

LAND RESOURCE MANAGEMENT IN AGRICULTURAL BUSINESS BASED ON SUSTAINABLE DEVELOPMENT

УПРАВЛІННЯ ЗЕМЕЛЬНИМИ РЕСУРСАМИ АГРАРНОГО БІЗНЕСУ НА ЗАСАДАХ СТАЛОГО РОЗВИТКУ

The relevance of the study is determined by the growing need to improve land resource management in agricultural business under conditions of increasing environmental challenges and the necessity to ensure sustainable development. It is established that the implementation of innovative tools contributes to improving the efficiency of land use, reducing environmental risks, and ensuring better control over land conditions. The study also proposes a complex system of indicators for evaluating the effectiveness of land management, which includes economic, ecological, and social criteria. A conceptual framework for managing land resources in the agricultural sector is presented. The practical value of the article lies in the possibility of applying the proposed approaches and recommendations in the activities of agricultural enterprises.

Key words: land resource management, land resources, agricultural business, land degradation, sustainable land use, sustainable development, Sustainable Development Goals, ecological and economic security, digital technologies, digitalization, rural areas.

Актуальність дослідження зумовлена необхідністю підвищення ефективності управління земельними ресурсами аграрного бізнесу в умовах загострення екологічних викликів та реалізації принципів сталого розвитку. У статті досліджено сучасні підходи до управління земельними ресурсами аграрного бізнесу в умовах реалізації принципів сталого розвитку. Проаналізовано глобальні тенденції використання ріллі та встановлено обмеженість можливостей розширення земельного фонду, що актуалізує потребу в інтенсифікації використання наявних ресурсів. Розглянуто основні причини деградації земель, серед яких антропогенний вплив, інтенсивне землеробство, урбанізація, ерозійні процеси та кліматичні зміни. Доведено, що ці фактори негативно впливають на ефективність аграрного виробництва та продовольчу безпеку. Визначено роль цифровізації як важливого інструменту підвищення ефективності управління земельними ресурсами. Обґрунтовано доцільність впровадження систем точного землеробства, геоінформаційних технологій та дистанційного моніторингу, що дозволяє оптимізувати використання земель, здійснювати контроль за їх станом і зменшувати негативний вплив на довкілля. Запропоновано комплекс оціночних показників ефективності управління земельними ресурсами, який охоплює економічні, екологічні та соціальні аспекти діяльності аграрних підприємств. Наголошено на необхідності узгодження інтересів бізнесу, держави та місцевих громад у контексті забезпечення продовольчої безпеки та сталого розвитку сільських територій. Представлено концептуальну схему підходу до управління земельними ресурсами аграрного бізнесу. Доведено, що впровадження принципів сталого розвитку та цифрових інструментів управління сприяє формуванню збалансованої моделі аграрного бізнесу, підвищенню врожайності, ефективності використання ресурсів, зменшенню екологічних ризиків та забезпеченню довгострокової стійкості аграрного сектору. Обґрунтовано, що інтеграція принципів сталого розвитку та інноваційних підходів у систему управління земельними ресурсами сприяє підвищенню ефективності аграрного виробництва, збереженню природних ресурсів і забезпеченню довгострокової стійкості аграрного сектору.

Ключові слова: управління земельними ресурсами, земельні ресурси, аграрний бізнес, деградація земель, сталий землекористування, сталий розвиток, Цілі сталого розвитку, еколого-економічна безпека, цифрові технології, цифровізація, сільські території.

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Problem statement. Existing approaches to land resource management in agricultural business are often primarily focused on achieving short-term economic results, which leads to inefficient land use, soil depletion, and the deterioration of agroecosystems. Of particular relevance is the problem of balancing the economic interests of agribusiness entities with environmental requirements and the social needs of society.

Therefore, in the context of implementing the Sustainable Development Goals, there is a growing need to develop new approaches to land resource management that ensure their rational use, the restoration of soil fertility, the preservation of natural ecosystems, and the improvement of agricultural

production efficiency. An important role in this process is played by the digitalization of the agricultural sector, which creates opportunities for the implementation of precision farming systems, remote sensing technologies, geographic information systems, and other innovative solutions. The application of digital technologies makes it possible to increase the efficiency of land use, ensure effective monitoring of land conditions, optimize production processes, and minimize negative environmental impacts.

However, at present, there is a lack of a sufficiently comprehensive approach to integrating the principles of sustainable development into the land resource management system of agricultural business, which complicates the achievement of

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ecological and economic security and the long-term sustainability of the sector. Thus, the need to improve the theoretical and practical foundations of land resource management in agricultural business based on sustainable development principles determines the relevance of this study.

Analysis of the latest researches and publications. Land is the primary resource of agricultural production and plays a key role in ensuring food security, serving as the material basis for the functioning and development of society, as noted by Bhilare A. [3] and Wang B. et al. [13]. Researchers Paz D. et al. [10] and Alemu M. [1] emphasize that the condition of land resources is significantly affected by degradation processes, which lead to a decline in agricultural productivity. Mirzabaev A. et al. [9] also point to a reduction in profitability as a consequence. At the same time, according to Wang B. et al. [13], the undervaluation of land resources in market transactions is one of the factors that exacerbate inefficiencies in their use.

The reform of agricultural and land management is considered a pressing global issue, as noted by Pretty J. [11]. Effective land resource management requires taking into account the challenges faced by modern agricultural business, which necessitates the adoption of new approaches and technologies. Lemma T. et al. [8] emphasize that modern agriculture is predominantly based on advanced technologies, including the use of contemporary tools for soil cultivation, irrigation, and crop protection, which contribute to increased yields and reduced environmental impact. Land use and land cover change, associated with climate change and anthropogenic influence, pose a significant threat to agroecosystems and negatively affect environmental security, as indicated by Cai G. et al. [4].

It is worth noting that, as emphasized by Hurley P. et al. [3], governments in many countries are increasingly oriented toward implementing sustainable development principles in agriculture, declaring a transition to more environmentally balanced models of farming. Researchers highlight that this leads to a growing scientific interest in sustainable land use, which is becoming increasingly relevant under current conditions [2]. At the same time, according to Koshkalda I. et al. [7], effective land resource management at agricultural enterprises should take into account regional characteristics, natural resource potential, and the socio-economic conditions of rural development. Global agriculture faces numerous challenges, and sustainable developments along with sustainable land use are key factors in achieving a balance between economic efficiency, social equity, and environmental sustainability. The implementation of innovative approaches, effective land management, and the support of sustainable food systems are critically important for ensuring the future of the planet.

At the same time, the integration of sustainable development principles into the land resource management system of agricultural business remains insufficiently explored, particularly in terms of balancing economic efficiency, environmental safety, and social responsibility, which determines the relevance of further research in this area.

The purpose of the article is to substantiate theoretical and methodological foundations and develop practical recommendations for land resource management in the context of achieving the Sustainable Development Goals.

Presentation of the main research material. Modern agrarian business is a branch of the economy that covers all types of agricultural production, processing and sales of products, agricultural services, and management of agricultural resources. It involves the use of modern technologies, scientific achievements, innovations and adherence to quality standards to increase productivity, quality and profitability of agricultural production. It demands from representatives of agrarian business to improve, learn and adapt to global changes.

Therefore, the activity and development of agrarian business enterprises, considering the SDGs, should be implemented based on the formation and implementation of strategies that would contribute to effective agrarian business, food security, the preservation of natural resources of agro-ecosystems (the main of which are land resources), the improvement of product quality and compliance with social standards, as well as the active implementation of digitalization as a tool for achieving sustainable development.

There is no country in the world, which is able to ensure stability and economic development without a balanced land policy. Let us emphasize that the land market is a powerful tool for stimulating the increase in agricultural production and attracting investments. In countries where private ownership of land and developed land markets protected by law through the development and implementation of legislative norms, the state still has significant rights to control the use of land to ensure public welfare. The cadastral registration and land registration in the economic and legal sense have a special intra-state significance, as they make it possible to ensure the unity of the administrative management system of land resources.

Land resources constitute a critical pillar of agricultural production and overall economic development. They provide the essential basis for crop cultivation, support the expansion of livestock farming, and supply raw materials for processing industries. Beyond their economic function, land resources also serve as the spatial framework for rural development, enabling employment generation and sustaining traditional lifestyles within local communities.

Within the broader structure of land assets, cropland land occupies a particularly significant

position, as it defines the productive capacity of the agricultural sector. The effectiveness with which it is utilized has a direct impact on food security, economic resilience, and the environmental sustainability of agroecosystems. Therefore, ensuring the rational and responsible management of cropland land is of paramount importance, especially in the context of sustainable development, which requires a balanced integration of economic efficiency, social well-being, and environmental protection.

To gain a deeper understanding of trends in land resource use, it is advisable to analyze the dynamics of cropland land areas worldwide (Figure 1). As illustrated in Figure 1, the global extent of cropland land expanded only marginally between 1963 and 2023 (by approximately 16.55%) highlighting the constrained capacity for further enlargement of cultivable areas. Moreover, a temporary decline in cropland land was observed toward the end of the twentieth century, which can be attributed to the intensification of urbanization processes as well as the deterioration of soil quality. Collectively, these dynamics indicate that the potential for extensive agricultural expansion is nearing its natural limits, thereby shifting the focus of future agricultural development toward the more efficient and intensive use of existing land resources.

Concurrently, recent evidence suggests that land degradation has become increasingly severe. Over the past several decades, significant losses of productive land have been recorded worldwide due to both natural processes and anthropogenic pressures. For instance, during the period from 2015 to 2019, nearly 100 million hectares of fertile land were degraded annually – an area comparable in scale to that of two territories the size of Greenland [12].

These developments clearly signal the urgency of revising traditional approaches to land management

in agriculture and underscore the need to introduce effective systems for land conservation and rehabilitation in line with sustainable development principles.

The issue of ensuring efficient land resource management has become particularly critical within the framework of Sustainable Development Goal 15, which prioritizes combating land degradation, especially in relation to arable land. This process is manifested through a gradual decline in both biological productivity and economic returns, driven by factors such as intensified soil erosion, depletion of essential nutrients, contamination from human activities, and other cumulative environmental stresses. As a result, these processes pose substantial risks to agricultural stability, global food security, and biodiversity conservation.

Key drivers of land degradation on a global scale include rapid urban growth, unsustainable agricultural intensification, excessive grazing pressure, deforestation, as well as water and wind erosion, salinization, and climate variability. Addressing these multifaceted challenges requires the adoption of an integrated land management paradigm. Such a framework combines elements of regenerative agriculture, forest conservation, large-scale soil restoration, and the systematic minimization of environmental impacts.

Accordingly, preventing soil degradation and implementing effective management instruments are essential prerequisites for strengthening ecological resilience, ensuring long-term economic sustainability, and advancing the broader agenda of sustainable development.

At the national level, land resource management in the agricultural sector is strategically oriented toward their rational, sustainable, and highly efficient use. This approach is grounded in a balanced framework that harmonizes economic performance, environmental protection, and social considerations. The principal objectives, operational tools, and

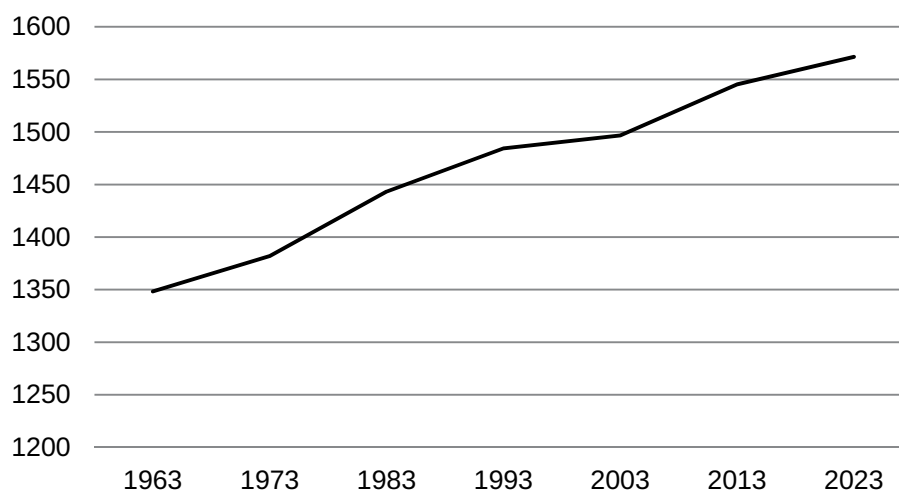


Fig. 1. World dynamics for cropland area, 1963–2023, million ha

Source: compiled by the authors according to [5]

methodological foundations of this management model are comprehensively presented in Figure 2.

At the level of individual agribusiness operations, where land functions simultaneously as a spatial foundation and a key productive resource, management approaches should extend beyond narrowly defined economic goals. Effective land governance requires harmonizing financial performance with the interests of local communities, regional stakeholders, and the state, particularly in the context of ensuring national food security. A fundamental element of this approach is the long-term conservation and systematic restoration of soil fertility.

In a broader perspective, the alignment of agribusiness strategies with societal priorities should be guided by the United Nations Sustainable Development Goals, especially SDGs 1, 2, 8, 12, 13, and 15. Integrating these priorities into management practices, alongside adherence to environmental sustainability and economic stability principles, enables the formation of a robust and adaptive model of land resource utilization.

To operationalize these principles, it is proposed to conduct a comprehensive assessment of land resource management effectiveness within agricultural enterprises. This evaluation is based on a structured system of criteria and performance indicators, organized into a dedicated analytical framework, as presented in Table 1. The developed

evaluation matrix should be viewed as a fundamental tool for agricultural management, enabling the design and execution of strategic decisions that influence land use as a primary production asset.

In this context, the governance of land resources must be systematically aligned with the principles of sustainable development, as well as with the imperatives of environmental and economic security. A comprehensive conceptual model that embodies this integrated approach is illustrated in Figure 3.

Effective land resource management represents a crucial condition for the successful implementation of the Sustainable Development Goals. Achieving this requires a multidimensional approach that integrates long-term planning, efficient resource allocation, continuous monitoring, and the adoption of innovative solutions. In particular, the application of digital technologies and advanced analytical instruments contributes to higher agricultural productivity while preserving the ecological stability of agroecosystems, thereby ensuring the long-term viability of the agricultural sector.

Beyond ecological benefits, the introduction of such management practices serves as a driver of rural development. By stimulating local economic activity and expanding employment opportunities, these approaches contribute to improving the quality of life in rural areas. Digitalization is especially important in this regard, as it enhances transparency in land use

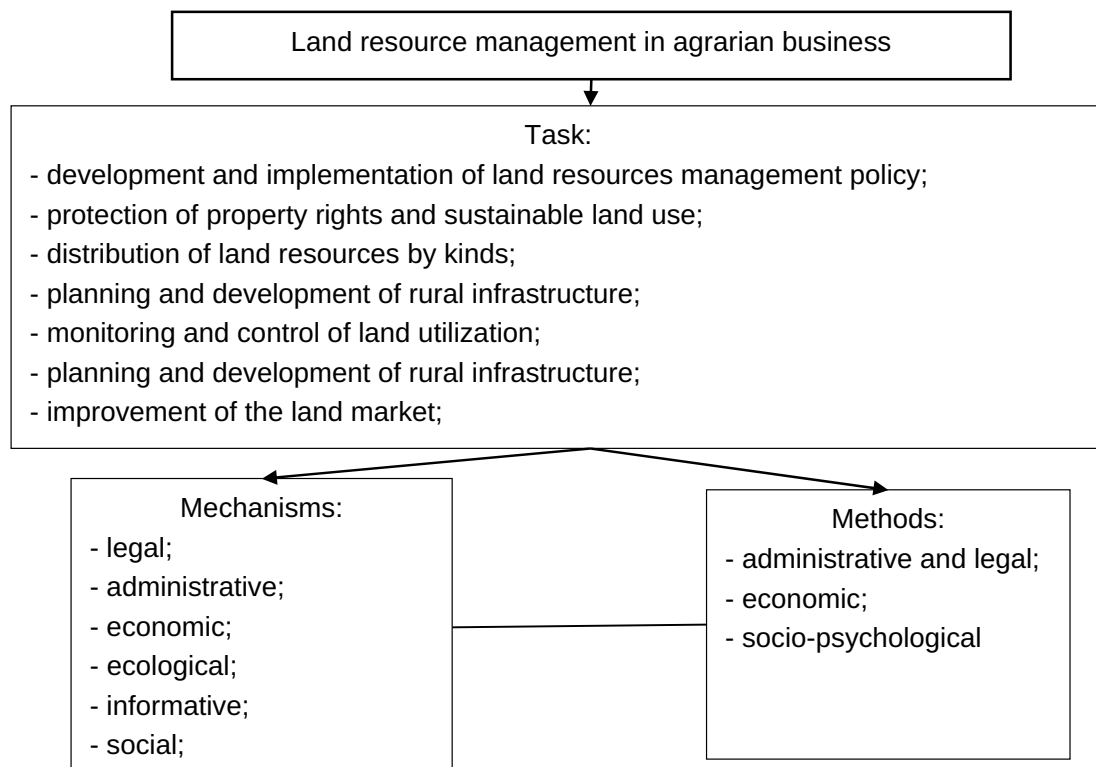


Fig. 2. Components of agrarian business land resource management

Source: compiled by the authors

Table 1

**A set of assessment indicators
of the land resource management effectiveness provided by agrarian business entities**

Criteria	Indicators
1. Economic condition	Financial result (profit). Profitability of activity. Cost of business
2. Environmental costs and their effectiveness	Costs for land resources restoration. Economic effect of environmental protection measures
3. The level of agro-ecological safety	Production of ecologically safe products. State of land resources. Compliance with ecological requirements in crop and livestock production
4. Socio-economic level	Income levels of employees in the agricultural sector. Participation in local community development programs and implementation of corporate social responsibility initiatives in rural areas

Source: compiled by the authors

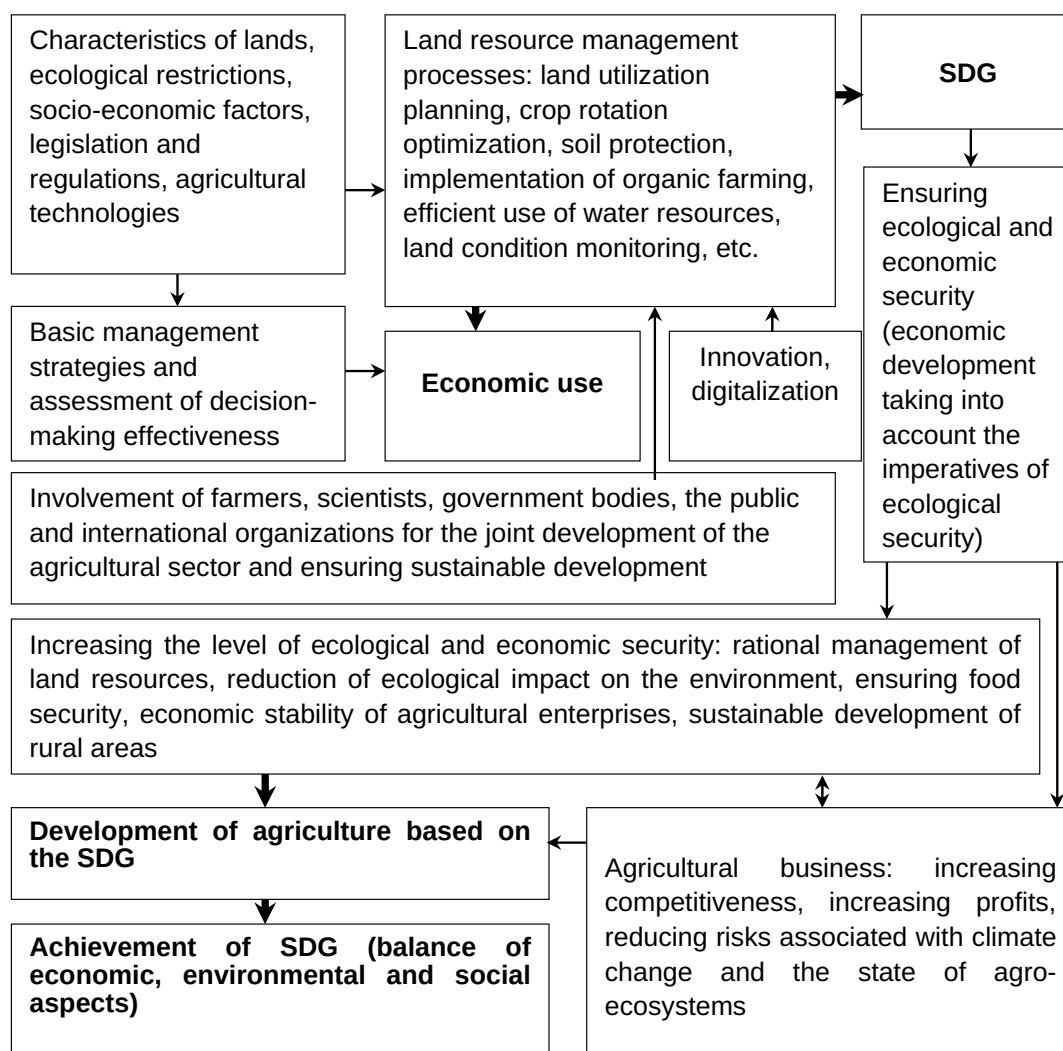


Fig. 3. Conceptual diagram of the approach to the management of land resources of agrarian business based on the determinants of the SDG and the imperatives of environmental and economic security

Source: compiled by the authors

processes and allows for precise monitoring of soil conditions. Consequently, managerial decisions become more data-driven and substantiated, reinforcing the sustainability of agribusiness operations over time.

Particular attention should be given to innovative technologies such as precision agriculture, geographic information systems, remote sensing, and automated data processing platforms. These tools enable prompt evaluation of soil health, facilitate the prediction of environmental changes, and support the reduction of adverse ecological impacts associated with intensive farming. Overall, the integration of digital solutions into land management not only improves cost efficiency and production performance but also increases the investment appeal of rural areas and promotes the development of their infrastructure.

Conclusions. The results of this research indicate that adherence to globally recognized business standards, especially those aligned with the Sustainable Development Goals, serves as a key driver for enhancing the credibility and reputation of agribusiness enterprises. Such compliance not only strengthens their competitive position in both national and international markets but also facilitates entry into new markets by ensuring conformity with varying legal and regulatory environments.

Environmentally responsible land-use strategies enable enterprises to minimize the costs associated with land rehabilitation, reduce production risks, and support the implementation of socio-economic development initiatives at local, regional, and national levels.

Furthermore, the achievement of global sustainability goals largely depends on the proactive involvement of key international stakeholders in fostering responsible governance and evidence-based decision-making across all societal levels. Meaningful progress in this area requires strong collaboration between public authorities, private sector entities, and civil society institutions. Their collective efforts should focus on aligning policy frameworks, advancing educational initiatives, and refining regulatory systems governing economic, social, and environmental resources. Such coordinated action ensures a deeper awareness of sustainability challenges and promotes consistent, long-term solutions aimed at improving overall societal well-being.

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