources management in Ukraine, considering global climate changes, which is confirmed by the conclusions of P. Borrelli *et al.* (2020), B. Rexha *et al.* (2024) on the need to develop adaptive land-use strategies for climate change.

The results of the study highlight the need for significant changes in approaches to managing sustainable land use development projects in Ukraine. A significant lag behind the EU countries in all the aspects under study indicates the need for a comprehensive solution to problems, which would include improving the regulatory framework, strengthening institutional capacity, increasing investment, and introducing innovative technologies. Overcoming this gap is critical not only for ensuring the sustainable development of the agricultural sector of Ukraine, but also for the successful European integration of the country. The implementation of European standards and practices in the field of land and water resources management will not only increase the efficiency of agriculture and solve environmental problems, but also open up new opportunities for economic growth and integration of Ukraine into the European space.

The results of the study also indicate the need for further scientific research in the field of evaluating the effectiveness of sustainable land use development projects, developing innovative technologies for land and water resources management, and studying the impact of sustainable land use policies on the socio-economic development of the regions of Ukraine. These areas of research should become a priority for the Ukrainian scientific community in the context of the country's European integration aspirations and global challenges to sustainable development.

## CONCLUSIONS

The study comprehensively analysed the management of sustainable land development projects in Ukraine and the EU countries, focusing on three key aspects: restoration of degraded land, introduction of organic farming, and water resources management. The results of the study revealed a significant lag of Ukraine from the studied EU countries in all the parameters considered. In the field of restoration of degraded land, it was found that the area of restored land in Ukraine (8.4% of the total area of degraded land) is almost twice less than the average for the EU countries under study (16.8%). Investment in land restoration in Ukraine (310 EUR/ha) accounts for only 39% of the EU average (792 EUR/ha). The recovery efficiency estimated by experts in Ukraine (4.3 points) is significantly lower than the average of the EU countries (7 points). Analysis of the development of organic farming showed that the share of organic land in Ukraine (1.1% of the total agricultural area) is almost 6 times less than the average indicator of the studied EU countries (6.7%). The number of certified organic producers in Ukraine (3.2 per 100,000 population) is 6.4 times less than the EU average (20.5). The market of organic products in Ukraine (EUR 8 per capita) is 8 times less than the average of the EU countries (EUR 64). In the field of water resources management, it was found that irrigation efficiency in Ukraine (60%) is significantly lower than the EU average (77.4%). The share of land with drip irrigation in Ukraine (5.2%) is 3.5 times less than the average of EU countries (18%). The volume of water reuse in Ukraine (12 million m<sup>3</sup>/year) is 5.3 times less than the average of the EU countries (63.6 million m<sup>3</sup>/year). The calculation of the integral index of compliance with EU requirements showed that Ukraine (56 points) significantly lags behind the average of the EU countries surveyed (82.4 points). The greatest lag is observed in terms of resource provision and project performance. Based on the identified differences and successful practices of the EU countries, a set of recommendations has been developed to improve the management of sustainable land use development projects in Ukraine. The key recommendations are: development of a comprehensive national strategy; creation of specialised funding funds; introduction

of economic incentives; modernisation of monitoring systems; harmonisation of standards with the EU and large-scale educational campaigns.

Among the limitations of the study, it is worth noting the insufficient consideration of regional features of implementing the principles of sustainable land use in Ukraine and the limited number of experts involved. In addition, the impact of land reform on the possibilities of implementing European land use standards was not considered in detail. Promising areas for further research are the analysis of the impact of land reform on the implementation of the principles of sustainable land use, the development of differentiated approaches to project management in different regions of Ukraine,

the study of the impact of climate change on land use practices and the improvement of methods for evaluating the effectiveness of sustainable development projects. Special attention should be paid to the study of mechanisms for involving various groups of stakeholders in the management of sustainable land use development projects and the development of economic instruments to encourage sustainable practices.

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## CONFLICT OF INTEREST

None.

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**Анотація.** Метою дослідження було проведення порівняльного аналізу управління проєктами сталого розвитку землекористування в Україні та країнах ЄС та розробка рекомендації щодо вдосконалення українських практик відповідно до вимог Європейського Союзу. Методологія базувалася на системному підході та включала аналіз статистичних даних, проведення експертного опитування та розрахунок інтегрального індексу відповідності вимогам ЄС. Дослідження зосереджувалося на трьох ключових аспектах: відновленні деградованих земель, впровадженні органічного землеробства та управлінні водними ресурсами. Результати виявили значне відставання України за всіма досліджуваними параметрами. У сфері відновлення деградованих земель встановлено, що площа відновлених земель в Україні (8,4 % від загальної площі деградованих земель) майже вдвічі менша за середній показник досліджуваних країн ЄС (16,8 %). Інвестиції у відновлення земель в Україні (310 €/га) становлять лише 39 % від середнього показника країн ЄС (792 €/га). Аналіз розвитку органічного землеробства показав, що частка органічних земель в Україні (1,1 % від загальної сільськогосподарської площі) майже в 6 разів менша за середній показник досліджуваних країн ЄС (6,7 %). Кількість сертифікованих органічних виробників в Україні (3,2 на 100 000 населення) у 6,4 рази менша за середній показник країн ЄС. У сфері управління водними ресурсами виявлено, що ефективність зрошення в Україні (60 %) значно нижча за середній показник країн ЄС (77,4 %), а частка земель з крапельним зрошенням в Україні (5,2 %) у 3,5 рази менша за середній показник країн ЄС (18 %). Розрахунок інтегрального індексу відповідності вимогам ЄС показав, що Україна (56 балів) суттєво відстає від середнього показника досліджуваних країн ЄС (82,4 бали). На основі виявлених відмінностей та успішних практик країн ЄС розроблено комплекс рекомендацій для вдосконалення управління проєктами сталого розвитку землекористування в Україні. Ключові рекомендації включають розробку комплексної національної стратегії, створення спеціалізованих фондів фінансування, впровадження економічних стимулів, модернізацію систем моніторингу, гармонізацію стандартів з ЄС та проведення масштабних освітніх кампаній. Дослідження підкреслює необхідність суттєвого вдосконалення підходів до управління проєктами сталого розвитку землекористування в Україні для наближення до стандартів ЄС та забезпечення ефективного використання земельних ресурсів.

**Ключові слова:** екологічна ефективність; інституційна спроможність; інтегральний індекс; економічні стимули; адаптація законодавства; інноваційні технології