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Introduction of Innovations and Improvement of Their Efficiency in the Samarkand Agro-Industrial Complex

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Abstract: *The article considers the main directions of innovative development of the agro-industrial complex of the Samarkand region and substantiates some intersectoral differences in innovative development. We analyzed statistical indicators reflecting the development of this industry in Samarkand, and showed that the volume of losses in agricultural science increases mainly due to technological innovations. The article also presents relevant conclusions and suggestions for their solution along with the study of existing problems.*

Keywords: *Innovative development, agro-industrial complex, knowledge intensity, utility models.*

Introduction. In the framework of the new Uzbekistan development strategy for 2022 – 2026: to increase the income of dexkans and farmers at least 2 times through the intensive development of Agriculture on a scientific basis, to increase the annual growth of agriculture by at least 5%; to implement a separate state feed program for the radical islox of the water resource management system and water economy; to expand; by proportional development of the regions, it is established to increase the foreign economy by 1.4-1.6 times; development of fruit and vegetable production, increasing the area of intensive Gardens by 3 times and greenhouses by 2 times, increasing export sales by 1 billion dollars.

The above-mentioned goals cannot be achieved without innovative development, introducing science and high technologies into the industry. As noted by our distinguished president: as long as there is no innovation, there will be no competition, no development in any area [1]. In order for Uzbekistan to achieve the goals set out in the strategy, it will first have to stimulate the introduction of innovations in the field.

In economies based on advanced knowledge, food and agricultural production have little comparative advantage. This means that the rural-food industry is rarely the focal point of innovative policies, and is instead seen as a backward sector, or at least a deeply unexplored sector [2]. This is a sad situation, as today the sector faces complex global demands ranging from providing healthy and safe food to actively responding to climate change and environmental problems for a regularly growing world population. The pandemic that has occurred in recent years has become special again, since it has been argued that the reduction in biodiversity is one of the factors that lead to the emergence of such epidemics [3]. To eliminate such threats, agricultural organizations should be well integrated into the national innovation system and the country's innovation policy should focus on supporting appropriate and favorable innovation measures in introducing innovation for organizations in this sector [4].

Despite this, agricultural organizations are often characterized as innovators rather than innovators. Their innovations are often seen as the result of knowledge and technology transfer from other industries [5, 6]. Consequently, innovation in agriculture is mainly studied by costs and by production in lower proportions [7]. Some studies consider the innovative results of the sector, in addition to the ability to master new technologies developed in other areas. Thus, literature ignores the possibilities of agricultural organizations to innovate themselves [8, 9].

Based on the stated goals, we have analyzed the current state and trends of innovative development in the field in our article. In our research work, we used the data of the State Statistical Committee and the intellectual property agency for the purpose of a comprehensive analysis of innovative activity in agriculture. We studied the levels of innovation introduction in agricultural organizations. This is a comprehensive data set on the analysis of innovative activity in Agriculture of Uzbekistan, which helps us to analyze innovative activity in agriculture, available opportunities and how it differs from other industries. Using empirical analysis, we have identified factors that allow innovation in agricultural firms and thus fill the knowledge gap in research and management decision making. The current level of knowledge is based mainly on the study of innovation in large organizations that operate in the areas of production or service. Our research work is focused precisely on the study of innovation in agriculture.

Our research is important in the implementation of innovative policies, since modern systems of support for innovation, as a rule, are located in urban areas, mainly focused on the industrial production sector. Agriculture and rural areas are experiencing deep transformation related to concentration and globalization on the one hand and postindustrialism and sustainable development on the other. These transformation processes require policies aimed at implementing mission-oriented innovation based on new conditions and goals [10]. An important component of the transformation process is an innovative system that is relevant and popular for agricultural organizations.

Economists who analyzed agricultural knowledge and innovation in Uzbekistan noted that the level of innovative activity in the field has decreased [11]. The reasons for this may be that agricultural entities are ignored by a more general innovation system. In addition, agricultural entities are located mainly in rural areas, where the geographical distances to knowledge and innovation centers are longer. These characteristics can not only hinder the innovative capabilities of agricultural firms, but also reduce their access to innovation support systems. In order to strengthen the innovative potential in agriculture, it is necessary to conduct a more in-depth analysis of the differences and similarities in innovative production and innovative opportunities across industries. However, the conduct of this type of analysis is hindered by the lack of formal innovative information that covers enterprises in all regions and sectors, as well as including agriculture and rural areas [12]. The paper also explores some of the challenges and solutions to the introduction of innovation in agriculture. Proposals and conclusions are made to increase innovative activity.

Analysis of literature on the topic. Research on innovation in agriculture largely follows the traditions of early innovative literature focused on innovation systems, the local environment, and the availability and impact of public policy on innovation at the level of networks, clusters, or regions. However, innovation is a phenomenon that often occurs at the firm level. Even though new technologies and inventions are primarily developed in research departments (public or private), they are not generally considered innovations until they are applied, commercialized, and incorporated into the market [13]. This innovation process usually involves one or more firms and is often very complex because it seeks to pool resources from different sources [14, 15]. In our study, we examined the issue of innovative development at the macroeconomic level.

One of the factors affecting the innovative development of the country is human capital. Human capital allows the assimilation and introduction of knowledge in processes in which ideas become commercial products and processes. The level of formal education is considered to be a general measure of human capital and capacity to master, and previous studies have shown that higher education is positively correlated with innovative efficiency at the macro and micro levels [16, 17, 18]. Agriculture is no exception, although this sector has been little studied at the macro level. Much research on macro-level innovation focuses on the ability to master new technologies.

In some foreign literature, the field has shown a positive link between innovative development and exports [19]. The relationship between innovation and exports in agriculture has been noted to be relatively weak.

The presence of external factors of knowledge attracts knowledge-intensive activities to dense areas, which explains the strong concentration of knowledge-intensive services and high-tech production in dense urban areas. [20, 21].

However, the spatial distribution of the agricultural sector depends not on the geography of research departments and human capital, but on the geography of agricultural land. Many agricultural firms are located in less dense areas due to the fact that agricultural land is scattered and geographically clearly defined. This negatively affects the sluggish mobility of agricultural entities and the geographical conditions their innovative capacity. Nevertheless, while the influence of territorial location-specific factors is widely recognized in other sectoral studies, insufficient attention is paid to this factor in Agricultural Innovation Studies [22, 23]. There are also some studies where these issues are covered. For example, Lapple et al, and Botha et al have highlighted the role of spreading knowledge in areas in promoting innovative processes in agriculture. They also observe that there is a clear spatial concentration of innovations. Mate-Sanchez-Val and Harris study the impact of geographic proximity on innovation in Spanish agricultural-food firms and identify the significant and positive effects of proximity to R & D centers [24]. As Bjerke points out, proximity to field-specific knowledge services increases efficiency among firms in the agricultural sector [25].

Analysis and results. The agricultural sector fulfills an important function in the economy of every country as a source of food security, supply of raw materials necessary for industrial production and other resources. At the same time, the field is extremely influential on external influences and requires operational decision-making. The development of the industry can serve as a driver for ensuring growth in all the rest of the economy. Therefore, the development of Agriculture is an urgent issue for our national economy. The widespread introduction of innovations in the field, the use of Science and advanced technologies - is the main factor in the development of the industry.

Currently, the main goals of agricultural development are implemented within the framework of the agricultural development strategy of the Republic of Uzbekistan for 2020 — 2030 and the development strategy of the New Uzbekistan for 2022-2026.

In the transition of agricultural development to an innovative way, it is important to coordinate the volume of costs for research and design work. Experience of developed foreign countries shows that the costs allocated to ITTKI in the country should grow at a pace corresponding to the volume of GDP. Dynamics of GDP growth rates and costs of research and development in Uzbekistan are shown in Figure 1.

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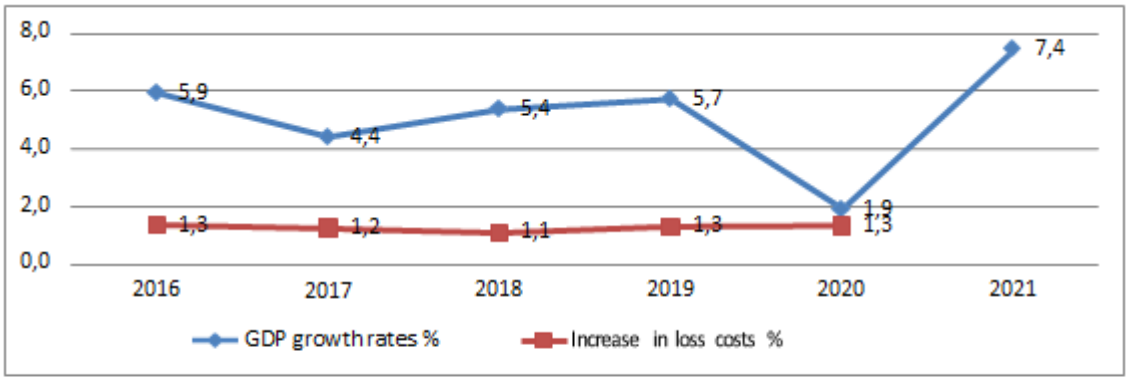


Source: *Compiled on the basis of data from the State Statistical Committee.*

Figure 1. Dynamics of GDP growth rates in Uzbekistan and spending on research and development.

In agriculture, the costs for research and development work (Table 1) increased 2.74 times. It should be noted that the growth rate of research and development costs in agriculture is higher than in some other areas.

Applied research had the largest increase in costs (188.7%). Annual expenditure on R & D in agriculture increased by 47,695.1 crore in 2021 compared to 2015. The cost of R & D and pilot development in Agricultural Sciences has decreased by 0.003% compared to agricultural gross product.

Also, in the structure of costs to ITTKI, the share of expenses in agricultural sciences increased by 2.8% (Table 2).

The fan capacity of GDP increased by 0.98 percentage points, and in 2020 was 1.4% of GDP at 10 kopecks (Figure 2). In agriculture, the fan capacity of gross product was reduced by 0.003 percentage points and gross agricultural product was 0.02 kopecks per 1 SOH. This is a very low indicator. The science capacity of GDP in the economy of leading countries is more than 3% and has a tendency to grow again [26].

Table 1. Expenses for ITTKI work in the fields of science, Sums.

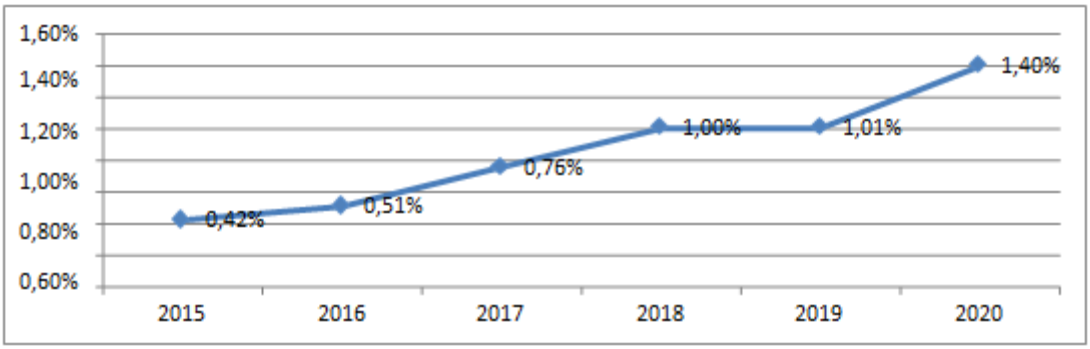
Cost structure	2015		2017		2019		2020		The difference 2015/2020 years	
	Sum	in %	Sum	in %	Sum	in %	Sum	in %	Sum	in %
Total	365160,1	100,0	470938,3	100,0	602281,4	100,0	838633,8	100,0	473473,7	130%
Including fields of science by										
Natural subjects	116191,3	31,8	174455	37,0	266423	44,2	409279,5	48,8	293088	17,0
Technical Sciences	136297,4	37,3	144214	30,6	120538	20,0	159756,9	19,0	23459,5	-18,3
Medical Sciences	26630,20	7,3	30427,6	6,5	41702,9	6,9	52653,5	6,3	26023,3	-1,0
Agriculture science	27345,8	7,5	45539,7	9,7	64937,6	10,8	86386,4	10,3	59040,6	2,8
Social Sciences	35934,20	9,8	49819,5	10,6	54199,8	9,0	65 032,40	7,8	29098,2	-2,1
Human sciences	22761,40	6,2	26481,9	5,6	54480	9,0	65 525,10	7,8	42763,7	1,6

Source: Compiled on the basis of data from the State Statistical Committee.

Table 2. Costs for research and development work in agriculture

Cost composition	2015	2017	2019	2021	Difference 2015/2021
Losses to expenses in total, million Soums	365160,1	470938,3	853404,4	-	229,7%
Agricultural Sciences	**27345,8**	**45539,7**	**64937,6**	**75040,9**	**274,4%**
including:					
fundamental research	4952,8	7337,3	6314,7	8430,8	170,2%
for applied research	16671,6	28876,4	46493,7	31459,9	188,7%
scientific and technical developments	4362,8	5064,7	6585,4	7684,8	176,1%
Total loss to the share of agricultural sciences in expenses, in %	**7,5%**	**9,7%**	**7,6%**	**-**	2,8%
Agricultural sciences in relation to agricultural gross domestic product the cost of research and experimental-design developments enhance, in %	0,027%	0,031%	0,030%	0,025%	-0,003%

Source: Compiled on the basis of data from the State Statistical Committee.



***Source**: https://rep.bstu.by/bitstream/handle/data/8117/165-169.pdf?sequence=1 based on Statistics Committee compiled using data*

Figure 2. Knowledge intensity of GDP

In the decree of the president of the Republic of Uzbekistan dated 29.10.2020 on approval of the concept of development of Science PF-6097-until 2030, the globalization of the world economy and its transition to new technological development are leading to increasing competition in the world commodity and financial markets, in the field of introduction of digital technologies and in ways It has been argued that the main solution to these issues should be to take a place among the leading countries in the field of Science and innovation, achieve international competitiveness during the Fourth Industrial Revolution, seek new solutions to accumulated institutional problems, as well as solve controversial issues caused by globalization. It was also approved by the decree of the president of the Republic of Uzbekistan PF-5544 of September 21, 2018—2019-2021-in the strategy for the innovative development of the Republic of Uzbekistan in the years, the main goal of the Republic of Uzbekistan is to be among the 50 leading countries of the world by the Global Innovation Index until 2030.

The introduction of innovations is largely associated with soil processing in rural and forestry; details and related parts, equipment of agricultural machines; livestock; breeding and storage of poultry, fish; fish production; fishing; storage of new breeds of animals, food, which indicate a significant increase in the production of products of this direction.

In cultivation, it is the acquisition of seedlings; planting; fertilizers; harvesting; harvesting, plant defenses, disinfectants, pesticides, herbicides; repellents or attractants; plant growth regulators and new plant varieties.

In the following years, great importance is attached to the startup mechanism in the development of innovative agricultural production. Some directions are successfully implemented in the agro-industrial complex, which should include the development of selection and seeding, the use of robotics and drones, digital technologies, etc. If we talk about the volume of introduction, investments in startups over the past decade, according to some experts, amounted to more than US $ 1 billion in the development of technologies for the cultivation of grain crops alone.

Conclusions and suggestions. Thus, the agro-industrial complex is one of the branches of the national economy that is not prepared for the introduction and digitalization of innovations. Today, this problem can only be solved in a complex way, starting from the formation of a solid foundation of digitization.

In our opinion, the digitalization of Agriculture is an important factor in innovative development. The introduction of digital technologies into agricultural production makes it possible to take into account the local characteristics of fields and animals, their natural variability, which will reduce resource consumption, increase crop yields and animal productivity, improve the quality of decisions and the efficiency of their adoption. Key digital technologies include:

- Software for SaaS solutions(web-based data processing
- equipment for the use of digital technologies (feeding, maintenance, regulation of the microclimate, milking, control of the state and vital activity of animals) [27].
- auxiliary equipment (sensors, camcorders, microphones, monitors).

Due to the limited financial capabilities of agricultural producers, their high debt burden, the introduction of digital technologies has an expensive and undesirable distribution. However, with the spread and introduction of innovations, their cost decreases [28].

In the implementation of measures to develop the system of digitalization in the agro-industrial complex and Agriculture of the Republic of Uzbekistan, the development of digital technologies and the localization of their services is an urgent issue. Because, an increase in dependence on imported products can in essence make it difficult to further control the sphere of influence on external factors and increase the cost of end products. Therefore, it is advisable to develop the IT sector, attract investments, equip higher education institutions with technical excellence, support them with various subsidies.

Strengthening the integration of scientific research organizations and agrarian organizations is considered extremely important.

It is also of concern that the costs to ITTKI in Agricultural Sciences increase year after year, but the decline in patent activity. Chunonchi, in fact, investments in the industry were supposed to increase the introduction of innovations. This means that the return on capital is falling. That is, the funds allocated for innovation in the field are used ineffectively. This may be influenced by a number of negative factors. In our opinion, the mechanisms of financing innovative projects should be revised. Giving the introduction of innovative developments in scientific research institutes directly to the discretion of Agrarian organizations to reduce the influence of intermediary organizations, we think

that the Ministry of innovation should only participate in financing projects chosen by agrarian organizations in the pilot mode and monitoring capital return.

At the same time, the acquisition of operational statistics in the field is limited, which makes it difficult for agrarian organizations to conduct marketing research. As a solution, it was introduced in the Russian Federation within the framework of the digital agriculture program for the purpose of collecting network information —it would be desirable to master the digital window system to our economy [29].

In general, the priorities for the formation of an effective innovation system in our republic are: the formation of a clear and simple legal framework for the organization of innovative activities of producers of agricultural products; the development of a program for the promotion of innovative activities in agriculture and the development of targeted financing mechanisms; strengthening the nobility between research centers, insituts and private enterprises and production enterprises, organizing branches of scientific organizations in agricultural areas, providing laboratories and necessary equipment; assigning a specific poor organization for the introduction of new methods, varieties of production in agriculture and identifying sources of financing; attracting foreign investments in rural areas, improving infrastructure [30].

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