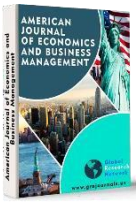

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Article

Evaluation of Efficiency of Innovations in Agriculture

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Abstract: This article examines the assessment of the effectiveness of innovations in agriculture and the influencing factors. In the article, a review of the scientific literature on innovation performance indicators and influencing factors is carried out. In the analysis, the results obtained from the introduction of water-saving technologies and the mechanism of innovation promotion were analyzed. On the basis of the analyzes carried out, appropriate conclusions were formed regarding the improvement of the efficiency of innovations.

Keywords: Agriculture, Innovation, Innovative Activity, Technology, Efficiency, Profitability, Resources

1. Introduction

At the current stage of agricultural market development, economic growth is mainly ensured by innovative activity, which is associated with increased competition both in the domestic and world markets. Innovative development of agriculture, in particular, is inextricably linked with the strengthening and deepening of the integration between science and production, mechanisms for organizational and economic stimulation and state support of innovative activity. Of course, it is important that innovative development in agriculture is carried out on the basis of an appropriate innovation model, taking into account regional characteristics. There are many approaches to defining the concept of innovation. From a brief analysis of the economic literature, it can be said that, in general, the innovation process consists of obtaining and commercializing new technologies, types of products and services, production, financial, administrative or other solutions, and other results of intellectual activity [1]. The innovation process in agriculture is a constant and continuous flow of certain technical or technological ideas based on scientific developments, their direct application in production and their transformation into new technologies (or individual components) in order to obtain qualitatively new products [2].

The decisive factor for the effective development of innovative activities in agriculture is the correct development of new approaches using innovative developments. Competitive, sustainable and predictable development in the development trends of agriculture is possible only if it moves towards the path of innovative development [3]. The long-term experience of economically developed countries shows that the efficiency of innovative activities and the level of involvement of producers in the innovation process largely determines the success of entering the world agricultural market and the competitiveness of agricultural producers.

Literature review

The innovative process in agriculture has a number of features, in particular [4]:

1. The diversity of agricultural products, significant differences in the technology of their cultivation and production;

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2. The close relationship between the technologies used in agriculture and natural and climatic conditions;
3. Differences in the duration of the production cycle of agricultural products;
4. A high level of territorial differentiation of agricultural production;
5. The separation of agricultural producers from organizations producing scientific and technical products;
6. The variety of forms and connections of agricultural producers with innovative structures;
7. The absence of a clear and scientifically based organizational and economic mechanism for applying scientific achievements to agricultural production;
8. The lag of the sector compared to industrial production in the introduction and use of innovations in production.

In the conditions of competitive market competition, increased business risks, as well as the periodic occurrence of crisis economic events, the problem of ensuring the economic efficiency of agricultural enterprises is becoming increasingly acute. Economic efficiency is a multifaceted category of economics, which penetrates all sectors of the country's economy and serves as the basis for creating criteria for assessing the value of decisions made. Modern economic conditions require the creation of an uncompromising definition of economic efficiency that corresponds to the stable and dynamic state of the enterprise, as well as taking into account the closeness of its relations with other entities [6]. The application of the results of scientific and technical progress in agricultural production is expedient only if the main problem of increasing labor productivity and profitability of production funds is solved. An important component of the process of introducing high-efficiency innovations into agricultural activities is a theoretical understanding of the essence of this phenomenon, which should be considered separately and in conjunction with other circumstances [5]. The efficiency of agricultural production depends on a number of factors: biological, technical and technological, social, and others. The efficiency of agricultural production is understood as the effective use of all its resources, which are factors of production, such as land, capital, labor, and entrepreneurial activity [7]. A system of natural and value indicators is used to assess the economic efficiency of agricultural production. Natural indicators include: crop productivity, livestock productivity. Increasing these indicators is one of the main tasks of agriculture, and to determine economic efficiency, it is necessary to know the total labor costs that ensure an increase in productivity and yield. The same level of productivity or productivity can be achieved with different labor costs and production capacities. The volume of products produced is converted into a value form to assess the comparative costs of material resources and monetary funds and the results of production [8].

In the current conditions, innovative activity is the main factor in the development of agriculture. The maximum use of this factor is the only way to ensure the sustainable development of the agro-industrial complex in our country. In the conditions of accelerating socio-economic changes and increasing globalization of the world economy, our country needs to make a rapid transition to the innovative path of agricultural development in the short term, to develop this strategically important sector of the economy on a qualitatively new technical and technological basis that meets the requirements of the times. Otherwise, the agricultural sector will lag behind in development and will not be able to ensure its competitiveness. The effectiveness of the introduction of innovation in the agricultural sector depends on the specifics of the sector, and innovation in agriculture requires the improvement of not only equipment and technologies, but also agrotechnical processes [9]. The development and implementation of targeted programs for the innovative development of agriculture, the promotion of scientific research and the introduction of innovative technologies provide an opportunity to increase efficiency. In recent years, certain measures have been taken to increase the efficiency of scientific research activities in agriculture, the widespread introduction of advanced technologies and scientific achievements, the organization of services related to the dissemination of knowledge and the introduction of innovations in the agricultural sector. As a result of the reforms being carried out in the field of science, new varieties of

plants adapted to the soil and climatic conditions of the regions and allowing the production of export-oriented products, resource-saving intensive agrotechnologies for crop cultivation and production are being consistently implemented in practice. The state order in the production of agricultural products has been abolished, and market principles and new financing mechanisms have been introduced in the sector. Modern forms of economic management, including clusters and cooperatives, are being organized, measures are being taken to create an added value chain by expanding the storage, processing, and logistics system of agricultural products [10].

2. Materials and Methods

In the article, the concept of efficiency of innovations in agriculture and the assessment of innovation efficiency and the review of scientific literature on the factors affecting it were carried out. The methods of scientific abstraction, analysis and synthesis, induction and deduction, and comparative analysis were used to evaluate the effectiveness of innovations in agriculture.

3. Results and Discussion

In modern conditions, the effective development of agriculture requires the constant introduction of new technologies, the improvement of economic relations between producers and consumers of scientific products, the formation of a policy for the development of the agro-industrial complex, which should be based on the basic rules of the country's economy's transition to an innovative path of development. Innovations are always associated with the demand for innovations and the availability of investment potential in a given situation. Under the influence of innovations, the structure of the economy changes. After all, optimization of the use of production resources occurs as a result of increasing the efficiency of innovations, and part of the resources is economized and redistributed to other areas of activity.

It is aimed at further deepening the integration of education, science, innovative activities and production in agriculture, creating and applying new knowledge, introducing resource-saving innovative technologies, advanced foreign and domestic scientific achievements, training specialists with modern knowledge and skills, and developing the system of providing agricultural services, and includes the following priority areas:

Improvement of the agricultural education system aimed at developing human capital in line with changing labor market conditions;

Further development of scientific and innovative activities of scientific institutions in the agro-industrial complex;

Development of the agro-services network operating on the basis of an information and advisory system for entities engaged in the production, storage and processing of agricultural products.

In particular, there are 6 sectoral centers for retraining and advanced training of specialists and teaching staff in the agricultural sector, where 28 (41 in total) employees work. For information: There are 2 centers at Tashkent State Agricultural University, 2 at Samarkand Veterinary University, 1 at the International Agricultural University, and 1 at the Institute of Food Engineering and Technology. In the development of innovative activities in agriculture, it is important to widely introduce resource-saving technologies into agricultural production, primarily modern agricultural technologies that save water and resources, and to expand research and development work to create and introduce into production new high-yielding varieties of agricultural crops that are resistant to diseases and pests, adapted to local soil, climate and environmental conditions, and new breeding breeds. In particular, the main part of the subsidies allocated from the state budget in 2024 is allocated to financial support for the development of innovations, see Table 1.

Table 1. Subsidies allocated from the state budget in 2024, billion soums.

Total subsidies allocated	**311,2**
Including:	
Water-saving technologies	119,7
To cover 50% of electricity	113,5
Increase the amount of gum	52,3
Ground leveling units with laser device	8,0
Productive breeding stock imported from foreign countries	17,7
To purchase renewable energy equipment	0,1

It is clear that due to problems with water resources, today a large amount of money is being allocated to finance the widespread introduction of modern agricultural technologies that save water resources in agriculture. Analysis of the effectiveness of the introduction of innovative technologies has shown that compared to traditional irrigation technology, drip irrigation saves a lot of material and labor resources, and due to the high level of moisture reaching the root system of plants and the complete assimilation of fertilizers, productivity has increased by at least 35-45 percent.

It was found that the consumption of mineral fertilizers per 1 ha of crop area in farms is 119.4 thousand soums less than in the case of conventional irrigation, and fuel and lubricants are 626.9 thousand soums less than in the case of conventional irrigation, and the cost of mechanization services is also 567.1 thousand soums less than in the case of conventional irrigation, see Table 2.

Table 2. Analysis of the effectiveness of introducing drip irrigation technology on 1 hectare of cotton field in the farm, thousand soums [11].

Indicators	**In the traditional way**	**By drip irrigation**	**Difference (+,-)**
Seed costs	268,6	268,6	
Consumption of fuel and lubricants	1231,3	604,5	-119,4
Costs of mechanization services	1582,1	1015,0	-567,1
Labor costs	3097,0	4567,2	+1470,2
other expenses	835,0	835,0	
Total production costs	9200,6	9357,5	+22,1
Total investment in drip irrigation		19604,4	
One year's cost (with a payback in 5 years)		3920,9	
General expenses	9200,6	13278,4	
Productivity centner/hectare	29	45	+16
Income from 1 hectare	9425	14625	+5200
Profit	224,4	1346,6	+1302,1
Profitability, %	2,4	10,1	+7,7

Due to the fact that in drip irrigation technology, moisture reaches the cotton root system in sufficient quantities along with fertilizers and the level of mineral fertilizer absorption is 50-60 percent higher, the yield is 16 centners higher than in the case of conventional irrigation. Despite the higher cost per 1 ha in drip irrigation, the income and profit received are 1.5 times higher than in the case of conventional irrigation, which also leads to a higher level of profitability. That is, if the rate of profitability was 2.4 percent in the normal irrigation method, this indicator was 10.1 percent in the drip irrigation method. In order to increase the effectiveness of innovations in agriculture, the directions of development and implementation of effective incentive mechanisms by the state in the financial and credit, tax, customs and insurance sectors are mentioned, see Table 3.

Table 3. Directions of state support in increasing the efficiency of innovations in agriculture.

Support directions	Content of recommended activities
In the field of financing and lending	Allocation of grants for innovative fundamental, practical and technical projects; Allocation of preferential bank loans for the introduction of innovative technologies; Development of a mechanism for allocating low-interest preferential loans for innovative technologies (water-saving technologies, technologies that increase land productivity, etc.)
In the direction of taxation	Use of tax holidays and tax deductions to encourage innovative activity; Providing differentiated and temporary tax benefits based on innovative efficiency.
In the direction of subsidies	Introduction of a mechanism for subsidizing innovation costs up to 50% from the state budget based on economic, social and environmental performance indicators; Introduction of effective mechanisms for subsidizing the activities of biotechnology, breeding, breeding, implementation of digital technologies, etc.
In the field of insurance	Insurance of risks related to the introduction of innovations; Covering 50 percent of innovation-related insurance costs from the budget.

A distinctive feature of the modern era of innovative development of all branches and fields of agriculture is the need to accelerate scientific and technical progress on the basis of innovative processes that allow continuous renewal of production based on the development of science, technology and best practices. World experience shows that the efficiency of innovations in agriculture is regulated by the evaluation of economic, social and environmental indicators, and by the formulation of appropriate policies by the state and the systematic organization of innovative activities.

4. Conclusion

Methodological approaches to assessing the economic efficiency of various technologies in agriculture allow for a comparative assessment with the standard and the selection of production methods that simultaneously increase productivity and productivity. In modern conditions, the problem of increasing the efficiency of innovative activities and their components, in particular, predicting their impact on the level of development of agricultural production, comes to the fore. In this regard, there is a need to deepen the theoretical study of the mechanism of managing innovative processes in agriculture. It should be emphasized that changing the forms of activity and development of innovations, scientific and financial support for agriculture involves clarifying and further developing methodological foundations and practical recommendations for the development and implementation of innovative processes, and assessing their effectiveness. It is advisable to encourage the expansion of the use of resource-saving technologies in agriculture by increasing the volume of preferential loans and subsidies allocated to them. Financing on the basis of such benefits is one of the main incentive mechanisms for the introduction of resource-efficient technologies and increasing their efficiency.

It is necessary to encourage the widespread introduction of resource-saving innovative technologies in the production of agricultural products and to ensure their effectiveness, targeted tax incentives should be used and the insurance system should be implemented.

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