3. МЕНЕДЖМЕНТ

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Atalavei Mary Ene
Postgraduate Student,
Sumy National Agrarian University

Аталавеі Мері Ене
Сумський національний агарний університет

ARTIFICIAL INTELLIGENCE IN THE STRATEGY OF INDIVIDUAL DEVELOPMENT OF TERRITORIAL COMMUNITIES

The study analyzes the peculiarities of attracting investments, innovations, and new developments of artificial intelligence in the development of a strategy for the development of territorial communities on the example of Ukraine. The author substantiates the directions of investing own and borrowed funds for the successful development of territorial communities in the war and post-war periods. The peculiarities of using drones in agriculture and humanitarian demining of territories are clarified. Strategic priorities in agriculture for the implementation of support measures aimed at diversifying production, improving quality and safety standards, and the necessary institutional, educational and promotional capacities to improve the development of territorial communities are proposed. Investments in improving soil fertility expand the range of options for agricultural enterprises in terms of product and resource allocation. In addition to the choice of technologies and crops, the optimization problem now includes the allocation of resources between different types of products and future land quality. The most important thing in Ukraine during the war and post-war period is humanitarian demining of both agricultural and other land. The development and increase in the number of demining robots, both domestic and foreign, will speed up this process.

Key words: *artificial intelligence, territorial community, investment, humanitarian demining, quality of land resources.*

Formulation of the problem. In Ukraine, the concept of "territorial community" is relatively new to economic science. A territorial community is a group of residents united by permanent residence within a village, town, or city that is an independent administrative unit, or a voluntary association of residents of several villages, towns, or cities that have a single administrative center.

Global experience clearly indicates that the redistribution of power and resources between levels of government is considered in developed countries as one of the systemic tools for regulating macroeconomic stability. European countries have developed a number of models and mechanisms of decentralized governance based on local self-government [1]. Therefore, it is advisable to consider the best examples of such mechanisms from the point of view of the potential for their implementation in domestic practice and the possibility of obtaining managerial and economic effects.

During the wartime and post-war periods in Ukraine, demining of land and water areas of all types, particularly in rural areas, is essential for the development of territorial communities. Therefore, it is necessary to develop a mine action strategy consisting of the following main areas:

– management in the field of mine action;
– supporting the effectiveness of mine action operators;
– prevention of accidents;
– comprehensive assistance to victims;
– innovation;
– gender balance and representation;
– development of the private market;
– effective and transparent coordination with donors.

Adoption of the strategy will allow to coordinate the work and define the areas of responsibility, the role and tasks of public authorities, non-governmental and private demining operators, as well as priority areas for attracting support from international partners.

Analysis of recent research and publications. Research on the use of artificial intelligence in the development strategy of territorial communities requires analysis and clarification of their role in the development

of the state's economy, the peculiarities of attracting investment resources for the needs of the state, etc. Various aspects of the study of the role of artificial intelligence, its development and the possibility of its application in rural areas are devoted to various aspects of the study: Bhawra J. [5], Buchan M.C. [5], Green B. [5], Skinner K. [5], Gryshova I. [8], Balian A. [8], Antonik I. [8], Miniailo V. [8], Nehodenko V. [8], Nyzhnychenko Y. [8], Semenda D. [15[, Semenda O. [15], Plastun A. [19], Makarenko I. [19], Grabovska T. [19], Situmeang R. [19], Bashlai S. [19], Polyakov P [20]., Khanin I. [20], Bilozubenko V. [20], Korneyev M. [20], Shevchenko G. [20], Ulko Ye. [21] and others.

At the same time, the issue of the peculiarities of using drones in agricultural production and demining during the war and post-war development of Ukraine requires further consideration.

Formulation of the purpose of the article. *The purpose of the article* is to substantiate and develop theoretical and methodological provisions, scientific and practical recommendations for the use of artificial intelligence in the development of a strategy for the individual development of territorial communities. To achieve this goal, it is necessary to solve *the following tasks*:

– to analyze and identify the essence of the territorial community, to find out its role in the development of the state economy;

– to find out the peculiarities of the use of drones in agricultural production and demining during the war and post-war development of Ukraine;

– to substantiate the peculiarities of attracting investment resources for the needs of the state;

– to prove the need to invest in the reproduction of soil fertility in agricultural production.

Presentation of the main research material. The territorial community as an integral entity characterized by the unity of the social community, the local self-government entity and the basic link of the administrative and territorial structure of the country is shown in Fig. 1.

A territorial community as a social community creates and maintains social life within a certain territory, guided by economic, political, socio-cultural and environmental interests; as a local self-government entity, it is able to manage in the context of interaction with the external environment and be responsible for maintaining integral guidelines; as a basic link of the administrative-territorial structure, characterized by systematicity, possesses a certain resource potential, which provides it with competitive advantages and creates opportunities for development.

The need to study territorial communities from the standpoint of enhancing their development opportunities and realizing their resource potential is associated with the decentralization reform and increasing the role and responsibility of local governments for the socio-economic development of their territories [2–4].

Amalgamated territorial communities have the authority to function as administrative-territorial units and as subjects of regulation of socio-economic development of their territories. The economic and social interests of territorial communities are realized through the regulation

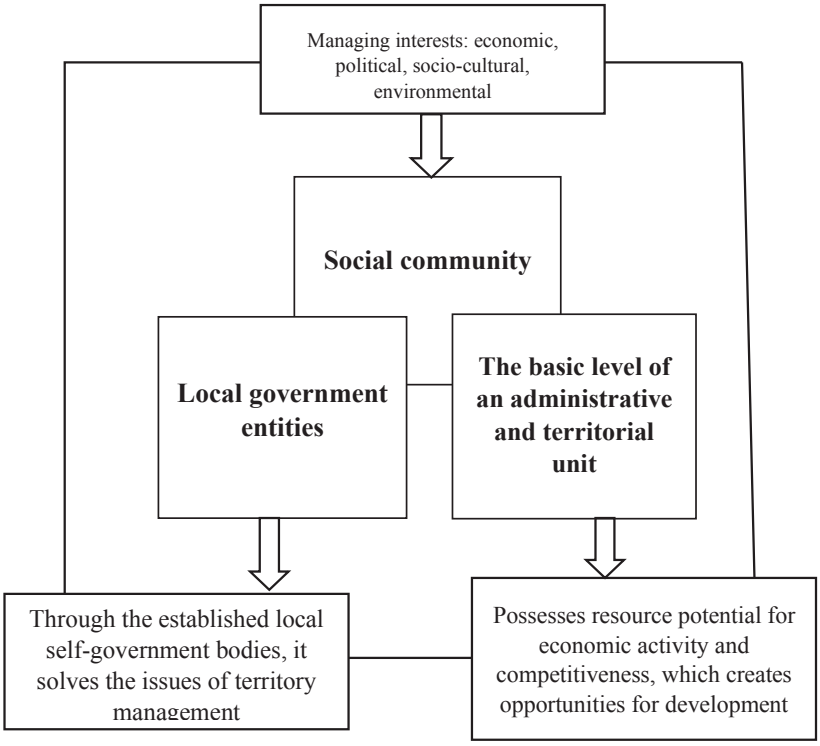

Figure 1. Identification of the territorial community

Source: authors' presentation

of economic processes within their own powers. Territorial communities should be studied not only as subjects of regulation of the development of their own territories, but also as objects of regulation in the management system of higher-level authorities (regional, state).

By regulating the development of territorial communities, we mean ensuring favorable conditions on the part of state, regional and local authorities to ensure the socio-economic development of territorial communities through the use of various instruments and methods of influence.

Among the methods of regulating the development of territorial communities, it is advisable to distinguish legal, economic, organizational and financial. Legal methods regulate the constitutionally and legally enshrined rights and powers granted and delegated to the territorial community. Relations between the territorial community, business entities and local self-government bodies are regulated; between the authorities regarding the distribution of powers. Organizational regulation is realized in the ability of a community or local government to independently determine its own internal structure and the nature of its interaction with other elements of society. Economic methods influence the behavior of a business entity when making decisions in the field of production and service provision (regulation of business activities, regional pricing policy, compliance with antitrust laws, etc.) Financial regulation ensures the availability of financial resources necessary for local governments to perform their functions (regulators include types of local taxes, tax rates, benefits, subventions, etc.) [5].

In the context of administrative-territorial and decentralization reforms, qualitatively new requirements are put forward for the study of territorial communities from the standpoint of not only a social community and a local government entity, but also a regulator of the development of its territory, which requires an in-depth study of the economic, financial, and property side of relations. The established united territorial communities are legally endowed with rights that allow them, on the one hand, to increase their financial capacity, and, on the other hand, to be responsible for the development of their territories. Territorial communities are simultaneously the subject of regulation of the development of their own territory and the object of regulation (as a basic-level administrative-territorial unit) in the management system of higher-level authorities (regional, state).

It is advisable to distinguish two areas of state regulation of the development of territorial communities: leveling the imbalances of socio-economic development and stimulating the development of territories. The former includes indirect mechanisms and is implemented through interbudgetary relations using financial equalization instruments; the latter is a direct mechanism and is implemented through investment and innovation support for the development of territorial communities. From this point of view, the areas of development of territorial communities with the possibility of creating technology parks; becoming a platform for testing and using unmanned vehicles, drones, demining robots for demining; development of green tourism; investing in environmental, energy-saving technologies (wind energy, solar panels, biofuels), etc.

The use of drones in agricultural production can help increase productivity and conserve resources. Two things are needed to implement the use of such technologies: the adoption of EU plant protection legislation and the establishment of rules for the use of drones for the application of plant protection products [6–7].

Drones can be used for aerial photography and video recording, field monitoring, 3D modeling, thermal imaging, laser scanning, planting and sowing, fertilization and chemical application, crop monitoring, and animal control in agriculture.

For example, the state regulation of plant protection should focus on the following main areas

– harmonization of legislation with a number of relevant EU legal acts to align state regulation, control and application of plant protection products with EU standards in these areas;

– establishing rules for the use of drones for the application of plant protection products.

This will strengthen the state control over the circulation and use of plant protection products and reduce the negative impact of plant protection products on humans, animals and the environment, including from their illegal trafficking. It will also stimulate the transition to the use of new technologies in agriculture, which can reduce the negative impact on the environment.

Mine clearance of agricultural land is one of Ukraine's top priorities for humanitarian assistance. This will help strengthen both global food security and economic stability in Ukraine, which requires a significant number of robots for humanitarian demining in Ukraine [7].

Thus, according to the Ministry of Economy, in 2023, Ukraine managed to clear the area of agricultural land that can grow 1 million tons of grain, and 18 thousand square kilometers of land were returned to circulation during the year.

The area recognized as potentially mined is 174 thousand square kilometers. Agricultural land affected by mining includes 208 thousand hectares. Currently, the area of 156 thousand square kilometers needs to be checked for explosive devices [7].

Thanks to the assistance of its partners in demining, Ukraine remains a key player in the global grain and sunflower oil markets, with a share of more than 10% of international trade. In 2023, Ukraine exported 16.1 million tons of wheat to 65 countries, 26.2 million tons of corn to 80 countries, and 5.7 million tons of sunflower oil to 130 countries [7].

In 2023, sappers performed a significant amount of work on surveying and demining agricultural land. They inspected 274 thousand hectares, which is more than half of the areas planned to be returned to farmers for use within four years. According to the updated plan, the priority return of land to economic use will take place in 8 regions over four

years. It is also planned to survey and, if necessary, clean up and demine the eight regions of the country (Table 1).

Table 1

Plans for returning land to economic use

Region	Cleanup and demining, thousand hectares
Donetsk	12.8
Chernihiv	2
Sumy	85
Dnipro	6.6
Kyiv	9.4
Mykolaiv	44
Kharkiv	190
Kherson	248

Source: Press Service of the Verkhovna Rada of Ukraine [7]

At the same time, according to World Bank experts, priority demining of agricultural land in Ukraine will cost about $1.5 billion. Without surveying and demining, it is impossible for farmers to use these lands.

Successful development of territorial communities in Ukraine requires investment resources for the following purposes:

1. Eliminate the negative effects of the war by cleaning and restoring damaged infrastructure and facilities in compliance with the principles of the "rebuild better than before" concept. This includes demining and clearing of agricultural land and reconstruction of irrigation and drainage infrastructure, including reconstruction of pipelines, pumping stations, on-farm infrastructure, and restoration of vital structures such as the Kakhovka hydroelectric power plant.

2. Expand financial support for farmers to support recovery over several production seasons. Such funds should primarily be directed to farms that offer sustainable, digitalized, and efficient investment projects. Instruments should be tailored to size and needs, with special attention to the smallest farmers.

3. Expand financial support for producers in higher value-added sectors. Priority sectors include producers and processing industries, including protein nutrition and purified protein extracts, organic food production, milk and dairy production, horticulture, viticulture, and other higher value-added subsectors.

4. Financial support should be complemented by access to know-how, and it should include other forms of actors such as producer organizations. In particular, the reformed advisory system should focus on increasing agricultural diversity, inclusion, climate resilience, integration of the food and energy sectors, and environmental and social sustainability, in line with the requirements of the EU Green Pact. It should also emphasize environmentally friendly agricultural practices, which are an integral part of the EU's Common Agricultural Policy.

5. Strengthening agricultural value chains in general and supporting logistics. This may include reconstruction and improvement of damaged storage facilities, warehouses and rural roads.

6. Supporting the long-term recovery of agricultural production to increase diversity, inclusiveness, climate resilience, energy and food integration, and environmental and social sustainability.

7. Stimulating digital integration and modernization can have a direct impact on productivity, resource use and climate change adaptation. This could include precision agriculture and the use of automation, IT and AI technologies across value chains, such as global positioning systems, geographic information systems, farm management information systems, variable rate technology, the use of drones to monitor livestock and crops, seeding, fertilizer and pest management, internet devices, management applications for smart agriculture, moving sensors for data collection, or IT solutions for climate resilience.

8. Increased investment in public institutions. This includes infrastructure for expanded sanitary and phytosanitary measures, including digital veterinary and phytosanitary laboratories, digitalization of land monitoring and registration, soil analysis for precision agriculture, official control systems in livestock, fisheries, organic certification and other priority sectors, including through the digitalization of various state registers (farms, animals) and databases (including soil management databases and geographic information systems).

9. Survey and demining of all types of land and water areas, as well as, where necessary, reclamation and other works necessary to return certain areas to productive use. With investments of about USD 20 billion in 2024–2027 and de-occupation of all temporarily occupied territories, the following results can potentially be achieved: non-technical survey of 100% of potentially contaminated territories (i.e., all 174 thousand square kilometers); technical survey of approximately 86% of the territories that require it based on the results of the non-technical survey; demining of approximately 24% of the territories that require it based on the results of the technical survey [7–8].

According to the RDNA2, the priority medium- and long-term investment needs for landmine clearance in 2024–2033 amount to €27.6 billion. The most urgent investments include restoration of damaged assets, support for agricultural recovery by addressing liquidity issues, particularly for small farmers, focus on higher value-added products and export orientation, and investment in climate change resilience [9].

Let's look at the peculiarities of using drones in agriculture.

Elevation maps. With the help of drones, you can get an elevation map – a flat map that shows the relief of the field. On this map, surface level differences are coded with a color like on a geophysical map familiar from school, where the mountains are brown and the lowlands are green. In addition to color coding, the relief map has isolines connecting points that lie on the same level. When working with terrain, it is convenient to have heights in meters marked along with isolines. Such markings help to identify problem areas in the fields (Fig. 2).

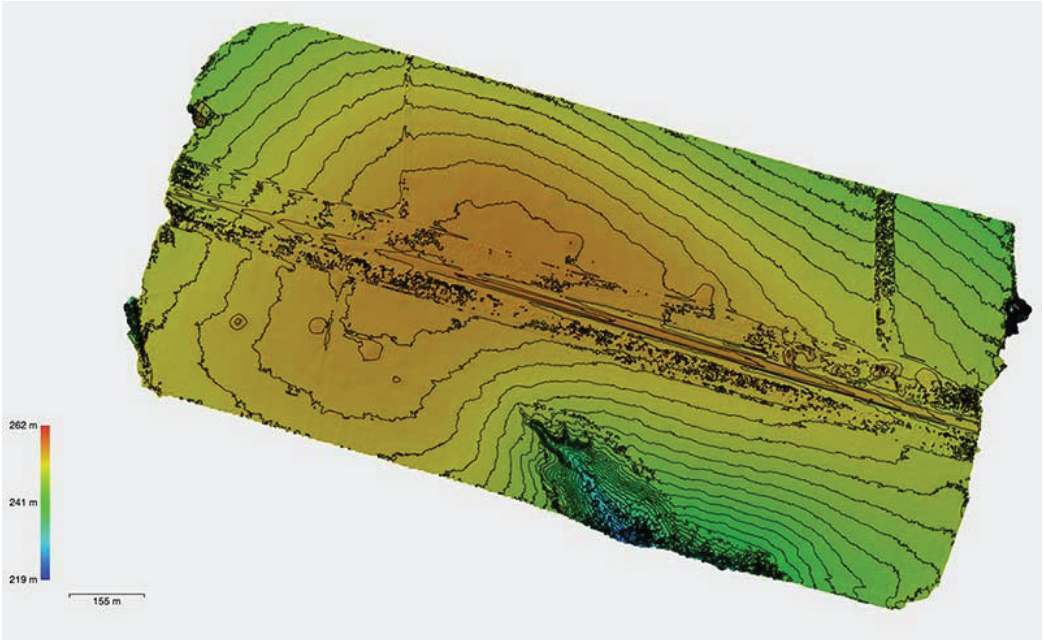

Figure 2. Map of field heights taken by drone

Source: use of drones in agriculture [6]

Multispectral imaging. All fields are different and heterogeneous; within one field, there are areas where the yield is always different from the average. For different crops, these differences can be significant. The output data for the system can be the information obtained as a result of processing multispectral imagery from a drone.

Multispectral imaging of fields by a drone allows, for example, to apply herbicide differentially using a wheeled sprayer, which is cheaper in terms of drug consumption but more expensive in terms of application cost. Or you can use an unmanned agrodron, which not only was originally designed for differential application of liquids, but also does not make the soil of the field more shielding, does not add stress to plants from mechanical contact with parts of the sprayer and heat from its engine.

Investing in soil fertility restoration. The impact of environmental conditions on production is essential for ensuring organic farming. The goal of environmental and economic planning is not only to determine the conditions necessary to increase production, but also to ensure a balance between production and the environment, where land plays a key role. Therefore, in the field of agricultural natural resource management, the main attention should be paid to the environmental aspects of land use – protection of land resources from pollution and restoration of degraded land in order to ensure the possibility of their further effective use by current and future generations, which requires investment of the natural resource potential of the ARA [10–13].

The problem of soil fertility management in Ukraine is the most rational way to obtain cheap and environmentally friendly products without external investment. Natural fertility is the fertility that can be used to obtain a certain yield without additional measures to improve it, provided that the requirements of technology are met. Under favorable agroclimatic conditions, the natural yield of grain crops grown in Sumy region (Ukraine) in the forest-steppe zone is 26.4 c/ha, in the transition zone – 19.5 c/ha, in the Polissya zone – 13.6 c/ha [14].

We have conducted a factor analysis of the organizational and economic mechanism of agrotechnologies for humus balance without deficit. This allowed us to identify groups of factors that can be used to manage the level of soil fertility. The mechanism includes the use of mineral and organic fertilizers, liming, gypsumization, irrigation and drainage in combination with favorable climatic conditions. Research shows that soil fertility is most significantly improved by enriching it with humus through the application of manure. Due to the constant growth of its deficit, our research was aimed at exploring other economically feasible and appropriate alternative manure substitutes. These include the use of grain straw, crop and root residues, green fertilizers, growing perennial grasses, changing the structure of sown areas, and optimizing the ratio of arable land to other agricultural land. The implementation of these measures will contribute to the economic development of the livestock sector.

Combining organic fertilizers with a range of other factors and determining the cost of the humus balance agricultural technology allows us to choose a specific crop rotation and soil cultivation method. The level of soil fertility can play a crucial role in assessing the investment attractiveness of an agricultural enterprise. The structural and systemic analysis of factors makes it possible to determine the on-farm organizational and economic mechanism for managing soil fertility [15–17].

The productive capacity of land is determined by the content of organic matter in the soil, which forms the level

of soil fertility that ensures the potential yield of agricultural land use. The level of fertility and a set of agricultural technologies have a major impact on actual yields and gross output. The revenue received from the sale of agricultural products allows to determine the financial capabilities of the enterprise and make appropriate management decisions on the use of services of agro-service enterprises to perform a range of works to improve soil fertility.

The effectiveness of soil fertility management largely depends on the methods used and the capabilities of agricultural enterprises to provide it with fertility improvement means, and therefore on the level of competent management of these processes. The economic tools of soil fertility management include the use of state and market regulators.

Conclusions. The development of territorial communities implies understanding the importance of financial, natural, social, human, intellectual, and industrial capital and being careful about their use. Territorial communities perceive business as a partner for development; they carefully consider where they invest, determining the economic feasibility of certain projects and expenses in general. Communities should take care of their lands, forests, water, soil, and air quality – the environment is perceived as an asset, not a resource to be spent. Communities need to be technologically advanced and innovative local businesses; their creativity, the ability to use the latest technologies, artificial intelligence, which requires significant funds, and the need to attract foreign capital and assistance from sponsoring states to restore Ukraine's economy in the postwar period.

Ukraine needs to develop a strategy for the individual development of rural communities in the postwar period. This will increase the productivity, efficiency, and competitiveness of agricultural production. Priorities include the functioning of the land market, compliance with environmental standards, harmonization of legislation with the EU, and others.

The development and definition of strategic priorities in agriculture and the subsequent implementation of support measures, which will mainly focus on diversification of production, improvement of quality and safety standards, and the necessary institutional, educational and promotional capacities, will contribute to evidence-based policy making and strengthening of the agri-food sector.

Access to finance should be transparent and inclusive, in particular for small farmers. To implement the proposed strategy, it is necessary to

– implement state support measures (mainly funded through donor programs), including in selected sectors (including fisheries and aquaculture), based on the results of sectoral analysis and SWOT analysis, which are in line with national and European standards aligned with the EU acquis;

– support agricultural production during the war for small farms, as well as private investment (in physical assets of agricultural farms, for processing and marketing purposes) and the introduction of financial instruments for all categories of farms in cooperation with international financial institutions.

The main problems of farmers in the liberated territories of Ukraine are the destroyed infrastructure, the mining of a significant amount of agricultural land, and the need to attract modern technologies and investments to restore the functioning of territorial communities.

Improving soil fertility requires investment funds, which will allow to obtain a significant economic effect and ensure the reproduction of the most important natural resource of the agricultural sector – land, which is a geographically limited means of production in agriculture. An economic study of soil fertility management allows us to perceive the quality of land to improve under conditions of proper agricultural technology as an object of production relations necessary for its active inclusion in the system of expanded reproduction, which determines the environmental orientation of land reform – effective rational use of land resources and their reproduction. Investments in improving soil quality expand the range of opportunities for agricultural producers in terms of product and resource allocation.

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ШТУЧНИЙ ІНТЕЛЕКТ У СТРАТЕГІЇ ІНДИВІДУАЛЬНОГО РОЗВИТКУ ТЕРИТОРІАЛЬНИХ ГРОМАД

У дослідженні проаналізовано особливості залучення інвестицій, інновацій, нових розробок штучного інтелекту при розробці стратегії розвитку територіальних громад на прикладі України. Автор обґрунтовує напрямки інвестування власних та позикових коштів для успішного розвитку територіальних громад у воєнний та повоєнний періоди. Доведено, що регулюванням розвитку територіальних громад слід розуміти створення сприятливих умов з боку державної, регіональної та місцевої влади для забезпечення соціально-економічного розвитку територіальних громад шляхом використання різноманітних інструментів і методів впливу. З'ясовано

особливості використання безпілотників у сільському господарстві та гуманітарному розмінуванні територій. Обґрунтовано напрями спрямовування інвестиційних ресурсів для успішного розвитку територіальних громад в Україні. Запропоновано стратегічні пріоритети в сільському господарстві для реалізації заходів підтримки, спрямованих на диверсифікацію виробництва, підвищення стандартів якості та безпеки, а також необхідні інституційні та освітні можливості для покращення розвитку територіальних громад. Інвестиції в підвищення родючості ґрунтів розширюють спектр можливостей для сільськогосподарських підприємств щодо розміщення продукції та ресурсів. Окрім вибору технологій та культур, проблема оптимізації тепер включає розподіл ресурсів між різними видами продукції та майбутню якість землі. Доведено, що ефективність управління родючістю ґрунту значною мірою залежить від застосовуваних методів і можливостей сільськогосподарських підприємств забезпечити його засобами підвищення родючості, а отже, від рівня грамотного управління цими процесами. До економічних інструментів управління родючістю ґрунтів відноситься використання державних і ринкових регуляторів. Найважливішим в Україні у воєнний і післявоєнний період є гуманітарне розмінування як сільськогосподарських, так і інших земель. Розвиток і збільшення кількості роботів-розмінувальників, як вітчизняних, так й іноземних, прискорить цей процес.

Ключові слова: *штучний інтелект, територіальна громада, інвестиції, гуманітарне розмінування, якість земельних ресурсів.*