ASSESSING THE ECONOMIC EFFICIENCY OF LAND USE

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Abstract. *This article analyzes the economic efficiency of land use across the regions of Uzbekistan. The study examines long-term data on the gross agricultural output per hectare and identifies regions with both high and low efficiency. In addition, international experience in wheat cultivation in Kazakhstan is reviewed. According to the findings, the highest efficiency was observed in the Andijan, Bukhara, and Navoi regions, while the lowest indicators were recorded in the Republic of Karakalpakstan and the Jizzakh region. The paper also provides recommendations for improving the effective use of land resources.*

Keywords: *land use efficiency, productivity, gross output, Uzbekistan, Kazakhstan, wheat, NDVI, economic efficiency.*
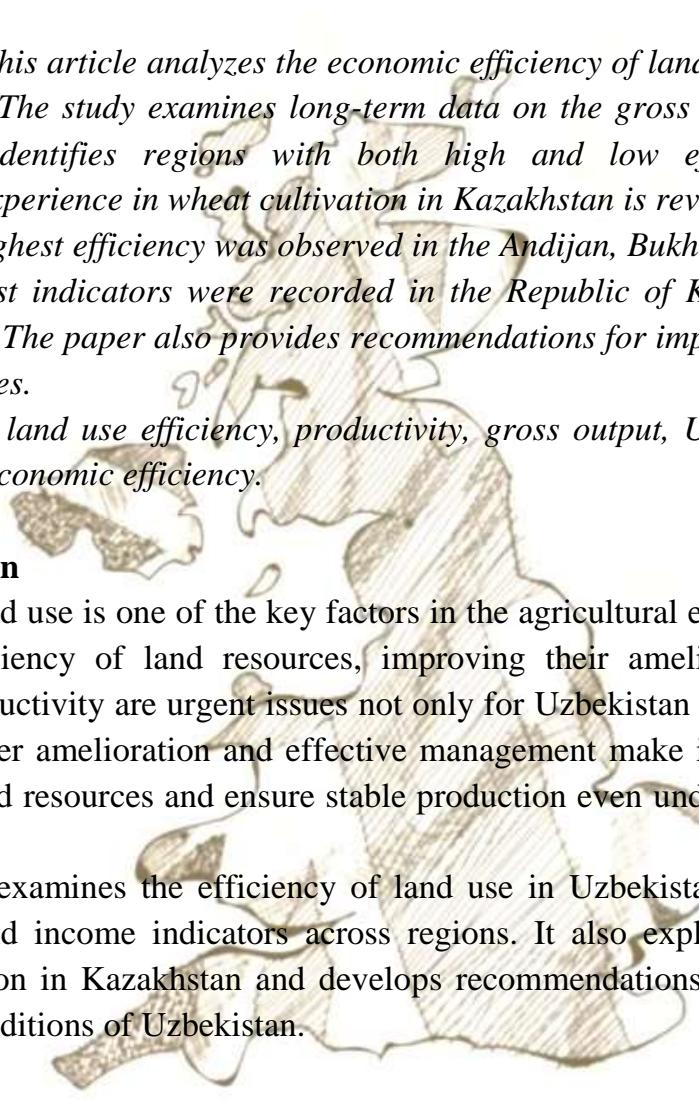
Introduction

Rational land use is one of the key factors in the agricultural economy. Increasing the economic efficiency of land resources, improving their ameliorative condition, and enhancing productivity are urgent issues not only for Uzbekistan but also for many other countries. Proper amelioration and effective management make it possible to maximize yields from land resources and ensure stable production even under unfavorable climatic conditions.

This study examines the efficiency of land use in Uzbekistan by analyzing annual productivity and income indicators across regions. It also explores the experience of wheat cultivation in Kazakhstan and develops recommendations that can be applied to the specific conditions of Uzbekistan.

Main Part

One of the key indicators in assessing the efficiency of land resource use is its ameliorative condition. Well-ameliorated lands can multiply crop yields, ensure stable production even under unfavorable climatic conditions, and create favorable opportunities for cultivating various crops.

In this regard, intensive land use — that is, obtaining higher income from the land during a single growing season — is considered crucial. For this purpose, it is necessary to assess how effectively arable land is utilized and to monitor this efficiency across different regions.

According to the 2023 data from the Food and Agriculture Organization (FAO) of the United Nations, the productivity of cotton and wheat in the Republic of Uzbekistan can be observed. In 2022, wheat productivity amounted to 4.97 tons per hectare, while cotton

productivity reached 2.9 tons per hectare, which corresponds to the global average levels. In this study, the indicators were first systematized, and comparative analysis methods were applied.

It is well known that increasing the productivity and efficiency of crops in agriculture is a complex task. Therefore, we studied several international experiences in cotton and wheat cultivation. These data are based on the reports published in August 2024 by the Foreign Agricultural Service, the U.S. Department of Agriculture, and Global Market Analysis, and include studies on wheat production in Kazakhstan.

Wheat Production in Kazakhstan

In the northern wheat-producing regions of Kazakhstan — including North Kazakhstan, Kostanay, and Akmola — abundant precipitation contributed to the development of crops, while the growing season was significantly above average this year. The Normalized Difference Vegetation Index (NDVI), derived from satellite imagery, indicates high productivity.

The NDVI is a widely used metric based on sensor data that assesses plant development and density.

Despite favorable climatic conditions, satellite-derived soil moisture data revealed that moisture in the upper soil layers was significantly above the average level.

According to the Republic of Kazakhstan's Hydrometeorological Service, the condition of spring cereal crops is very satisfactory. However, cases of stem drying, yellowing of lower leaves, and plant mortality have also been observed.

As a result of favorable weather conditions, the plant indicators significantly exceeded the average level. In other words, soil moisture had a positive effect on wheat productivity.

Systematization of Evaluation Indicators

The systematization of indicators for assessing the efficiency of land use has been carried out by a number of researchers. In particular, G.N. Kaletnik [5, pp. 17–23], S.A. Orel, V. Chudovskaya, N. Stupen, N. Makarenko, V. Voronenko, T. Koladiynskaya, and B. Sultonov recommend classifying the efficiency indicators of land use in agriculture into two groups:

Natural indicators and **Value indicators.**

Natural indicators reflect the natural productivity of agricultural land. For example:

crop yields, agricultural land area, arable land, hayfields, and pastures measured in feed units and digestible protein yield;

production of livestock products per unit of land area (cattle and sheep per unit of agricultural land, poultry products per unit of grain-sown area);

livestock density per unit of agricultural land, arable land, or cereal crops, and so on.

Value indicators of effective land use include:

1. Gross output — the monetary value of gross agricultural production per hectare.

2. Gross, net income and profit per hectare (which can be calculated for agricultural land, arable land, or a specific crop).

Additionally, the level of profitability achieved in land use reflects the return on current expenses, fixed assets, and working capital. The **efficiency indicator** is defined as the volume of gross agricultural output per unit of agricultural land.

The **productivity indicator** refers to the amount of crop production per unit area of sown land.

In this study, the average gross agricultural output per hectare across the regions of Uzbekistan was compared, and a long-term analysis was conducted (Figure 1).

(Figure 1)

Average income per hectare of land by regions during 2000–2022 (million UZS/ha)
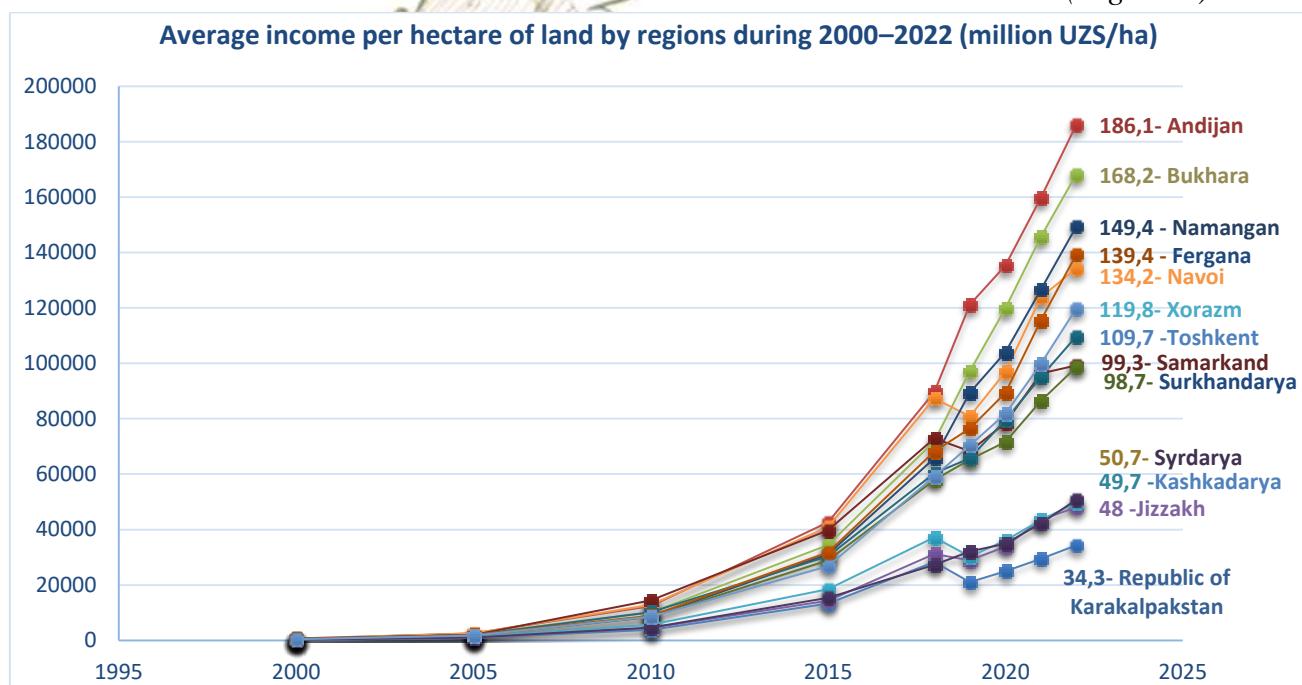
Comparative analysis methods were used in the study to identify trends in the efficiency of land use across the regions. The indicators were analyzed for the period from 2000 to 2022.

In 2000, the regions with the highest income per hectare were: Andijan — 642.5 thousand UZS, Namangan — 571.8 thousand UZS, Tashkent — 542 thousand UZS, Fergana — 492.8 thousand UZS. The regions with the lowest income were: Republic of Karakalpakstan — 109.1 thousand UZS, Jizzakh — 172.3 thousand UZS, Kashkadarya — 220.3 thousand UZS, and Syrdarya — 195 thousand UZS.

In 2005, the regions with the highest income were: Andijan — 2.5 million UZS, Navoi — 2.5 million UZS, Bukhara — 2.2 million UZS. The regions with the lowest income were: Republic of Karakalpakstan — 830.6 thousand UZS, Jizzakh — 873.3 thousand UZS, and Syrdarya — 988 thousand UZS.

In 2010, the regions with the highest income were: Samarkand — 14.4 million UZS, Navoi — 12.7 million UZS, Andijan — 12.3 million UZS. The regions with the lowest income were: Republic of Karakalpakstan — 3.7 million UZS, Jizzakh — 4.4 million UZS, Syrdarya — 4.6 million UZS, and Kashkadarya — 5.6 million UZS.

In 2015, the regions with the highest income were: Andijan — 42.6 million UZS, Navoi — 41 million UZS, Samarkand — 39.7 million UZS. The regions with the lowest income were: Republic of Karakalpakstan — 13.2 million UZS, Jizzakh — 14.3 million UZS, Syrdarya — 15.4 million UZS, and Kashkadarya — 18.4 million UZS.

In 2020, the regions with the highest income were: Andijan — 135.3 million UZS, Bukhara — 119.8 million UZS, Namangan — 104 million UZS. The regions with the lowest income were: Republic of Karakalpakstan — 25 million UZS, Jizzakh — 34 million UZS, Syrdarya — 35 million UZS, and Kashkadarya — 36 million UZS.

In 2022, the regions with the highest income were: Andijan — 186.1 million UZS (+37% compared to 2020), Bukhara — 168.2 million UZS (+40%), Namangan — 149.4 million UZS (+44%), Fergana — 139.4 million UZS (+56%), Navoi — 134.2 million UZS (+39%). The regions with the lowest income were: Republic of Karakalpakstan — 34.3 million UZS (+38%), Syrdarya — 50.7 million UZS (+45%), Jizzakh — 48 million UZS (+42%), and Kashkadarya — 49.7 million UZS (+38%).

According to the results of the study, the following can be concluded:

– In Navoi, Andijan, Bukhara, Namangan, Khorezm, and Fergana regions, the income per hectare has been the highest over the years, while in Samarkand, Surkhandarya, and Tashkent regions it has been average, and in the Republic of Karakalpakstan, Kashkadarya, Jizzakh, and Syrdarya regions the lowest results were recorded.

✓ The following recommendations are proposed for the rational and efficient use of land resources in the regions:

✓ Complete inventory of the land fund and deepen specialization by land categories with the involvement of relevant specialists;

✓ Placement of agricultural crops based on the soil and climatic conditions of each district, taking into account primarily the opinions of local specialists and producers;

✓ Strict adherence to crop rotation schedules in order to increase soil bonitet (quality) scores and productivity;

✓ Expanding the area of fodder crops in mountainous and foothill areas by widely introducing water-saving technologies to increase the volume of agricultural and livestock products;

✓ Specialization of low-productivity, unpromising cotton and grain farms—operating on low-bonitet lands—towards livestock and melon production;

✓ Establishment of orchards (almond, walnut, pistachio, etc.) on mountain slopes by introducing innovative water-saving technologies;

✓ Implementation of modern and intensive technologies in all types of agrotechnical measures;

✓ Promotion of sowing new, promising, export-oriented, and high-yielding varieties of crops.

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