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## Imperatives of Efficient Use of Land and Resource Potential of the Agricultural Enterprises of Ukraine

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**Abstract.** The article considers the institutionalization of land relations and the imperatives of efficient use of land and resource potential of agricultural enterprises of Ukraine. Within the institutionalization of land relations, the methodical approach to complex estimation of effective use of land and resource potential of agricultural enterprises is substantiated, by definition of an integral indicator of efficiency (quantitative and qualitative characteristics of involved resources, productivity and efficiency) of basic kinds of activity of economic entities on agricultural lands. Indicators of transparency in the assessment of land and resource potential and indicators of land policy according to the level of their use in agriculture are proposed. Comprehensive criteria for assessing the components of the efficiency of the use of land and resource potential of agricultural enterprises are presented. The amount of rent for land shares and the amount of fertilizer application per 1 ha of sown area of agricultural enterprises of Ukraine are analyzed. The productive capacity of natural and potential yields for grain and legumes (excluding corn for grain) in Ukraine has been determined. The normative monetary value of 1 ha of arable land in rural areas is calculated on average for one region of Ukraine, adjusted for the natural yield of cereals and legumes, without taking into account the application of fertilizers. The forecast level of technical, social and economic efficiency of the use of land and resource potential of agricultural enterprises is presented

**Keywords:** land and resource potential, land relations, rent, yield, costs, cost price, income, profitability



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## INTRODUCTION

Institutional changes in land relations in the conditions of uncertainty in the development of agricultural entities require comprehensive characterization in the system of targeted land use and differentiation of the functional purpose of land and resources potential. At the same time, modern stereotypes of the formation of land and resource potential are focused on the requirements of the institution of land ownership along with the need for resource provision of agricultural enterprises. Within the framework of institutional changes, the formation of new trends in the accumulation of land resources and their distribution among enterprises of a particular rural area are due not only to material but also to public goods, because in the process of decentralization and creation of united territorial communities certain restrictions of the state on land ownership are taken into account.

As part of the intensification of the initiative of territorial communities on their possible development and ability to independently solve the problem of the mobilization of internal reserves, in relation to the strategic imperatives of efficient use of land and resource potential, the land use within agglomerations of large cities sometimes ends with the futility. Therefore, to solve this problem, along with theoretical and methodological aspects of institutional support of land and resource potential of agricultural enterprises, it is necessary to distinguish between qualitative and quantitative assessment of efficient and rational land use, taking into account the growing social orientation of economic entities to economic development. This is especially true for the diversification of the rural economy, which involves the development of production, services, recreation. This is a guarantee of improving the quality of life of the rural population, preserving the natural environment in the spatial location of agricultural enterprises, which play a leading role in ensuring sustainable development of the village as a whole.

Theoretical and methodological principles of building a system of land resources distribution are widely studied by the European community: C. Barnard, G. Whittaker, D. Westenbarger, M. Ahearn [1], S. Blancard, J. Boussemart, W. Briec, K. Kerstens [2], H. Guyomard, C. Mouël, A. Gohin [3], L. Khan [4], Yu. Khvesyuk, R. Busel [5]; the application of institutional provisions of the economy in the practice of land and resource potential formation is reflected in the works by P. Ciaian, d'A. Kancs, J. Swinnen, H. Van, L. Vranken [6], M. Fedorov and V. Mesel-Veseliak [7], O. Khodakivska and I. Yurchenko [8], H. Sharyi [9]. Modern problems of improving the efficiency of the use of land and resource potential, including in agriculture were solved by – V. Andriichuk and S. Sas [10], V. Dankevych [11], S. Kay, J. Peuch, J. Franco [12], M. Shchuryk [13], N. Ulitskaya and L. Semerkova [14], I. Yasinetska [15], O. Yatsenko [16]. Noting the value of scientific work for the theory and practice of the use of land and resource potential and opportunities for modernization of land relations through

institutional mechanisms, it should be noted that some aspects of this problem remain insufficiently studied. Transparency and institutionalization of land relations in rural areas, substantiation of methodological support for a comprehensive assessment of the sectoral distribution of land resources within the territory need in-depth study.

The priority of our study is to substantiate within the institutionalization of land relations methodological approach to comprehensive assessment of effective use of land and resource potential of agricultural enterprises, by determining an integrated indicator of effectiveness (quantitative and qualitative characteristics of resources, productivity and efficiency) of basic activities of economic entities on agricultural lands.

## MATERIALS AND METHODS

Institutionalization of land relations in the state is regulated by the behavior of land agents and their relationship with agricultural enterprises to attract land to a particular type of economic activity. Acquisition of their status, capacity and profitability according to legal, economic and environmental norms in the market situation of land demand is due to the established foundation of the institutional environment, which has a direct and indirect impact (through the state) on sustainable land use and protection in agriculture and its industries. In the global context, the management of regulators of rational distribution of land and resource potential between enterprises in rural areas is justified by the attractiveness and competitiveness of agricultural land resources.

Given the principles of transparency and openness of the economic system of agricultural enterprises for the formation of environmentally friendly and efficient land use, modern strategic imperatives for the use of land and resource potential operate in accordance with three main provisions. First, they operate in the context of the economic regime of balancing the land and financial goals of the participants in land relations, as well as the rights and responsibilities of landowners or land users. Secondly, the vector of directing resources to the formation of land and resource potential is modified according to the basic economic rules: profitability of land, its value and price, supply and demand in the market, competitiveness of the territorial product, and so on. Third, land and resource potential are a specific economic field, where land relations are constantly implemented, which accelerate and integrate the distribution of rights to agricultural land and on the basis of financial feasibility, physical capacity, legal capacity ensure efficient use of land resources.

The main reason for the development of transparency in the use of land and resource potential is the investment attractiveness and competitiveness of the territorial product of agricultural enterprises. At the same time, for the organization of transparent use of land resources,

the objective necessity is the direction of transparency. This is the transparency of data on land with the permission of the landowner or land user; transparency of data on land with the permission of public authorities and local governments; transparency of data on landowners and land users with partial securitization of their land plots on the land market.

Systematic application of transparent, market and institutional approaches to the study of a new direction of land relations and assessment of land and resource potential allows creating a single methodological complex, which on the platform of methods and models of analysis involves building a common methodology for assessing land use in the economic system of agricultural enterprises within a certain region and formed rural areas. The methodology of this study highlights the following key points: development of methodological approaches to creating a transparent assessment of market turnover of agricultural land, identifying the relationship between land yield and decisions of the local village council to classify land in a particular category of land involved in business in the field of agriculture, the creation of a strong institutional base of land relations for different types of enterprises that own a certain category of agricultural land in compliance with economic, environmental, legal and social factors [17].

The latest methods in the methodology for assessing the effective use of land and resource potential of agricultural enterprises at different levels of sectoral distribution of land in rural areas, are the following [17]:

- method of coefficients and standardization of indicators (for the calculation of the difference between the indicators of profitability of land resources involved in different sectors of agriculture);
- application of the analysis for the purpose of definition of directions of institutional maintenance of land

relations in the conditions of decentralization of the power;

- integrated method (development of land resources assessment according to a large number of characteristics, which reduces multidimensional statistical indicators of the object of assessment into a single integrated indicator);

- method of expert assessments for forecasting and assessment of future results from the use of land and resource potential.

The use of indicators to assess the land and resource potential of agricultural enterprises at the regional level contributes to the development of measures to improve the conditions of targeted use of agricultural land, and, consequently, improve land relations between land market participants (especially in agriculture) at the national level. It is proposed to use indicators that introduce effective practices of regulating land relations in rural areas and allow assessing the state of different categories of land while ensuring the profitability of agricultural sectors.

The indicators cover two aspects: monitoring the process of formation of land and resource potential of agricultural enterprises and land profitability in agricultural sectors, taking into account the parameters of their efficiency. Assessment of land and resource potential in rural areas involves determining its ability to form agricultural land resources for all types of land use to meet the production needs of economic entities in accordance with the planned income and expenses, taking into account economic, intellectual, social aspects of property rights (ownership, orders). At the same time, the analysis of alternative land use of agricultural enterprises for their most rational and efficient distribution among land market participants for the future is carried out (Table 1).

**Table 1.** Indicators for assessing land and resource potential, its development and transparent use

Indicator	Evaluation mark
Price and volume in the markets of agricultural lands	Directions of coordination of the market of agricultural lands
Information on property rights	Rational distribution of land between branches of agriculture
Information on the activities of institutions operating in the market	The same attitude of the state to all citizens, citizens' trust in the government, the legal foundation of society
Corruption-unstable spheres of the agricultural sector of the economy	Identifying areas of the agricultural sector of the economy that are threatened by corruption
Procedures for changing the targeted purpose of agricultural land	Transition from "manual valuation regime" to forecast regime, according to land use incentives, carried out with the help of land tax rates
Public auctions	Granting lease rights on a transparent basis via the Internet and publishing the results on websites
Evaluation indicators	Rating, economic and monetary valuation of land plots for various agricultural purposes
Rent charge	Determining rent rates by conducting open electronic land auctions
Economic indicators of agricultural industries	Attractive and profitable agricultural sectors for investment
Taxation	The number and composition of taxpayers in terms of legal entities and individuals for agricultural land and their functional use shows the most effective market measures for land use and stimulates the development of agriculture

**Source:** developed by the authors

The proposed indicators are an innovative lever for assessing the state of land resources at the local level, which can be used by local governments of united territorial communities, interested investors to identify conflicts in sectoral land use of agriculture and increase the investment attractiveness of agricultural enterprises in agricultural market.

## RESULTS AND DISCUSSION

### *Peculiarities of the method of assessing the effectiveness of the use of land and resource potential*

Institutional provision of natural resources to the land and resource potential of agricultural enterprises forms the status of their land use, one of the forms of expression of which is the targeted purpose. The purpose of agricultural land simultaneously forms the profitability of land in rural areas [18].

In agricultural production, the tools of economic analysis of credit, financial, investment direction of land are coefficients (indicators) that characterize land rent, income, profitability, land value, productivity of agricultural land groups, as well as identify differences between forms of labor organization, forms of ownership on land for various purposes and functional uses. The profitability ratio reflects changes in profitability, the level of economic efficiency of land use, comparison of economic efficiency of land use within the enterprise and industry. We propose to calculate the yield ratio in the classical way: the numerator is the yield obtained in the production of cereals, and the denominator is the normative monetary value of 1 ha of arable land, according to formula (1) [19]:

$$C_p = \frac{\Delta P}{NMV} \times 100 \quad (1)$$

where:  $C_p$  – profitability ratio, %;  $\Delta P$  – profitability obtained in production activities (agriculture: in the production of cereals and legumes);  $NMV$  – normative monetary valuation of 1 ha of land resource, USD.

Under market conditions, to determine the fair value of land and value in use by comparison with analogues in order to reduce errors and greater objectivity in determining the value of land we use the rent multiplier, which is calculated as the inverse of the rate of return by formula (2) [19]:

$$M_p = \frac{1}{C_p} \quad (2)$$

where:  $M_p$  – profitability multiplier;  $C_p$  – rate of return, %.

Under ideal conditions in the stable development of agriculture, profitability has limits in the range from 20 to 80. A high level of profitability is shown by a lower value of the multiplier, and vice versa. We propose to introduce in the cadastral accounting the coefficient of profitability, which allows to track changes in the economic use of agricultural land, form of ownership, functional use of land and resource potential of agricultural enterprises and the quality of agricultural groups. The

rate of return reflects land as capital involved in production activities. The relevance of the normative monetary valuation and its indexation is mediated by the inverse indicator of the rate of return – the profitability multiplier, which more characterizes the market value with the existing use of land and resource potential.

At the same time, in terms of free access to land and private ownership, there is a difference in the use of land and resource potential. The behavior of a typical private agricultural enterprise is determined by comparing its needs and costs. Therefore, the difference in the use of land in terms of free access and private property will be explained by the size of private needs. Private property will be determined by the value of the marginal product, and free access to land will be determined by the value of the average product. At the same time, the creation and protection of private property rights requires costs that should be reduced, provided that the rent from the use of land resources will exceed them, i.e. [19]:

$$NPV_p = \sum_{t=1}^n \frac{(R_t - C_t)}{(1+i)^t} - C_i \geq 0 \quad (3)$$

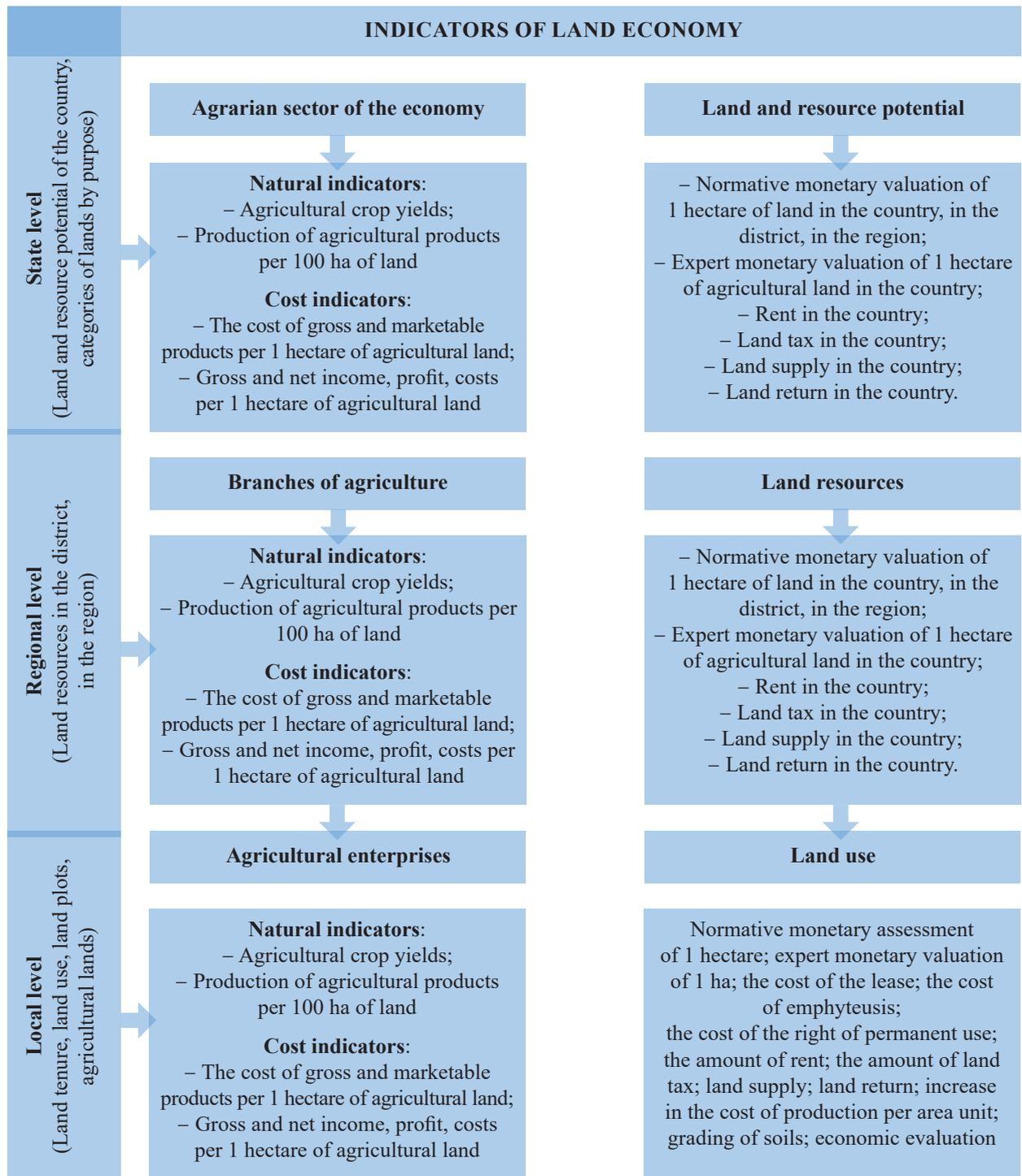
where:  $NPV_p$  – net present value of investments in the creation of exclusive property rights to a rare resource, %;  $C_t$  – current costs associated with the protection of property rights in time  $t$ ;  $R_t$  – profits in the form of rent, received due to the specification and protection of property rights in time  $t$ ;  $C_i$  – initial costs.

Land economy at the level of agriculture of the state analyzes the profitability and efficiency of the use of land and resource potential, at the level of industry – profitability and efficiency of land resources use, at the level of agricultural enterprises – profitability and efficiency of land use [7]. Accordingly, the economic efficiency of land use in agriculture is manifested in the level of production on it, which is determined by the number of products, taking into account the quality and cost per unit area. Economic efficiency of land use in agriculture is characterized by a system of natural and cost indicators [20] (Fig. 1).

Economic methods for assessing the effective use of land and resource potential of agriculture in the country are carried out in two directions:

- creation of an institutionalized economic environment (rent, quality and value of land (market, mortgage, regulatory), taxation system (tax, rent), promotion of rational land tenure and land use (system of benefits and subsidies));

- use of economic levers (investment, financing, lending, economic protection against withdrawal of agricultural land for non-agricultural purposes, penalties for mismanagement of land, reduction of soil fertility, losses, compensation for land conservation, etc.). The instruments of the economic mechanism of effective use of land and resource potential of agriculture are the institute of land valuation, the institute of taxation, the institute of the land market.

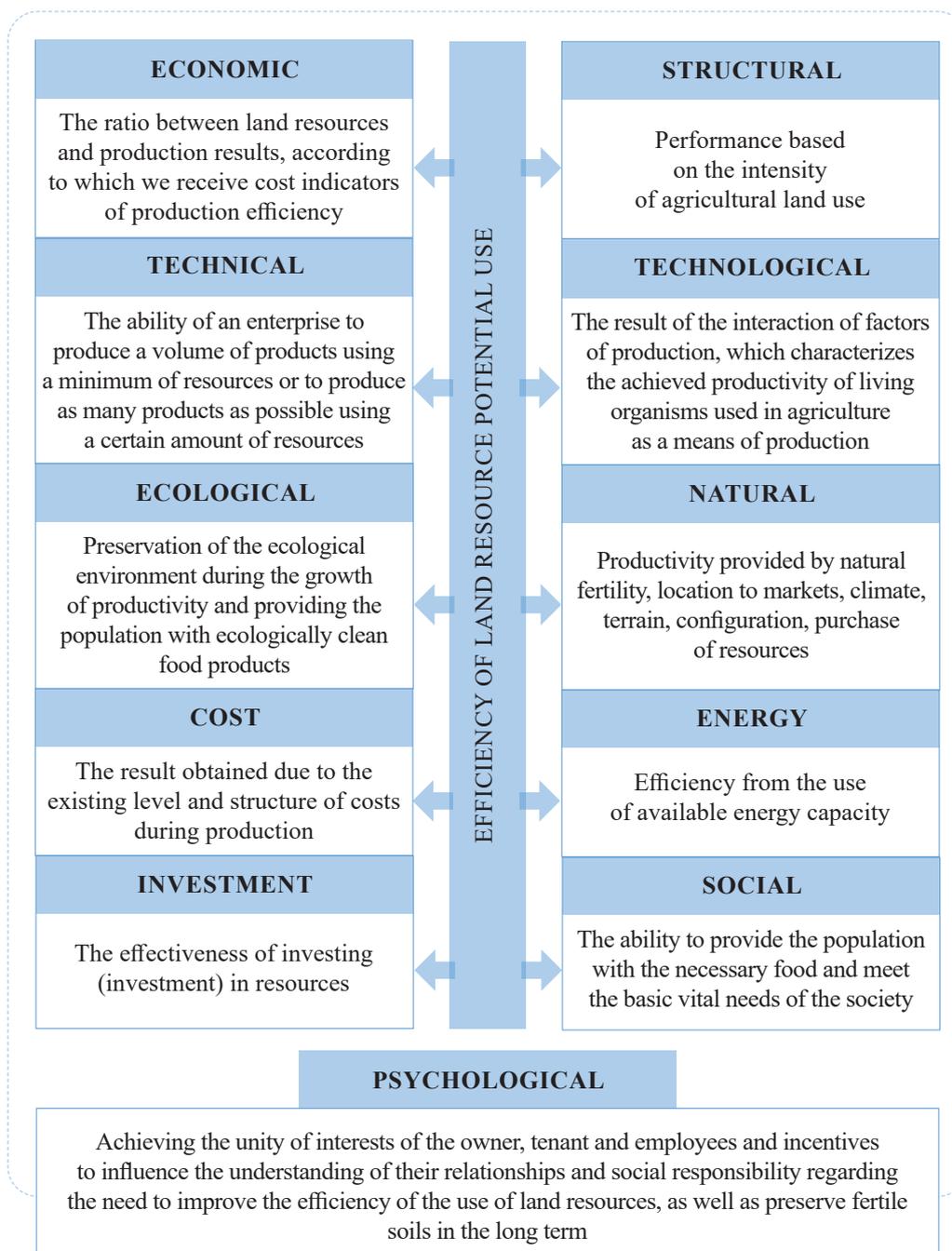


**Figure 1.** Indicators of land economy by levels of their use in agriculture

**Source:** developed by the authors based on data [7; 20]

In the process of evaluating the efficiency of the use of land and resource potential by agricultural enterprises, a comprehensive methodological approach is identified, which is determined by the variety of criteria (Fig. 2). An integrated methodological approach to land and resource potential assessment takes into

account the relationship and interdependence of indicators and criteria used in the study of land use efficiency of agricultural enterprises, and allows a deeper and comprehensive assessment of the effectiveness of the overall impact.



**Figure 2.** Components of the efficiency of the use of land and resource potential of agricultural enterprises  
**Source:** built by the authors according to data [6; 9; 14; 17-19]

Thus, ecological and economic efficiency of agricultural land use reflects the level of impact of the economic complex on the environment, reveals the interactions between economic and environmental subsystems and key environmental issues and disparities in economic development. This is an integrated economic efficiency of land use in agriculture, which takes into account the reduction of economic results due to the eco-destructive impact of economic activity [21; 22]. Coordination of ecological and economic interests acquires special significance in the context of ensuring the

environmental, resource-saving and reproductive nature of the exploitation of agricultural land.

A prerequisite for assessing the effectiveness of the use of land and resource potential of agricultural enterprises is to identify: 1) environmental results, which contributes to increasing the number and improving the quality of land suitable for use; 2) social result, which consists in improving the living standards of the population, health care, improving working and leisure conditions, maintaining ecological balance; 3) economic result, which provides a permanent economic effect from

the fuller and rational use and arrangement of land, increasing the efficiency of social production [17].

The importance of the issue of efficient use of land and resource potential of agricultural enterprises necessitates the definition of criteria and indicators for assessing

the efficiency of land use. We should note that the criteria provide a broad description of the effectiveness, while the indicators are derived from the criteria and act as their specific expression (Table 2).

**Table 2.** Criteria for evaluating the efficiency of the use of land and resource potential of agricultural enterprises

Kind of efficiency	Evaluation criteria
Economic	Agricultural products at actual prices; marketable products at current sales prices; net profit; gross net income per area unit; profit per hectare of agricultural land; profitability
Structural	Level of development of agricultural lands; the level of plowing of rural areas; proportion of intensive crops; land reuse rate; area of crops in the area of arable land; land supply; land armament; anthropogenic load factor; proportion of intensive crops; level of reclamation
Technical	Gross output per unit of land area; livestock productivity; agricultural crop yields
Technological	Cost of production; crop yield per unit of sown area; livestock and poultry productivity; increase in agricultural crop yields; reducing the energy intensity of agricultural production; increase in gross agricultural output at actual prices (per 1 ha of agricultural land, per worker)
Ecological	Soil fertility; humus balance; fertility of the soil; harvest area in the structure of agricultural crop areas; pollution; the level of erosion risk of crops; coefficient of ecological stability of rural area; anthropogenic load factor; reduction of environmental pollution; the level of land erosion; change of land area; the share of net profit of the enterprise aimed at environmental measures; share of environmentally friendly products; the scale of use of mineral fertilizers; availability of modern treatment facilities
Expensive	The general level of production costs; capital adequacy; depreciation level; cost price
Energy	Energy consumption; energy capacity per 1 hectare of agricultural land; energy capacity per 1 ha of arable land; energy cost; energy armament
Social	The share of income directed to social activities in the total mass of net income; the amount of profit directed to social activities, per one average employee of the enterprise; the level of remuneration of employees of agricultural enterprises; loading land (area of agricultural land per worker employed in agricultural production); structure of agricultural lands by forms of ownership; structure of agricultural lands by organizational and legal forms
Ecological and economic	Gross harvest and crop yields; area of agricultural land collection; the cost of gross output per area of land; product profitability; the amount of mineral and organic fertilizers; share of fertilized area with mineral and organic fertilizers; correlation of yield and condition of soils and means of stimulation of productivity; costs of reclamation and environmental measures; coefficient of variability of land productivity
Socio-economic	Rent for land shares; rent for property shares (units); increase in the value of a unit of land area and output per capita
Production and technical	Land return; return on assets; material efficiency; work capacity
Socio-ecological and economic	The amount of energy produced by biomass; the level of use of different energy sources; the ratio of biomass energy to energy consumption of natural fuel and man

**Source:** grouped by the authors according to data [6; 9; 14; 17-19; 21]

We offer economic efficiency of the use of land and resource potential of agricultural enterprises by [7]

calculation through profit of production, taking into account normative factors [23]:

$$Pr = \sum_{i=1}^{n\Sigma} \sum_{j=1}^{m\Sigma} C_{ci} \times P_{pj} \times Sq_{ij} - \sum_{i=1}^{n\Sigma} \sum_{j=1}^{m\Sigma} \sum_{l=1}^h Sq_{ijl} \times \left[ \frac{1}{f_1(G_f; N_s; C_c; T_{op}) \times K_1} \times (P_{n.ch} + \frac{7C_{tr_{ijl}} \times (a_{tr_{ijl}} + r_{tr_{ijl}})}{t_{ijl}} + \frac{7C_{m_{ijl}} \times (a_{m_{ijl}} + r_{m_{ijl}})}{t_{ijl}}) + f_2(G_f; P_{n.ch}; C_c; T_{op}) \times K_1 \times Poth_{lub} \right] \quad (4)$$

where:  $C_{ci}$  – agricultural crop yield, c/ha;  $P_{pj}$  – the price of production per unit, USD/c;  $Sq_{ij}$  – area of cultivated

crop, ha;  $n$  – the number of plots in the crop rotation field ( $i=1,2,3,\dots,n$ );  $m$  – the number of agricultural crops

grown in crop rotation ( $i=1,2,3,\dots,m$ );  $P_{n.ch}$  – price (cost) of norm change;  $G_f$  – field group;  $N_s$  – sowing rate of agricultural crops;  $T_{op}$  – type of operation;  $K$  – production rate, determined depending on the class of soils;  $h$  – the total number of technological operations in the cultivation of one agricultural crop ( $i=1,2,3,\dots,h$ );  $C_{tr}, C_m$  – book value of tractor and agricultural machine;  $a_{tr}, a_m$  – the percentage of depreciation deductions (normative) from the book value of the tractor and agricultural machinery, respectively;  $t$  – time of work performance;  $r_{tr}, r_m$  – deductions (deductions from the book value) for repair, inspection and storage of tractor and agricultural machinery, respectively, %;  $P_{lub}$  – unit price of fuels and lubricants;  $Cost_{oth}$  – other expenses, USD.

As there are different types of efficient use of land and resource potential of agricultural enterprises, approaches to its evaluation are not universal. In addition, there are absolute and comparative economic efficiency of land management [24]. The calculation of absolute efficiency aims at selecting the most appropriate areas and scope of land management measures in agriculture, its industries and enterprises. When assessing the comparative effectiveness, the best option for implementing specific measures is selected. On the basis of the above, we propose a comprehensive comparative indicator of the efficiency of the use of land and resource potential of agricultural enterprises, which is calculated by formula (5) [24]:

$$I_{LRP} = a_1 \frac{S_{lu}}{S_{lu^0}} + a_2 \frac{M_{p100ha}}{M_{p100ha^0}} a_3 \frac{Pr_{100ha}}{Pr_{100ha^0}} a_4 \frac{P_{lev}}{P_{lev^0}} + a_5 \frac{Em}{Em^0} \quad (5)$$

where:  $I_{LRP}$  – a comprehensive indicator of the efficiency of land use;  $a_1, a_2, a_3, a_4, a_5$  – weighting factors that determine the significance of indicators;  $S_{lu}$  – the amount of land use in the relevant year, ha;  $M_{p100ha}$  – received per 100 hectares of agricultural land of marketable products in the relevant year, USD;  $Pr_{100ha}$  – received per 100 hectares of agricultural land profit (loss) in the relevant year, USD;  $P_{lev}$  – the level of profitability in the relevant year, %;  $Em$  – per employee of agricultural land in the relevant year, ha;  $S_{lu^0}$  – the amount of land use in the reporting year, ha;  $M_{p100ha^0}$  – received per 100 hectares of agricultural land of marketable products in the reporting year, USD;  $Pr_{100ha^0}$  – received per 100 hectares of agricultural land profit (loss) in the reporting year, USD;  $P_{lev^0}$  – the level of profitability in the reporting year, %;  $Em^0$  – per employee of agricultural land in the reporting year, ha.

Predicting the magnitude of land and resource potential, using intuitive and formalized (extrapolation, modeling) methods allows distinguishing the following criteria for its evaluation [25]: a combination of subjective value and objective significance of estimates; clear application of estimates, which does not allow different interpretations of the choice of methods; enabling the accumulation of statistical information and its use for forecasting. The application of these methods is of great

value, because the identified forecast trends are the basis for the development of measures, levers of the economic mechanism of efficient use of land resources of agricultural enterprises.

To assess the effectiveness of the use of land and resource potential, it is proposed to apply the economic and mathematical model of the optimal structure of sown areas of agricultural enterprises. That is, the strategic direction of development and operation of each agricultural enterprise is the formation of a set of organizational, economic and agro-technological measures to improve the quality parameters of available land resources to increase the efficiency of production activities. In this case, the criterion of optimality is taken to be the maximum profit of activity [25]:

$$L = \sum_{j=1}^l C_j X_j + \sum_{k=l+1}^n C_k X_k \rightarrow \max \quad (6)$$

where:  $C_j$  – the amount of profit received from 1 hectare of the  $y$ -th crop;  $X_j$  – sown area of the  $i$ -th crop;  $C_k$  – the amount of profit received from one structural head of the  $k$ -th type of cattle;  $X_k$  – the number of structural heads of the  $k$ -th type of cattle;  $i$  – types of resources ( $i=1,2,3,\dots,n$ );  $j$  – ordinal number of agricultural crops ( $j=1,2,3,\dots,n$ ).

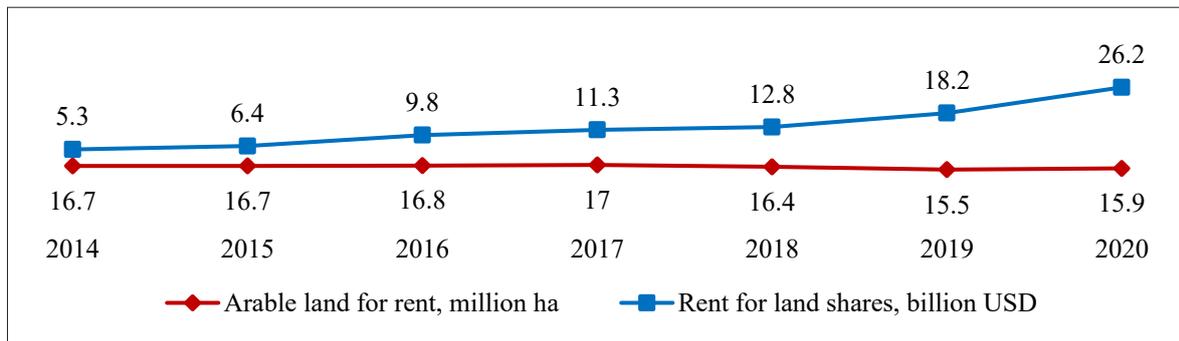
The obtained values of the variables are the optimized size of sown areas, according to which the farm is expected to increase the area of economically most profitable grain and industrial crops, as well as perennial grasses, which will contribute to the organization of the efficient land use. In conclusion, we should note that, in our opinion, the method of assessing the effectiveness of the use of land and resource potential should primarily include a study of the structure of the land fund by major landowners and land users and the development of the market for agricultural land lease. The role of land relations should be taken into account and strategic guidelines for the efficient use of agricultural land resources should be outlined. After all, a significant number of owners and users of land have no experience of rational land use. For example, the introduction of appropriate measures to preserve and restore soil fertility, rather than just trying to get the most out of property (rent). Therefore, it is necessary to take into account the interests of agricultural land use to improve the level of soil fertility and the possibility of increasing it through the implementation of land improvements.

### **Models of adjustment of normative monetary valuation of agricultural lands**

The permanent process of land relations, especially in the field of agriculture, which is taking place in Ukraine, has changed the vector of existing land ownership and land use of agricultural enterprises in the context of the use of land and resource potential. During the period 2016-2020, the number of agricultural enterprises in the country decreased by 3.5%, due to the dominance

of extensive farming and the inefficiency of relations regarding the lease of agricultural land. In addition, the

dynamics of land use of agricultural enterprises tends to decrease by 6% (Fig. 3).



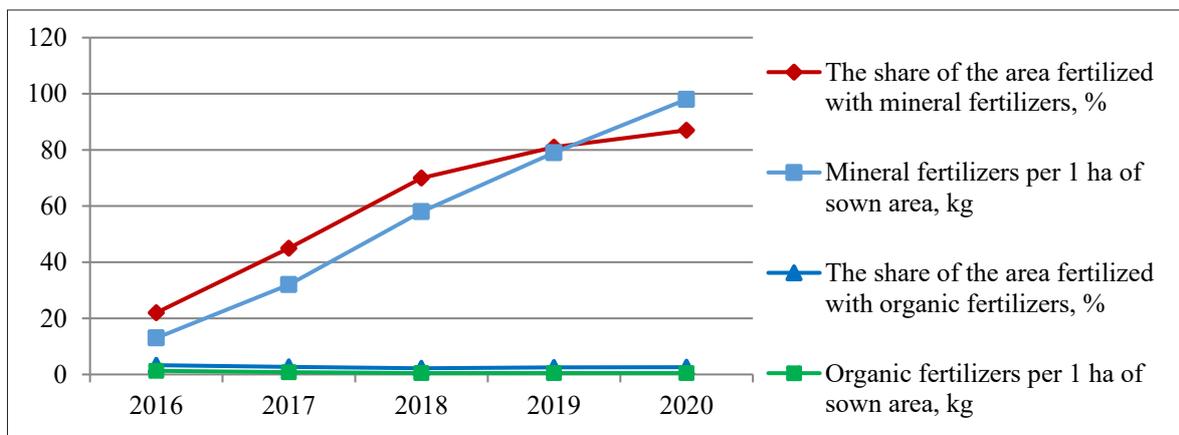
**Figure 3.** The amount of rent of agricultural enterprises of Ukraine by land shares for 2014-2020

**Source:** developed by the authors according to data [26]

During the period 2014-2020, the area of leased land decreased from 94.8% to 96.2%, the area of arable leased land decreased by 5%. The average rent per 1 ha of arable land in agricultural enterprises has increased almost 5.0 times.

World practice proves that only intensive use of soils with high fertility contributes to increasing the efficiency of production in agriculture, along with reducing investment in degraded and unproductive lands. Fertility is affected by the level of fertilizer application, as proper land use can improve its natural properties. During the

period of 2016-2020, the area fertilized with mineral fertilizers increased six times, organic – decreased by 68.4%. The significant reduction in the application of organic fertilizers is due to the decline of the livestock industry and the reduction of livestock. In 2016, the number of cattle in agricultural enterprises of Ukraine amounted to 9423.7 thousand heads, in 2020 – only 39% from the base period [27]. Annually 0.5-0.7 tons of humus is applied to 1 ha of arable land, but to ensure its deficit-free balance according to the standards, it should be 11-12 t/ha per year [26; 28] (Fig. 4).

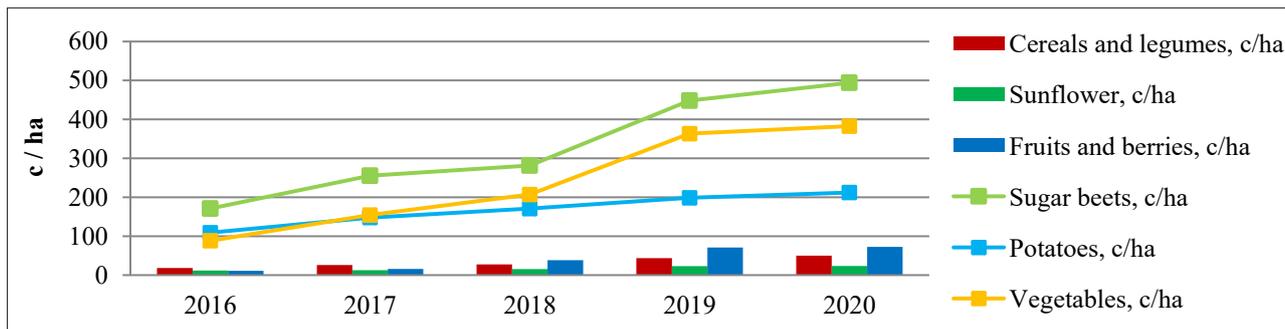


**Figure 4.** The amount of fertilizer per 1 ha of sown area of agricultural enterprises of Ukraine for 2016-2020

**Source:** calculated by the authors according to data [26-28]

The main tasks of the agricultural sector are to increase the volume of agricultural production, provide the population with food and agricultural products, achieve high economic performance and increase competitiveness in the world market. Among the main areas of functioning of the agricultural sector are: 1) positive results of the development of agricultural production;

2) increase in the production of basic crop products; 3) the general growth of indicators of the agricultural sector [27]. Thus, during the period of 2016-2020, the yield of grain crops in Ukraine increased on average by 2.7 times, sugar beets – by 2.9 times, sunflower – almost by 2 times, vegetables – by 4.3 times, fruit and berry crops – almost by 6.7 times (Fig. 5).

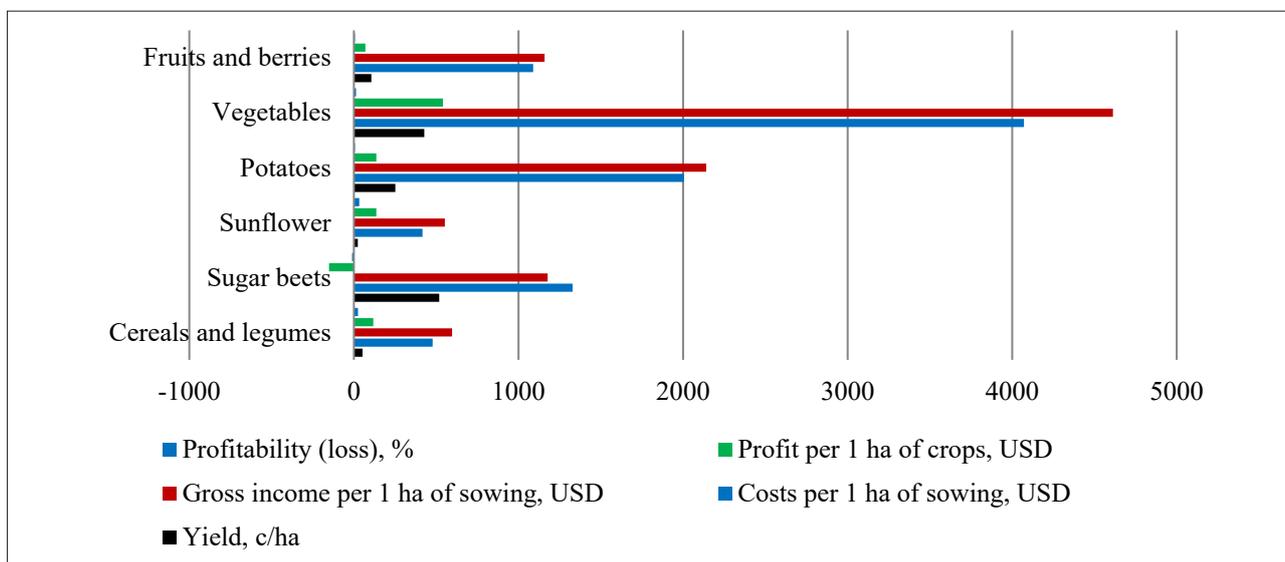


**Figure 5.** Crop yields of agricultural enterprises of Ukraine in 2016-2020, c/ha

Source: calculated by the authors according to data [26-28]

The reflection of interconnected and interacting results of agricultural enterprises in the plane of rational use of land and resource potential, through determining the overall economic effect of the production process

per 1 hectare of agricultural land, allowed determining the impact of the cost component and its comparability with profitability to achieve this effect (Fig. 6).



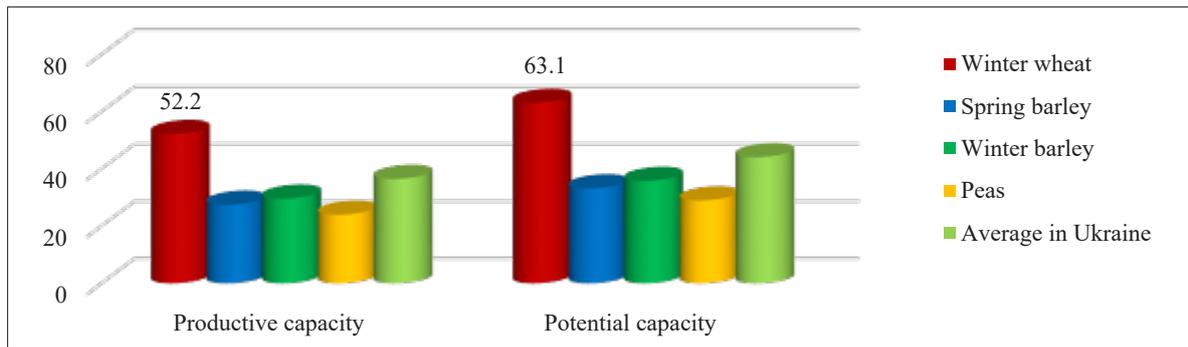
**Figure 6.** Economic efficiency of crop production in Ukraine in 2020

Source: calculated by the authors according to data [26-28]

Economic indicators of the results of economic activity of agricultural enterprises in the field of crop production are the basis for the normative monetary valuation of agricultural land according to the method [29], but it causes significant fluctuations in the monetary valuation of 1 ha of arable land. We believe that it is necessary to move the calculation of crop yields from its actual value to natural, i.e., without taking into account the cost of mineral and organic fertilizers [3; 7].

There are two options for calculating the normative monetary valuation of arable land, which is based

on the actual yield of cereals and legumes (excluding corn for grain) and its growth through the introduction of mineral and organic fertilizers (option I) in Ukraine; option II – on the natural yield of cereals and legumes (excluding corn for grain) in rural areas on average per region of Ukraine; option III – on the natural yield of cereals and legumes (excluding corn for grain) on average per one region of Ukraine. According to the first option, based on the research results, the natural yield of grain and legumes on average in Ukraine in 2020 is 52.2 c/ha [28], the potential yield is higher by 20.9%, i.e. 63.1 c/ha (Fig. 7).

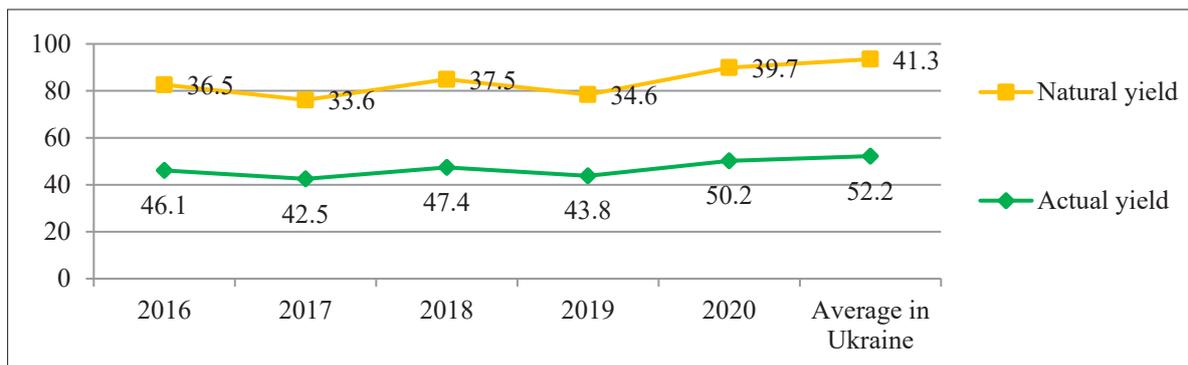


**Figure 7.** Productive capacity of natural and potential soil fertility by cereals and legumes (excluding corn for grain) in Ukraine

**Source:** calculated by the authors according to data [26-28]

The frequency of conducting and updating indicators of normative monetary valuation of agricultural lands is 5-7 years. The study period is five years (2016-2020), in which the actual yield of cereals and legumes without corn for grain fluctuated within 46.1-50.2 c/ha, and the average in Ukraine was 52.2 c/ha. The lowest yield was observed in 2017 – 42.5 c/ha, c/ha, and the

highest in 2020 – 52.2 c/ha [28]. Based on the fact that due to the application of mineral and organic fertilizers, the potential yield is achieved, respectively, the natural yield by reducing the actual by 20.9% will be equal to  $52.2 \times 0.791 = 41.3$  c/ha. Then the average natural yield for the study period will be  $(36.5 + 33.6 + 37.5 + 34.6 + 39.7 + 41.3) / 5 = 44.6$  c/ha (Fig. 8).

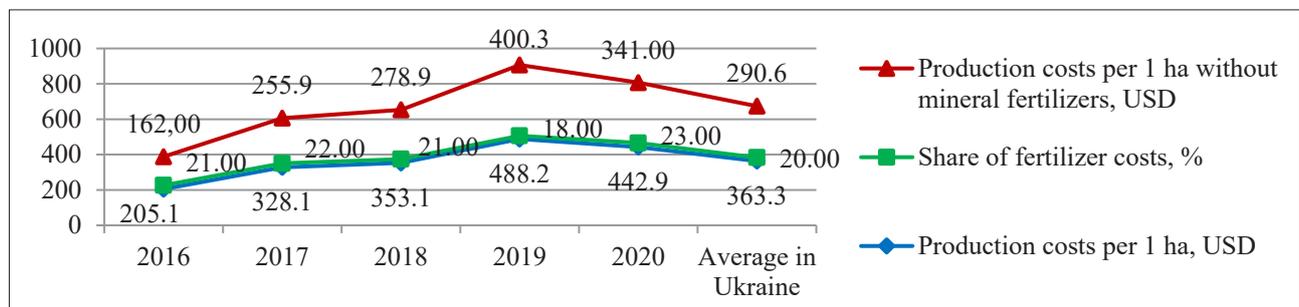


**Figure 8.** Natural and potential yields of cereals and legumes (excluding corn for grain) in Ukraine

**Source:** calculated by the authors according to data [26-28]

As part of the production costs of agricultural enterprises for the cultivation of cereals and legumes (excluding corn), the cost of mineral fertilizers for

2016-2020 fluctuated in the range 18-23%, in Ukraine they averaged 20% (Fig. 9).

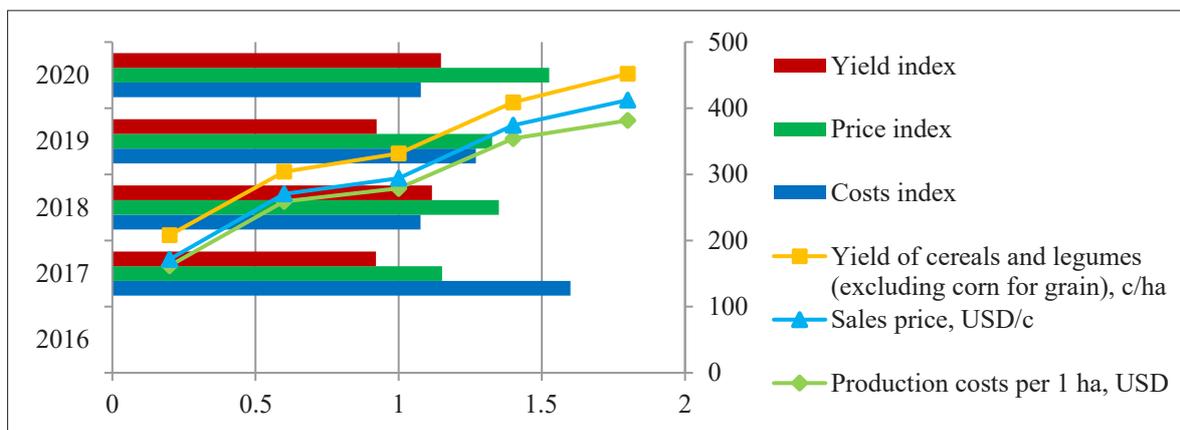


**Figure 9.** Production costs for growing cereals and legumes (excluding corn for grain) in Ukraine for 2016-2020

**Source:** calculated by the authors according to data [26-28]

We should note that there is a disproportion in the growth rate of costs in accordance with the rate of yield and price, which needs to be adjusted. Therefore, the growth rate of costs is greater than the growth rate of productivity by 21%, and the growth rate of sales price – by 5%. We should note that the average selling price of cereals and legumes (excluding corn for grain) in 2016

was – 10.30 USD/c, in 2017 – 11.86 USD/c, 2018 – 16.01 USD/c, 2019 – 21.23 USD/c, 2020 – 32.39 USD/c, the average in Ukraine – 20.4 USD/c (Fig. 10). That is, production costs when adjusting for natural yields will be for the study period within 161.9-381.5 USD/c, the selling price – within the limits 9.79-30.77 USD/c respectively.



**Figure 10.** Growth rates of grain and legumes (excluding corn for grain), sales prices and costs in Ukraine for 2016-2020

**Source:** calculated by the authors according to data [26-28]

The normative monetary valuation of 1 ha of arable land according to the first option, which forms the

potential of the land and resource potential of agricultural enterprises of Ukraine, is presented in (Table 3).

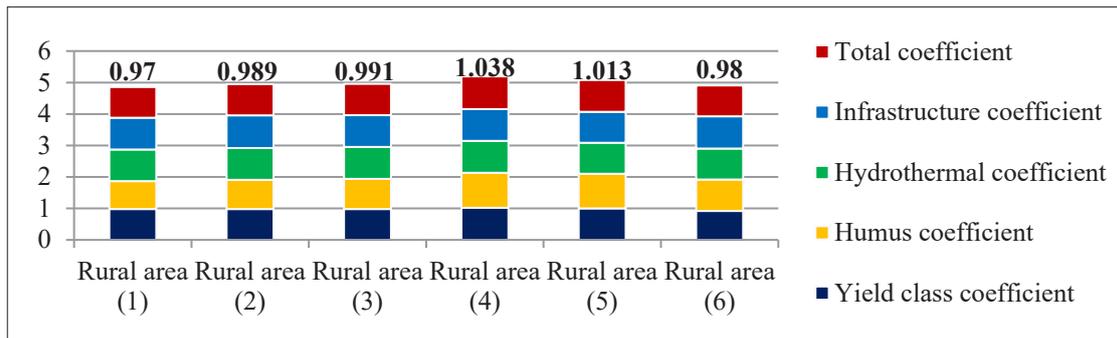
**Table 3.** Regulatory monetary valuation of 1 ha of arable land when adjusting for natural yields of cereals and legumes (excluding corn for grain) in Ukraine in 2020 (option I)

Indicators	Value
Yields of grains and legumes (without corn), c/ha	41.3
The average selling price of 1 centner of grain, USD USA	30.77
Gross output from 1 ha, USD	1270.8
Production costs per 1 ha, USD	381.5
Cost ratio (35%), USD	133.5
Costs with the standard, USD	515.0
Differential rental income, USD/ha	74.6
Differential rental income, c/ha	3.2
Absolute rental income, c/ha	1.6
Total rental income, c/ha	4.8
Normative monetary valuation, USD/ha	2472.0

**Source:** calculated by the authors

Differentiation of normative monetary valuation of 1 ha of arable land of agricultural enterprises depending on natural-climatic and qualitative-spatial indicators of

location of rural territories on average per one region of Ukraine in 2020 is carried out (Fig. 11).

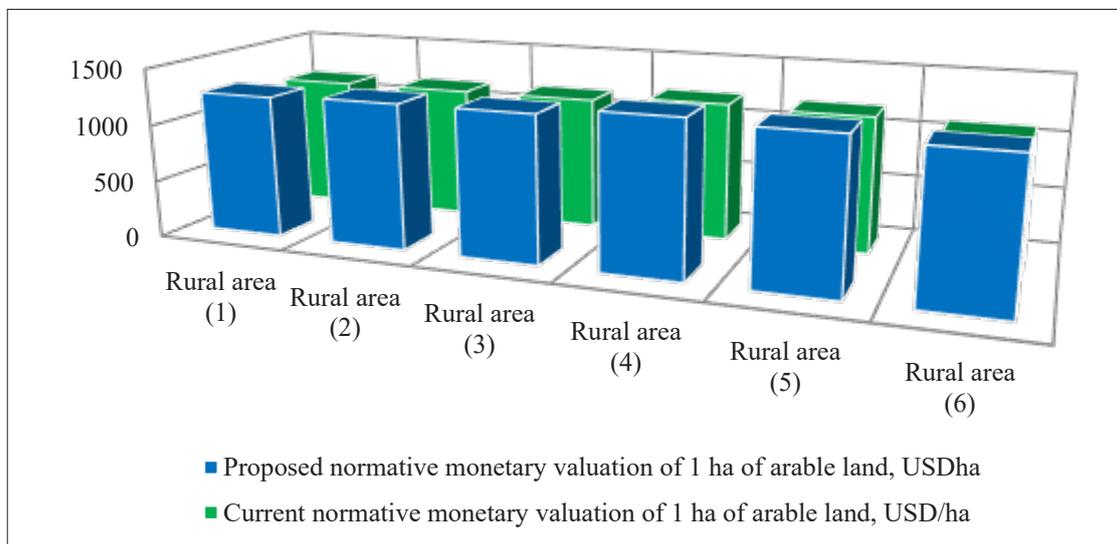


**Figure 11.** Determination of the total coefficient for arable land by natural characteristics of rural areas on average per region of Ukraine

**Source:** calculated by the authors

Thus, on average in one region of Ukraine the normative monetary valuation of 1 ha of arable land of agricultural enterprises, taking into account the total coefficient of differentiation is the largest in rural areas (4)

equal to 10.6% more than the Methodology [29], the smallest – in rural areas (1) is 1246.9 USD/ha, which is 7.4% more than the current Methodology [29] (Fig. 12).



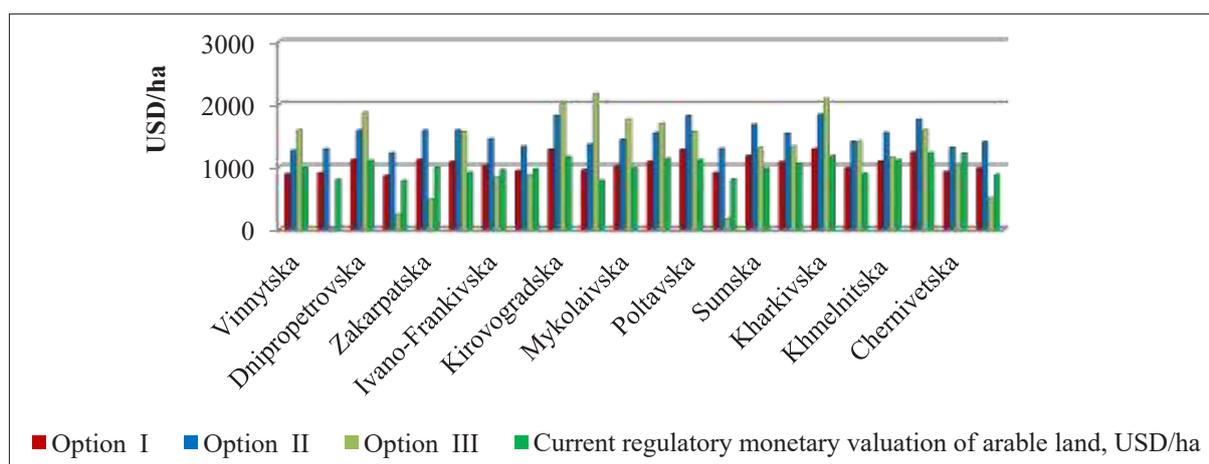
**Figure 12.** Comparison of the proposed and current normative monetary valuation of 1 ha of arable land in rural areas on average per one region of Ukraine, 2020 (option II)

**Source:** calculated by the authors

There are significant fluctuations in the normative monetary value of 1 ha of arable land, which is calculated on the basis of natural yields in each region of Ukraine separately. This will lead to a decrease in tax revenues to local budgets in some regions (Fig. 13).

The considered models of adjustment of normative monetary valuation of agricultural lands constitute

a scientifically substantiated system of imperatives of efficient use of land and resource potential of agricultural enterprises, taking into account differences in rural development in the regions of crop production, taking into account their natural and economic features on agrobiological basis.



**Figure 13.** Normative monetary valuation of arable land by regions of Ukraine when adjusting for natural yields of cereals and legumes (excluding corn for grain) in 2020, USD/ha

**Source:** calculated by the authors

The selected options for such an assessment include: first, the development of appropriate methods, secondly, a nationwide assessment of all lands in the country, and thirdly, the creation of a portal of normative monetary assessment for free and transparent access of stakeholders to its results in online mode at any time.

#### **Forecasting of the efficiency of the use of land and resource potential of agricultural enterprises in Ukraine**

Based on the study of concentration and intensification of agricultural production, it is advisable to determine the forecast efficiency of the use of land and resource potential of agricultural enterprises in one rural area of

Ukraine, on the three main components of efficiency – technological, social and economic (Table 4).

To predict the effectiveness of the use of land and resource potential of agricultural enterprises on a set of indicators, the latter must be reduced to a comparable form. To do this, each indicator determines the forecast direction of its positive development (i.e. the “best representative” of the studied group of indicators in terms of enterprises). Each value of the indicator is compared with the “best representative” of the studied group of indicators and transformed into appropriate coefficients. The transformed matrix of indicators of efficiency of the use of land and resource potential of agricultural enterprises is presented in (Table 5).

**Table 4.** Initial indicators for forecasting the efficiency of the use of land and resource potential of agricultural enterprises by technological, social and economic components, 2020 (on average per region of Ukraine)

Indicators	Agricultural enterprises					
	1	2	3	4	5	6
Technological efficiency indicators						
Commodity products on agricultural lands, thousand USD	0.4167	0.906	0.297	1.194	0.521	1.947
The amount of advanced capital per 1 hectare of agricultural land, thousand USD	0.662	0.778	0.298	1.073	0.346	37.59
Production costs per 1 hectare of agricultural land, thousand USD	0.295	0.560	0.356	0.887	0.422	1.589
Indicators of social efficiency						
The average salary of an employee, USD	165.8	213.5	273.1	237.8	253.9	246.5
Arable land area per 1 worker, ha	14	40	27	94	15	12
Labor costs per 1 ha of arable land, thousand USD	133.8	153.4	168.6	145.1	177.2	152.7
Indicators of economic efficiency						
Return on advanced capital ratio on net income from sales	0.6	1.2	1.0	1.1	1.5	0.1
Product profitability, %	85.4	59	51.6	27.2	15.1	22.4
Labor productivity, thousand USD	228.8	996.9	221.4	3078.6	374.2	530.1

**Source:** calculated by the authors

**Table 5.** Transformed matrix of indicators of efficiency of the use of land and resource potential of agricultural enterprises of the region (on average per region of Ukraine), 2020

Indicators	Agricultural enterprises					
	1	2	3	4	5	6
Technological efficiency indicators						
Commodity products on agricultural lands, thousand USD	0.21	0.47	0.15	0.61	0.27	1/00
The amount of advanced capital per 1 hectare of agricultural land, thousand USD	0.02	0/02	0/01	0.03	0.01	1.00
Production costs per 1 hectare of agricultural land, thousand USD	1.00	0.53	0.83	0.33	0.70	0.19
Indicators of social efficiency						
The average salary of an employee, USD	1.00	0.94	0.99	0.73	0.06	0.77
Arable land area per 1 worker, ha	0.15	0.43	0.29	1.01	0.16	0.11
Labor costs per 1 ha of arable land, thousand USD	0.45	0.68	0.72	1.00	0.34	0.06
Indicators of economic efficiency						
Return on advanced capital ratio on net income from sales	0.40	0.80	0.67	0.73	1.00	0.07
Product profitability, %	1.00	0.69	0.60	0.32	0.18	0.26
Labor productivity, thousand USD	0.07	0.32	0.07	1.00	0.12	0.17

**Source:** calculated by the authors

An important factor in the used research method is taking into account the use of expert assessments of the significance of each indicator within their study groups in terms of technological, social and economic efficiency, respectively. The ranking of the weight of the value of each important of the proposed indicators is on a scale in the range from 0 to 1. The generalized weight of each evaluation indicator was determined with the help of arithmetic mean. The obtained weights within each group of indicators are a total of 1.0 [10]. According to the results of the evaluation, nine groups

of significance weights were obtained, from which the final ones were derived. The final weights of significance of indicators of efficiency of the use of land and resource potential of agricultural enterprises are combined in Table 6. Based on the established transformed values of indicators and established weights of indicators and their groups, forecast values of indicators of technological, social and economic efficiency as generalizing characteristics of efficiency of the use of land and resource potential of agricultural enterprises in the region are determined (Table 7).

**Table 6.** Significance coefficients of the forecasted indicators of efficiency of the use of land and resource potential of agricultural enterprises of the region (on average per region of Ukraine)

Indicators	Result
Commodity products on agricultural lands, thousand USD	0.26
The amount of advanced capital per 1 hectare of agricultural land, thousand USD	0.36
Production costs per 1 hectare of agricultural land, thousand USD	0.38
<b>In general, according to indicators of technological efficiency</b>	<b>1</b>
The average salary of an employee, USD	0.34
Arable land area per 1 worker, ha	0.28
Labor costs per 1 ha of arable land, thousand USD	0.38
<b>In general, according to indicators of social efficiency</b>	<b>1</b>
Return on advanced capital ratio on net income from sales	0.45
Product profitability, %	0.27
Labor productivity, thousand USD	0.28
<b>In general, according to indicators of economic efficiency</b>	<b>1</b>

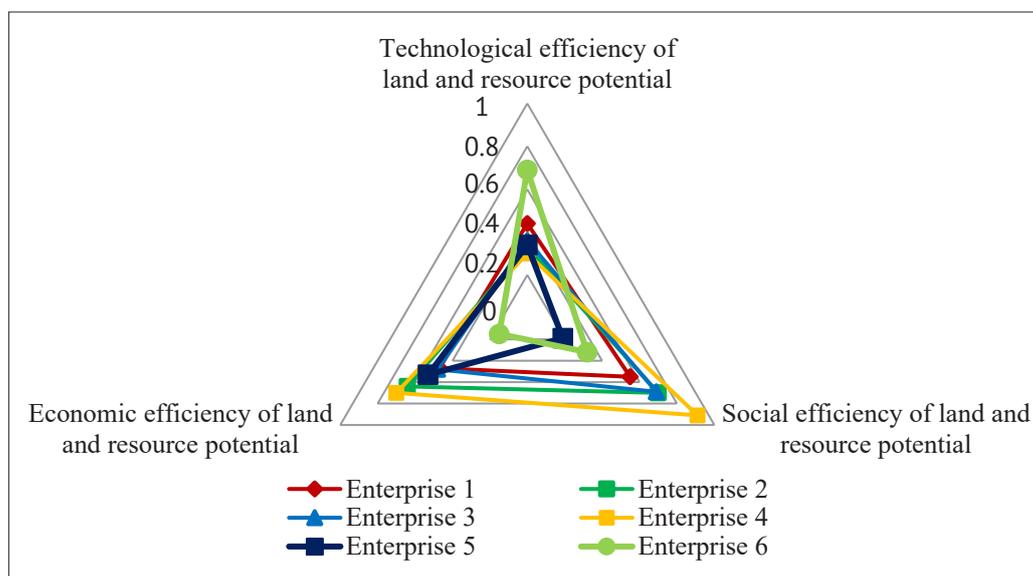
**Source:** calculated by the authors

**Table 7.** Matrix of forecast values of indicators of efficiency of the use of land and resource potential of the agricultural enterprises of the region for 2021 (on average per region of Ukraine)

Indicators	Agricultural enterprises					
	1	2	3	4	5	6
Commodity products on agricultural lands, thousand USD	0.06	0.12	0.04	0.16	0.07	0.26
The amount of advanced capital per 1 hectare of agricultural land, thousand USD	0.01	0.01	0.003	0.01	0.003	0.36
Production costs per 1 hectare of agricultural land, thousand USD	0.38	0.20	0.31	0.13	0.27	0.07
<b>Technological efficiency</b>	<b>0.44</b>	<b>0.33</b>	<b>0.36</b>	<b>0.30</b>	<b>0.34</b>	<b>0.69</b>
The average salary of an employee, USD	0.34	0.32	0.34	0.25	0.02	0.26
Arable land area per 1 worker, ha	0.04	0.32	0.34	0.25	0.02	0.26
Labor costs per 1 ha of arable land, thousand USD	0.17	0.26	0.27	0.38	0.13	0.02
<b>Social efficiency</b>	<b>0.55</b>	<b>0.70</b>	<b>0.69</b>	<b>0.91</b>	<b>0.19</b>	<b>0.32</b>
Return on advanced capital ratio on net income from sales	0.18	0.36	0.30	0.33	0.45	0.03
Product profitability, %	0.27	0.19	0.016	0.09	0.05	0.07
Labor productivity, thousand USD	0.02	0.09	0.02	0.28	0.03	0.05
<b>Economic efficiency</b>	<b>0.47</b>	<b>0.64</b>	<b>0.48</b>	<b>0.78</b>	<b>0.53</b>	<b>0.15</b>

Source: calculated by the authors

Forecast calculations of the effective use of land and resource potential of agricultural enterprises in the region by technological, social and economic component are presented in Figure 14.



**Figure 14.** Three-dimensional model of coordinates of efficiency of the use of land and resource potential of agricultural enterprises of the region for 2021 (on average per region of Ukraine)

Source: calculated by the authors

Based on the essence of the studied indicators, it is determined that the higher the value of each generalization of the efficiency indicator, the better the position of the agricultural enterprise, the higher the efficiency of its land and resource potential. It is established that the best results are demonstrated by an agricultural enterprise No. 4, the second place in the hierarchy of

efficient use of land and resource potential is occupied by enterprises No. 2, No. 3, No. 1, No. 5 and No. 6. However, it should be noted that the business entity No. 6 has the highest technological efficiency of the studied set of enterprises, which indicates the likelihood of increasing land use and the development of intensive production in the region.

## CONCLUSIONS

Thus, the use of land and resource potential in Ukraine should be carried out within a clearly defined land policy, as the state is given the main role of regulator of land relations and dynamic development of the private sector. Institutionalization of land relations should ensure the viability of the principles of administrative, fiscal or complex nature, which, respectively, should provide decentralization and democratic development of rural areas for rational land use of agricultural lands of enterprises in the field of crop production based on intensive production. At the same time, their purposeful development should be aimed at improving the efficiency of the use of land and resource potential, through additional investments, the use of new technologies, modern forms of organization of production and labor. However, in the conditions of transformation of land reform there is a decline in economic efficiency of intensification of agricultural production. This indicates a number of shortcomings in ensuring measures to reduce the cost of production per 1 hectare of agricultural land.

In this context, an important role in both strategic

and tactical terms is played by factors influencing the internal environment of agricultural enterprises, which are specific to agriculture. These are personnel, resources, technologies, economic mechanism, structure, business processes and products – as the results of management. The specificity of these factors for the efficient use of land and resource potential by agricultural enterprises is difficult to overestimate: soil fertility is the basis for harvesting; the number of sown areas rationally used is one of the sources of income. Effective use of agricultural land requires taking into account the impact of all factors and the degree of this impact on the technological, social and economic efficiency of the use of land and resource potential of agricultural enterprises of Ukraine demonstrate that the results of the three-dimensional coordinate model are rational because they represent not only the level of efficiency of the components, but also show a possible imbalance between them. This should be taken into account when developing imperatives to improve the efficiency of the use of land resources of agricultural enterprises in general.

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### **Імперативи ефективного використання земельного та ресурсного потенціалу сільськогосподарських підприємств України**

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**Анотація.** У статті розглянуто інституціоналізацію земельних відносин та імперативи ефективного використання земельного та ресурсного потенціалу сільськогосподарських підприємств України. У межах інституціоналізації земельних відносин обґрунтовано методичний підхід до комплексної оцінки ефективного використання земельного та ресурсного потенціалу сільськогосподарських підприємств шляхом визначення інтегрального показника ефективності (кількісних та якісних характеристик залучених ресурсів, продуктивності та ефективності) основних видів діяльності суб'єктів господарювання на землях сільськогосподарського призначення. Запропоновано показники прозорості оцінки земельного та ресурсного потенціалу та показники земельної політики відповідно до рівня їх використання у сільському господарстві. Представлені комплексні критерії оцінки складових ефективності використання земельних ресурсів та ресурсного потенціалу сільськогосподарських підприємств. Проаналізовано розмір орендної плати за земельні паї та обсяг внесення добрив на 1 га посівної площі сільськогосподарських підприємств України. Визначено виробничі можливості природних і потенційних врожаїв зернових і зернобобових культур (крім кукурудзи на зерно) в Україні. Нормативна грошова вартість 1 га ріллі в сільській місцевості розраховується в середньому за одним регіоном України з поправкою на природну врожайність зернових та зернобобових культур без урахування внесення добрив. Представлено прогнозний рівень технічної, соціальної та економічної ефективності використання земельного й ресурсного потенціалу сільськогосподарських підприємств

**Ключові слова:** земельний та ресурсний потенціал, земельні відносини, рента, врожайність, витрати, собівартість, дохід, рентабельність