PROSPECTS FOR INNOVATION AND INVESTMENT DEVELOPMENT OF AGRICULTURE ON THE BASIS OF REGIONAL PROGRAMS

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DOI : 10.67620/TIPUjournal.330003

ABSTRACT

The article analyzes the prospects for innovative and investment development of agriculture in the Surkhandarya region based on regional programs. The decoupling factor and the Environmental Kuznets Curve models were used. It was found that with an increase in investments, the growth rate of emissions decreased, and decoupling cases were observed in 2016 and 2021.

KEY WORDS

regional programs, agriculture, innovative development, investments, decoupling factor, Environmental Kuznets Curve, environmental pollution

ENTRANCE

In the process of building a new Uzbekistan, special importance is attached to the development of our country's regions. The Strategy of Actions for the Further Development of the Republic of Uzbekistan sets the tasks of "reducing the gap in the level of socio-economic development of regions by modernizing and diversifying the economies of regions, expanding their scale, and, first of all, accelerating the development of comparable districts and cities by increasing their industrial and export potential."[1]

the regions , a number of problems arise, among which the negative impact on the environment plays an important role. In this regard, the most important direction is the timely assessment and forecasting of the environmental consequences of sustainable development of agriculture in the region not only at the national level, but also at the local level. The state of the environment and public health are very relevant issues in the sustainable development of the region, and despite the emphasis on maintaining eco-intensive indicators at a standard level in

[1] Decree of the President of the Republic of Uzbekistan No. PF-6155 dated February 3, 2021 " On the State Program for the Implementation of the Strategy of Actions on Five Priority Areas of Development of the Republic of Uzbekistan in 2017-2021 in the "Year of Youth Support and Strengthening the Health of the Population" "Decree of the Supreme Council of the Republic of Kazakhstan, dated 04.02.2021, No. 06/21/6155/0082.

this area, the levels of certain types of pollution are increasing from year to year. This situation not only negatively affects the improvement of the living standards of the population, but also leads to a decrease in the sustainable development of agriculture in the region.

LITERATURE ANALYSIS

The theoretical and methodological foundations of innovations in agriculture are widely covered in foreign literature. A.I.Altukhov, V.M.Bautin, V.V.Butyrin, I.L.Vorotnikov, E.A.Derunova, B. A. Doronin, O.V. Mamai, R.N. Minnikhanov, E.E. Mojaev, V.N. Vinechaev, E.S.O. Globlin, V.G. Savenko, I.S. Sandu, J.A. Semina, I.G. Ushacheva and many other scientists studied in detail the specific features of scientific and technical progress and proposed approaches to the innovative development of agriculture, its state regulation, identified existing problems and proposed ways to improve it.

METHODOLOGY

The study assesses the prospects for innovative and investment development of agriculture in Surkhandarya region based on regional programs. For this purpose, the decoupling factor and Kuznets ecological curve (KECh) models are used to determine the relationship between economic growth and environmental pollution.

ANALYSIS AND ANALYSIS

To assess the relationship between economic growth and environmental pollution in the sustainable development of agriculture [2]based on regional programs, models are used that express the results of the analysis of the decoupling factor and the Kuznes ecological curve. The concept of “decoupling”, which determines the interaction of ecological and economic factors in the sustainable development of agriculture in the region, expresses the relationship between the harmful impact on the environment and the consumption of natural resources . In order to implement the decoupling effect, it is necessary that the growth rate of the environmental load has a decreasing trend compared to the economic growth rate in this period.

In a number of studies by foreign scientists, the decoupling factor (Dt) is estimated as the ratio of the level of environmental load to the gross agricultural product at the beginning and end of the period under study. If the coefficient value is less than one unit in the period under study, this indicates the presence of a decoupling effect, and if the value is greater than one unit, this indicates the presence of a relationship between the indicators. The decoupling factor (Dt) is determined

[2] **Kuznets S.** Economic growth and income inequality. *The American Economic Review* . 1955. Vol. 45, No. 1. P. 1–28.

according to the method of the Organization for Economic Cooperation and Development, and the ratio of the indicators is subtracted from one unit:

$$D_t = 1 - \frac{AY_t}{Q_t} \Big/ \frac{AY_{t-1}}{Q_{t-1}} (1)$$

where, AE is an indicator reflecting the adverse environmental impact (adverse yeffect), Q is an indicator reflecting the development of the economic system (quantity) (GDP, GRP, production volume, etc.).

If the value of D_t is zero or negative, the decoupling effect does not occur, and the positive value of D_t indicates the presence of the decoupling effect. In this case, the closer the calculated coefficient value is to unity, the lower the pressure of the regional economy on the environment. The decoupling factor is recognized as an important indicator in assessing economic and environmental policy and is widely used.

Increasing the competitiveness of the region Kuznes Environmental Curve (KEC) models are used to analyze the relationship between economic growth and environmental pollution. For this purpose , three types of models were used: linear, second-order, and third-order polynomial equations.

$$P = b_0 + b_1 Q + b_2 Q^2 + b_3 Q^3 \qquad (2)$$

where: P is an environmental indicator (pollution), Q is an indicator reflecting the level of development of the regional economy (quantity), b_0, b_1, b_2, b_3 - coefficients of the regression equation.

The following modification model was also used to test the KEECH hypothesis:

$$\ln(\mathrm{E}) = \beta_0 + \beta_1 \ln(\mathrm{Q})_{it} + \beta_2 \ln(\mathrm{Q})_{it}^2 + \beta_3 \ln I_t + \varepsilon_{it} (3)$$

where: E– emission of harmful substances (emission), I-investment, i, t– indices representing the object and time, b_0, b_1, b_2, b_3– coefficients of the regression equation, β_i, φ_t –single and time effects, ε_{it}– residual component. The volume of harmful substances emitted from stationary and mobile sources was taken as a general indicator of environmental pollution (Table 1).

Table 1

The volume of harmful substances emitted into the environment from stationary and mobile sources in Surkhandarya region in 2011-2025[3]

[3] Author's development based on data from the Surkhandarya regional statistics department

Years	Stationary sources and greenhouse gas from transportation gas h axis doer waste (thousand tons)	Total volume of agricultural products (annual) (billion soums)	**Q/X. Investment (billion soums)**
2011	3.3	2286.8	109.9
2012	4.4	4099.6	175.4
2013	3.7	4825.7	250.5
2014	5.8	5411.0	260.7
2015	3.1	6761.9	271.1
2016	3.2	8218.0	311.9
2017	3.2	8737.2	308.9
2018	5.1	11608.1	494.5
2019	6.9	15046.2	1019.2
2020	6.5	17844.1	1218.7
2021	7.1	19424.0	1177.4
2022	7.3	23415.5	1196.5
2023	7.4	26755.7	1084.7
2024	10.8	32849.3	1465.3
2025	11.2	35234.1	1586.5

In our research, we used (formula 1) We see that the environmental impact decreased compared to the previous year in 2016 and 2021, when the decoupling coefficient value was negative . In addition, it was found that the environmental load was at a high rate in 2017 and 2020. Compared to other years, the highest level of environmental pollution was observed in 2014 and 2024 (Figure 1).

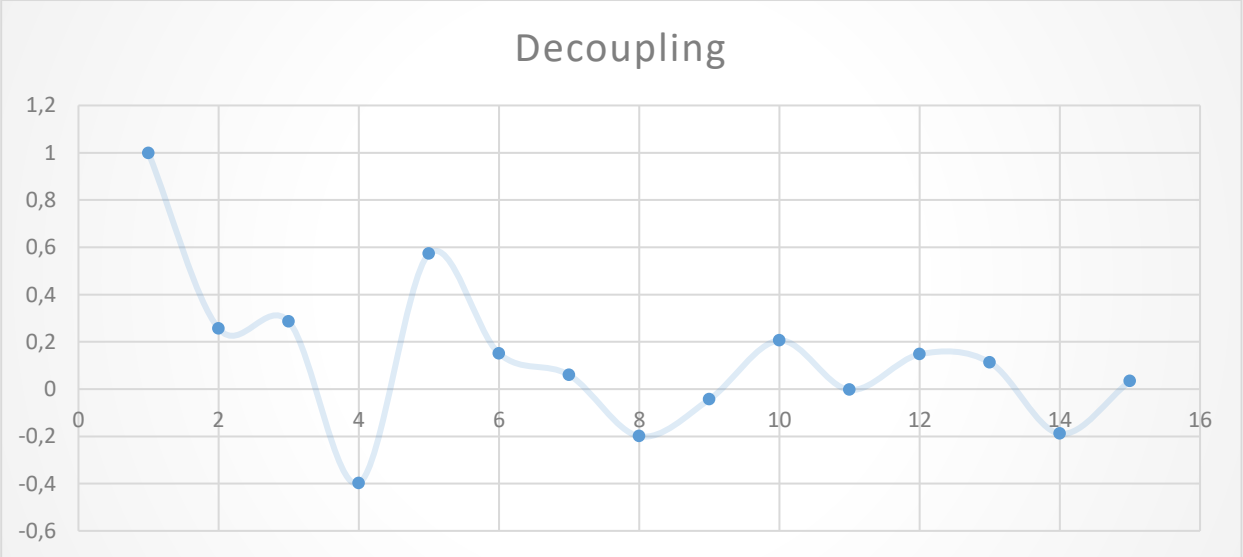


Figure 1. Dynamics of changes in the [4]decoupling coefficient for economic growth in agriculture and harmful substances emitted into the atmosphere from stationary and mobile sources in Surkhandarya regionin . 2025-2011

This study comprehensively analyzed the economic development of the agricultural sector and its impact on the environmental situation within the framework of regional programs. The analysis was based on the volume of

[4] Author development

greenhouse gases emitted from stationary sources and transport, the total volume of agricultural products, and indicators of investments directed to the sector for the period 2011–2025. The inclusion of the investment factor in the model further clarified the results of the study. According to the results obtained, investments have a negative impact on the environmental load, that is, with an increase in investments, the growth rate of emissions decreases. This indicates that investments in agriculture are mainly directed towards the introduction of modern, resource-saving and environmentally friendly technologies. Also, during the analysis, cases of decoupling were identified in 2016 and 2021, when, although economic growth continued in these years, the environmental load relatively slowed down or decreased. This situation shows that innovative approaches within regional programs are beginning to yield practical results.

The relationship between agricultural production and environmental pollution in the Surkhandarya region of the Kyrgyz Republic was studied using linear, second- and third-order polynomial functions (Figures 2 and 3).

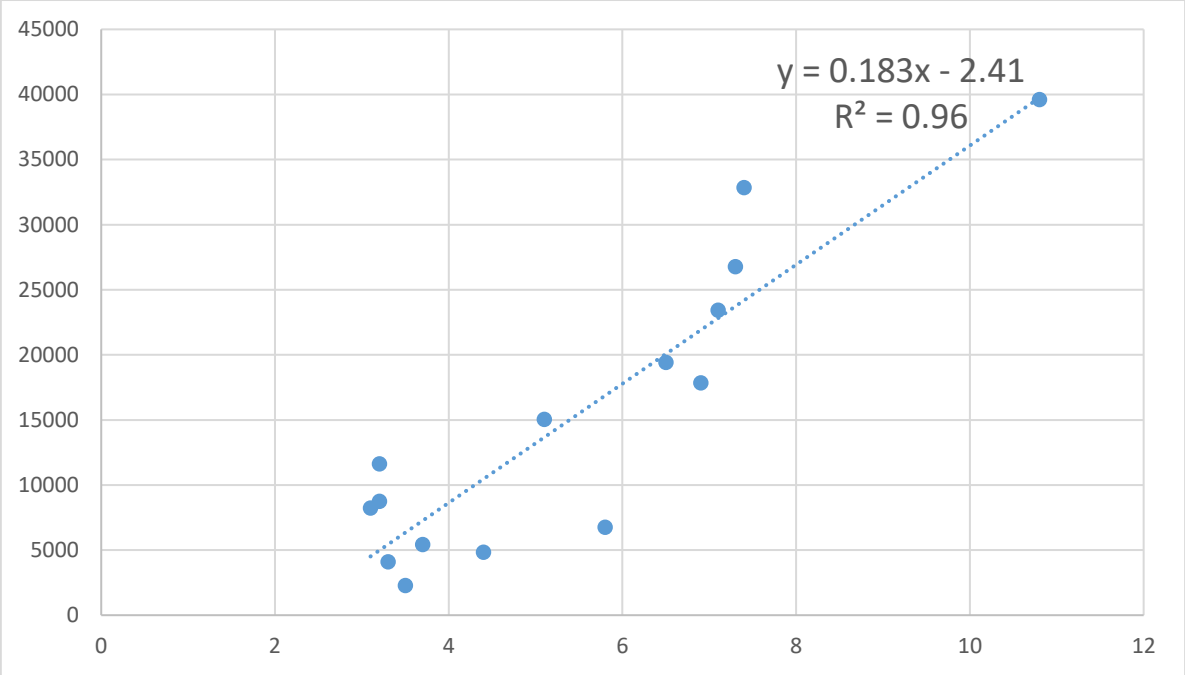


Figure 2. Agricultural production of the KEECH by linear function and environmental pollution changes[5]

Based on the regression equation constructed based on a linear function, it was determined that the share of agricultural production in the composition of the environmental indicator is 96.83 percent, and the share of other factors is 3.17 percent.

[5]Source: author's development

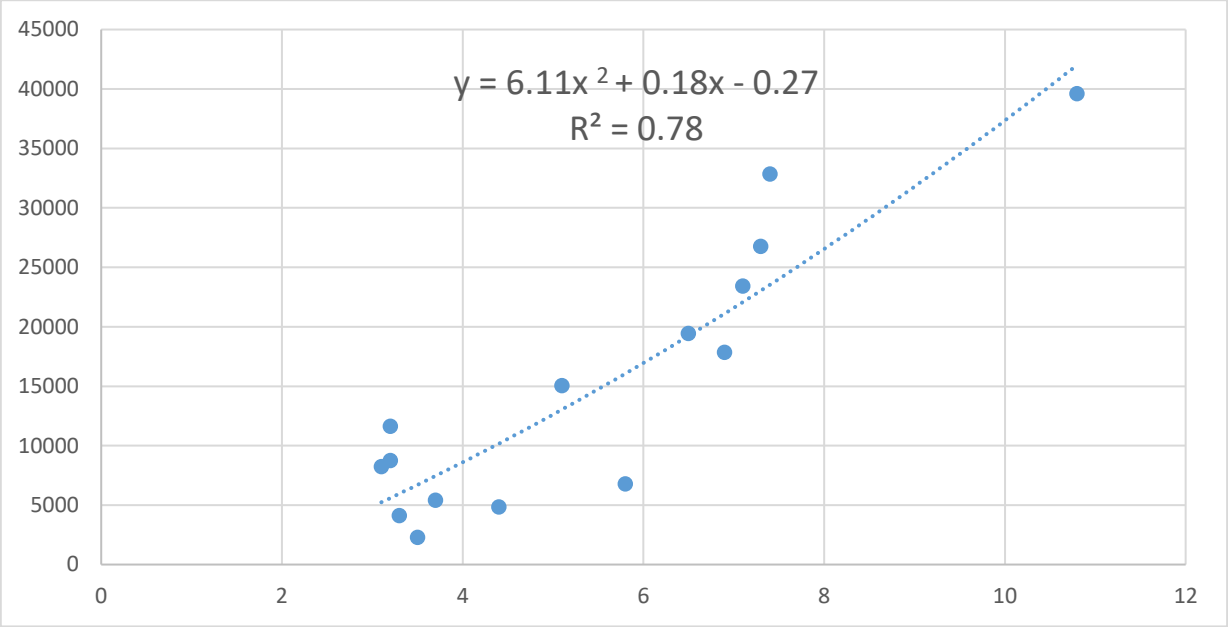


Figure 3. Variation of the relationship between agricultural production and environmental pollution of the KEECH by a second-order polynomial function[6]

Based on the regression equation constructed based on a second-order polynomial function, the share of GRP in the composition of the environmental indicator was 78.52 percent, and the share of other factors was 21.48 percent.

it was found that the correlation between the level of environmental pollution and the level of agricultural production in Surkhandarya region is very high, and the share of other factors not included in the model is very low. This, in turn, requires replacing the environmentally friendly production and service system with environmentally friendly innovative technologies in the process of increasing agricultural production , and the application of smart blockchain technologies and electronic platforms to ecological processes. In addition, it is advisable to analyze the share of factors not included in the model in addition to agricultural production in ecological studies , and to conduct research to reduce the impact of these factors.

CONCLUSION

On this basis, the following priority areas are proposed for the sustainable development of agriculture:

1. Expand the introduction of environmentally friendly agricultural technologies;

2. directing investments based on the principles of the "green economy";

3. promote the efficient use of water and land resources;

4. Enrich regional programs with an innovative component.

[6] Author development

As a result, not only the economic efficiency of the agricultural sector, but also the environmental sustainability is ensured.

On this basis, for the sustainable development of agriculture, the ecological orientation of investments, the widespread introduction of innovative technologies, and the improvement of mechanisms for the efficient use of resources should be considered a priority.

LIST OF REFERENCES USED

1. Decree of the President of the Republic of Uzbekistan No. PF-6155 dated February 3, 2021 " On the State Program for the Implementation of the Strategy of Actions on Five Priority Areas of Development of the Republic of Uzbekistan in 2017-2021 in the "Year of Youth Support and Strengthening the Health of the Population" "_Decree of the Supreme Council of the Republic of Kazakhstan, dated 04.02.2021, No. 06/21/6155/0082.
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