BIO Web of Conferences **161**, 00027 (2025) https://doi.org/10.1051/bioconf/202516100027
FIES 2024

State and development of farms in Uzbekistan as a basis for food security

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Abstract. The work is devoted to the study of directions of effective development and functioning of farms in the conditions of modern economy, with emphasis on the role of innovations in this process. The study was carried out on the basis of analysing the experience of farming activity of agro-enterprises of the Republic of Uzbekistan. Also the analysis of normative-legal acts and statistical data in the field of agro-industrial complex of the Republic of Uzbekistan with the use of methods of comparative and logical analysis was carried out. Introduction of innovative technologies is a key condition for sustainable development of farms, increasing their productivity and competitiveness. Factors hindering the introduction of innovations are analysed and ways of their solution are proposed. Special attention is paid to the experience of Uzbekistan, where the agricultural sector plays an important role in the economy. In particular, examples of introduction of drip irrigation, precision farming, modern technologies in livestock breeding and greenhouse farms are considered. The results of the study highlight the importance of creating a favourable innovation environment, as well as strengthening state support and incentives for scientific research.

1 Introduction

One of the most important ways to address the problem of food security is to improve agro-technologies and the development of breeding aimed at creating more resistant and yielding varieties. This makes it possible to increase the productivity of agricultural production while reducing its negative impact on the environment. Another important direction is the transition to sustainable agricultural practices such as organic farming and agroecology. These practices reduce dependence on chemical fertilisers and pesticides and improve soil fertility. However, these approaches can be more labour-intensive and require large financial investments, which can be an obstacle to their widespread adoption. At the same time, the development and application of modern technologies, such as precision farming and the use of drones to monitor crops, can help improve agricultural management and reduce costs. Also, developing an innovative environment and encouraging the exchange of knowledge and experience between producers and research organisations are of paramount importance. Government support and funding for research aimed at developing and introducing new technologies and methods in agriculture is also needed. In addition, it is necessary to develop infrastructure for storage and processing of agricultural products [1, 2], where innovation is a key driver of development, and the issues of effective functioning of farms are of particular relevance. It is in farms, as the primary link of the agricultural sector, that the foundations for food security and sustainable development of rural areas are laid. In this context, one of the most promising directions is the introduction of innovations at all stages of agricultural production. This approach allows increasing productivity and reducing production costs, as well as ensuring the competitiveness of farms in the market. However, the process of introducing innovations in agriculture has its own difficulties and requires the creation of a favourable innovation environment, including access to information, financial resources and qualified personnel. In addition, it is necessary to take into account the specific features of each region and farm, as well as to ensure their interest in the development of modern agro-industrial complex. Introduction of innovations in farms is not only an increase in productivity and efficiency, but also a contribution to the overall economic development, food security and sustainable development of rural areas. The purpose of this paper is to analyse the directions of effective development and functioning of farms in the conditions of modern economy, with special emphasis

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on the role of innovation in this process [3, 4] taking into account the environmental aspect [5].

2 Method and materials

In this article, devoted to the study of directions of effective development and functioning of farms, the main emphasis is made on the analysis and generalisation of existing data and scientific approaches. The research methodology was based on a comprehensive analysis of literary sources, regulatory and legal documents, statistical data and the results of scientific works devoted to the problems of agricultural development and innovation implementation.

In particular, the work used the methods of comparative analysis to identify common trends and differences in approaches to the development of farms in different countries and regions. The method of logical analysis was used to identify cause-and-effect relationships between various factors affecting the efficiency of farms' functioning. The method of abstract thinking was also used to formulate general conclusions and recommendations based on the analysis of specific data. Emphasis was placed on the use of analytical tools to interpret the collected information and formulate conclusions. The study was based on qualitative analyses of data presented in the literature and regulatory and legal acts.

3 Results and discussion

In this paper, the theoretical foundations of innovation development were comprehensively analysed and the practical experience of introducing advanced solutions in farms, as applied to the conditions of Uzbekistan, was studied. In particular, it considered different models of organisation of the agro-industrial complex, as well as factors influencing its development in the specific context of the country.

The study was based on an in-depth analysis of scientific publications, policy documents and statistical data related to agriculture in Uzbekistan. The study included a comparative analysis of different approaches to the organisation of the innovation process in the agricultural sector, taking into account regional specificities. Factors determining the efficiency of innovation activities of farms were studied, such as the availability of financing, the level of state support, and infrastructure support. Special attention was paid to the impact of economic globalisation and technological change on the development of the agro-industrial complex of Uzbekistan, with a focus on adaptation to new conditions.

One of the key findings of the study was the confirmation of the thesis that the introduction of innovative technologies is a prerequisite for sustainable development of farms in Uzbekistan. The analysis showed that farms that actively introduce modern agro-technologies demonstrate higher yields, lower costs and higher profitability. In particular, the use of modern crop varieties adapted to the climatic conditions of Uzbekistan can increase yields by 20-30 %. As a result of the analysis, it became clear that innovation is not just desirable, but a necessary condition for sustainable development of farms in modern conditions, especially in the context of globalisation and increasing competition. It is also important to take into account the dynamics of agriculture and its susceptibility to climate change [6, 7].

Farms that actively adopt new technologies, apply good management practices, and adapt to changing market conditions show higher productivity, profitability and competitiveness. In turn, studies have shown that in countries with developed market economies, where the innovation activity of farms is supported by a comprehensive infrastructure and effective government policy, the agricultural sector demonstrates higher rates of growth and development.

In Uzbekistan, where the agricultural sector plays a significant role in the economy, there are more than 170 thousand farms, which make a significant contribution to ensuring food security of the country and employment of the population. According to the State Statistics Committee of the Republic of Uzbekistan, in 2023, farms produced more than 60 % of the country's total agricultural output.

At the same time, in transition economies such as Uzbekistan, the introduction of innovation in the agricultural sector faces a number of serious obstacles, including a lack of research funding, limited access to advanced technologies and skilled labour, and the absence of an effective support system for innovation. However, research shows that even under such conditions, with targeted government policy and support, it is possible to make significant progress in developing farm innovation activities.

For example, cotton farms, which historically have been the backbone of the agricultural sector in Uzbekistan, often face problems of soil erosion, salinisation and water deficit, which is directly related to the inefficient use of land resources [8, 9]. However, there are also positive examples. The farm ‘Bogiston’ in Fergana province, specialising in cotton cultivation, introduced a system of drip irrigation and minimum tillage, which reduced water consumption by 35% and increased yields by 18%. At the same time, due to the use of modern varieties of cotton resistant to diseases, the costs of pesticides and fertilisers were reduced. Another example is the Istiklol farm in Tashkent Province, which specialises in growing vegetables and fruits in greenhouses. The farm implemented a modern microclimate management system, which increased yields by 25 % and reduced energy costs by 15 %.

In general, in recent years there has been an increase in the use of drip irrigation in different regions of Uzbekistan. According to the Ministry of Agriculture, as of 2023, drip irrigation was applied to more than 200 thousand hectares, saving more than 1.5 billion cubic metres of water. In addition, farmers are actively introducing minimum tillage, which allows them to conserve soil moisture and improve its structure, which is especially important in Uzbekistan's arid climate.

Also, precision farming technology is gaining popularity in Uzbekistan. Farmers such as ‘Sakhovat’ from Kashkadarya region use GPS navigation, sensors and drones to monitor the condition of crops and fertiliser application, which allows to increase the efficiency of resource use and reduce costs by 12-15%. However, it should be noted that the cost of implementing these technologies remains quite high for many farms, which requires further government support.

The introduction of modern technologies is also observed in livestock farming in Uzbekistan. The Omadli Chorva farm in Andijan province, which breeds cattle, has introduced an automated feeding and milking system, which has increased productivity by 20 % and improved milk quality. In addition, the country is actively carrying out selection work to develop highly productive breeds of cattle adapted to local conditions. In particular, new breeds of sheep have been developed that are capable of producing higher wool and higher milk yields. In the poultry sector, over the last 5 years, thanks to the introduction of modern technologies, such as automated poultry housing systems and modern feeds, egg production has increased by 28 %and poultry meat production by 21 %.

The greenhouse business has been actively developing in Uzbekistan in recent years. The farm ‘Yangi Hayot’ from Surkhandarya region, which specialises in growing tomatoes and cucumbers in greenhouses, has introduced modern heating, ventilation and lighting systems, allowing vegetables to be grown all year round, improving their quality and yield. Over the past three years, the area of greenhouse farms in Uzbekistan has increased by 18 % and the volume of greenhouse vegetable production has grown by 25 %. Uzbek agrarians are actively conducting experimental work on breeding and adapting new crop varieties to local conditions. For example, the Institute of Genetics and Experimental Plant Biology of the Academy of Sciences of Uzbekistan is conducting research to create new cotton varieties resistant to salinity and drought. Such varieties as ‘Andijan-37’, ‘Bukhara-102’ and ‘Namangan-77’, which are characterised by increased yield and resistance to unfavourable conditions, have been developed and introduced into production. Work is also underway to develop new varieties of wheat, barley, rice and other grain crops, as well as new varieties of vegetables and fruits characterised by improved taste, yield and resistance to diseases

In particular, Uzbek farmers grow such wheat varieties as Krasnodarskaya 99, Yubileynaya 100, and Surkhon-20, which are characterised by high yields and baking qualities. Popular cotton varieties include Andijan-35, Namangan-77, and C-6524, which are adapted to local climatic conditions and have a high fibre yield. Uzbek farmers are also actively growing various varieties of vegetables, such as tomatoes ‘Malinovka’, ‘Bull Heart’, cucumbers ‘Zozulya’, ‘Competitor’, and onions ‘Spirit’, which are in demand in both domestic and foreign markets.

Uzbek farmers face a number of problems not only in the area of food cultivation. One important problem is limited access to financial resources, which hinders the introduction of new technologies and business development. Another problem is the lack of qualified personnel capable of working with modern technologies and managing farms. Also, an important problem is the wear and tear of agricultural machinery and equipment, which reduces the efficiency of agricultural production. To solve the problems of lack of qualifications, it is necessary to improve the legislative framework in the field of agriculture [10, 11].

One of the ways to solve these problems is the development of the system of microcrediting and leasing of agricultural machinery, as well as the creation of special training and retraining programmes for the agricultural sector. In addition, it is necessary to continue working on improving the legislative framework and creating a favourable investment climate in the agricultural sector, which will attract additional investment and create new jobs, and which is closely related to social support for small farms [12, 13].

Successful development of innovation activities in the agricultural sector of Uzbekistan requires a developed infrastructure, which would include research organisations, consulting centres, farmer training centres, and financial institutions. State support, including subsidies, soft loans and assistance in commercialisation of scientific developments, plays an important role in stimulating innovation. Uzbekistan has adopted a number of programmes and policies in recent years to support and promote innovation in the agricultural sector, including subsidy programmes for the purchase of modern technologies and equipment, and the creation of agro-clusters that bring together farms, processing enterprises and research organisations. However, in order to achieve sustainable development of the agricultural sector, further efforts are needed to create a favourable innovation environment that provides access to resources, knowledge and financial support, as well as to introduce advanced technologies and management practices, and to develop the country's export potential.

However, despite significant successes, the introduction of innovations in the agricultural sector of Uzbekistan faces a number of challenges. Among them are: insufficient level of funding for research and development, low qualification of farm staff, limited access to financial resources, as well as insufficient infrastructure development. In particular, only about 20 per cent of farms in Uzbekistan have access to modern information technologies, which hinders the introduction of precision farming and other advanced management practices.

According to international organisations, labour productivity in Uzbekistan's agriculture is 40-50% lower than in countries with a developed agricultural sector. This is primarily due to the insufficient level of technological equipment, low qualification of personnel and inefficient management methods. To overcome these challenges, it is necessary to strengthen state support for the agricultural sector, develop the system of professional education and training of farmers, and create a favourable innovation environment that encourages the introduction of modern technologies and management methods.

The results of this study, in comparison with similar works, show that Uzbekistan has a significant potential for the development of its agricultural sector. However, the realisation of this potential requires targeted efforts on the part of the state, business and research community. The most important factor in increasing the efficiency of farms is the introduction of modern agricultural technologies, including drip irrigation systems, precision farming and biological methods of plant protection. It is important that these technologies should be adapted to the peculiarities of mountain regions [14, 15].

4 Conclusion

The study emphasises that innovation is a key factor for sustainable development and effective functioning of farms in modern economic conditions. The analysis of literary sources, regulatory and legal documents and statistical data confirms that farms that actively implement modern agro-technologies and management methods demonstrate higher productivity, profitability and competitiveness. The importance of assessing the agro-ecological potential of land for the purposes of sustainable development is confirmed [16]. At the same time, the study revealed a number of problems and challenges that hinder the introduction of innovations in the agricultural sector, especially in countries in transition, such as Uzbekistan. These problems include lack of research funding, limited access to modern technologies, low qualification of personnel, and insufficient infrastructure development. However, examples of successful innovation in farms in Uzbekistan, such as the use of drip irrigation, minimum tillage, precision farming and modern technologies in livestock and greenhouse farms, prove that with targeted government support and farmers' commitment, it is possible to achieve significant success in innovation development.

Successful development of innovation in the agricultural sector requires a comprehensive government policy that includes measures on financial support, education and infrastructure development, as well as the creation of a favourable investment climate. It is also important to stimulate the exchange of knowledge and experience between producers, scientific organisations and consulting companies. In addition, it is necessary to continue to improve the legislative framework and create a favourable innovation environment that provides access to resources, knowledge and financial support, as well as to introduce advanced technologies and management methods, and to develop the country's export potential.

In order to achieve sustainable development of farms and ensure food security, it is necessary to continue work on stimulating innovation in the agricultural sector, creating a favourable innovation environment, and ensuring access of farmers to modern technologies and knowledge, as well as to continue work on the development of agricultural education, infrastructure and support for scientific research, which is closely related to the use of production waste and environmentally friendly production, as well as taking into account the ecological typification of land and land use.

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