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Innovation as a tool for the development of the cotton industry in the Republic of Kazakhstan

La innovación como herramienta para el desarrollo de la industria algodonera en la República de Kazajstán

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Conteúdo

RESUMO:

This article analyzes the state of the cotton industry in the Republic of Kazakhstan for the last 25 years. The main task of the study is to conduct a statistical analysis on the innovative development of cotton production in Kazakhstan. The article substantiates some of the regularities and relationships of the process of cotton growing and processing. At the same time, wear and tear of the technical complex and climatic conditions, where innovation is a necessary tool for the development of the country's economy, have significant negative importance. The hypothesis is that the increase in innovative projects will give not only maximum profit to the state but also motivation for the development of the cotton industry, as part of the light industry. The constructed model can be used for forecasting and will enable the government to make effective decisions in the modernization of the cotton industry.

Key words: cotton production, Kazakhstan, innovation, statistical analysis, industrial-innovative program

ABSTRACT:

Este artículo analiza el estado de la industria algodonera en la República de Kazajstán durante los últimos 25 años. La tarea principal del estudio es realizar un análisis estadístico sobre el desarrollo innovador de la producción de algodón en Kazajstán. El artículo justifica algunas de las regularidades y relaciones del proceso de cultivo y procesamiento del algodón. Al mismo tiempo, el desgaste del complejo técnico y las condiciones climáticas, donde la innovación es una herramienta necesaria para el desarrollo de la economía del país, tienen una importancia negativa significativa. La hipótesis es que el aumento de los proyectos innovadores dará no sólo el máximo beneficio al Estado, sino también la motivación para el desarrollo de la industria del algodón, como parte de la industria ligera. El modelo construido puede ser utilizado para la previsión y permitirá al gobierno tomar decisiones efectivas en la modernización de la industria del algodón.

Palabras clave: producción de algodón, Kazajstán, innovación, análisis estadístico, programa innovador industrial

1. Introdução

Cotton production in the Republic of Kazakhstan is characterized by a low degree of integration and co-operation of peasant farms as well as a low level of application of agricultural technology in the production of raw cotton. The existing monopoly of cotton ginning plants does not allow the realization of effective integration with cotton-growing farms and other enterprises and cotton market participants. The lack of capacities of textile and clothing enterprises creates problems for the effective organization of processes of cotton fiber deep processing within the country. The insufficient development of these and other aspects of the economic mechanism for the formation and effective functioning of cotton businesses at the stage of modernization of the country's economy determines the urgency of conducting a number of in-depth studies of innovation in this industry and specifying the scientific and practical value of the effectiveness of their solution.

Of particular importance in innovative society is human thinking and activities. Innovation is the only real tool for creating successful brands. Successful innovation turns ideas into money. Therefore, it is necessary to invest in people, not in projects. Out of more than 10,000 enterprises of the republic, only 500 economic entities have technological innovations. The share of innovation-active enterprises in Germany is 80%, in the United States, Sweden, Italy, France – about 50%, in Russia – 9.1%, in the Republic of Kazakhstan – 4.3%. The share of Kazakhstan in the number of patents that are registered in Europe and the US is only 0.07%. In Kazakhstan, the level of innovation spending is only about 1% of GDP. In 2012 in the “Global Innovative Index” Kazakhstan ranked 83rd on the innovation index among 142 countries (OECD, 2013). Within the framework of industrialization, 20 new government support tools had been developed for innovators, but turned out to be ineffective. Innovative development in Kazakhstan is hampered by an acute shortage of personnel able to manage innovative processes and projects. In countries that are striving for economic leadership the processes of attracting investment, modernizing production and developing innovations should go in parallel, not in a sequential order (Morrissy, 1974).

The purpose of the study is to substantiate the development of the cotton industry through innovative opportunities during the economic crisis and, based on this, to specify the main tasks and problems of cotton production, identifying its prospects.

Innovations developed by scientists and used in cotton production led to an increase in yields in the region to 28.7 q/ha and to the improvement of the quality of raw cotton under a significant reduction in costs. A number of innovative methods of soil cultivation, new methods of sowing and inter-row processing, water-resource saving technologies and new technologies for cotton defoliation have been developed and introduced into production.

Over the past few years, cultivation technologies involving deep soil loosening have been introduced on the farms of the Maktaaral district. The task of innovation is soil loosening without overturning to a depth of 50-55 cm with minimum agrotechnical costs instead of autumn plowing with soil overturning, destroying the plow soil bottom, formed as a result of annual plowing for 50-70 years to a depth of 30-35 cm.

The main indicators of the economic efficiency of deep soil loosening in comparison with conventional plowing are as follows: saving of fuels and lubricants – 60%, productivity growth – more than 40%, and an increase in crop yields – 28-30%.

A new moisture-resource saving technology of cotton cultivation has been developed and introduced into production. The use of this technology can save up to 28-30% (350-400 m2/ha) of irrigation water and 35-40% (100-120 kg/ha) of mineral fertilizers. The number of agricultural methods for cotton cultivation is reduced from 37 to 27 with saving of fuels and lubricants to 20%, raw cotton production costs are reduced to 33% due to higher yields of cotton.

A water-saving technology has been introduced into production – cotton seeding with a row

spacing of 70 cm. Currently, 90 cm rows are used in all cotton fields in the region.

In conditions of the increasing deficit of irrigation water and deterioration of the ecological status of irrigated lands, the introduction of water-saving technologies is becoming relevant – cotton watering through the furrow.

For large agricultural farms, whose acreage areas are 80-100 ha, 9- and 10-crop cotton-lucerne-cereal rotations have been developed. For small agricultural farms three effective schemes of short cotton crop rotations have been elaborated, contributing to an increase of soil fertility by 15-20% and cotton yields – by 5.0-6.0 q/ha (Glover and Kusterer, 1990).

Currently, the sowing of winter wheat in growing cotton in autumn, without the use of basic treatments, is the demand of today. Zero technology is not only a refusal to conduct plowing, deep loosening and other intensive activities, but also an attempt to leave plant remains in the field and remove weeds. The next year after harvesting of winter wheat sown in growing cotton, it becomes possible to carry out agro-meliorative works (application of organic fertilizers – 40 tons/ha, plowing to a depth of 40 cm, planning, water recharge irrigation). Then one can sow corn on silage and other crops. As a result, in two years it is possible to get three yields. In this case, the upper layer of the soil horizon, fertilized with organic substances and plant remains, protects the soil from erosion, and the accumulated supply of nutrients intensively influences the growth and development of crops and guarantees a high yield.

One of the current problems in cotton production is the provision of cotton crops with irrigation water, especially in the Maktaaral district, where cotton crops occupy 80-85 thousand ha. The annual deficit of irrigation water in the summer vegetation period is up to 35-40% of the total amount of irrigation water required. The cotton-growing region faces problems related to the prevalence of cotton monoculture, the lack of water resources during the vegetation period and the deterioration of the reclamation state of irrigated lands. The whole problem is the deficit of irrigation water. To address these issues, the government of the country approved a comprehensive plan for the diversification of cultivated areas in the Maktaaral district of the South Kazakhstan region for 2014-2016. It provides for a reduction in the cotton-cultivated area from 94 to 66 thousand ha. The liberated lands will be occupied by other crops: melons and gourds – 5.9 thousand ha, corn – 6 thousand ha, lucerne – 7 thousand ha, fruits and berries – 3 thousand ha.

The comprehensive plan for the diversification of cultivated areas will reduce the dependence on irrigation water during the vegetation period. In the past few years, the planting of cotton, whose watering requires a huge amount of water at the same time, is gradually declining. However, this reduction does not solve the problem of water supply. In past years, cotton crops amounted to 94 thousand ha, of which 66 thousand ha of lands were saline. The cultivation of any other crops on these lands is inefficient. Cotton is the only crop that grows in similar conditions. Accordingly, it was decided to leave all 66 thousand ha for its cultivation. In general, the project provides for a reduction in cotton crop areas by 28,000 ha.

To solve the problem of providing cotton crops with irrigation water, in 2014 in the Maktaaral district, a regime for the irrigation of crops based on hydromodule zoning was developed and introduced into production. The effectiveness of its implementation consists in saving irrigation water and improving the structural, agrophysical and meliorative state of the soil. Irrigation water is optimally fed to simultaneous irrigation throughout the cotton plantation. It is possible to irrigate the unplanned land by saving irrigation water, as a result of which, the cost of cotton production decreases (Swinnen and Vandeplas, 2011).

The developed hydromodule zoning will allow the vegetation period to be spread from April to early October due to the planting of early vegetables and melons, being in the husk and in pots, in the open ground. This method has long been used by insightful heads of peasant farms. Cotton, which takes up to 80% of moisture limit allocated for the district, is planted much later.

The task is to breed all cultivated crops according to the terms of irrigation and to avoid situations when in the heat of July water is required for irrigation all at once. This is one of the

ways of reasonable water consumption. Another way is the use of underground drainage water diluted with arachnic water to reduce the level of mineralization.

A large role for the regulation of irrigation water in the irrigated zone of the south of Kazakhstan is played by the constructed Koksaray counter regulator. In order to provide cotton crops with irrigation water on an area of 85,000 ha in the Maktaaral district, pumps with a throughput of 60 m3/s were put into operation at the Shardara reservoir.

Today, on average, each agro-formation in the region includes, first of all, land plots with an area of 3 to 10 ha. Let us assume that a farm grows cotton, which means that there is a need for a cotton harvester. A small farm does not have the money to purchase it, and if does, it is extremely unprofitable to buy it, since it is a specific technique, which is used for 1-1.5 months in a year at best. It is advantageous to have such a harvester, when the land occupies about 120-150 ha. The same applies to tractors, seeders and other necessary equipment.

None of such mini-farms is able to comply with all advanced agricultural technologies and scientifically grounded crop rotations developed by scientists of Kazakh Research Institute of Cotton Growing for specific soil and climatic conditions. The economic efficiency of the enlarged farms that produce raw cotton is obvious. When enlarging crop areas to 120-150 ha, farms earn a profit three to four times more than farms with five-hectare allotments. Therefore, peasant farms should unite, quickly master new, modern methods of agricultural technology and buy new agricultural machinery (Swinnen et al., 2007).

To enlarge farms and increase crop yields through the use of modern agricultural technologies are important issues, which need to be addressed by farmers. According to experts, the process of uniting farms is stimulated by the fact that direct government support in the form of subsidies and other financial benefits is primarily provided to larger farms.

Of particular importance for the further development of peasant (private) farms is their information and advisory service and scientific provision, training and skill enhancement of farmers. In 2010, the center for the dissemination and transfer of knowledge in the sphere of agro-industrial complex "Maktaaral" was opened under the slogan "Through the system of knowledge dissemination to competitive agriculture" in order to improve the skills of specialists of peasant farms, cooperatives and other agricultural producers on the basis of Kazakh Research Institute of Cotton Growing.

The relevance of this work consists in the fact that based on the developed measures, it presents calculations, which prove that in the medium term the cotton processing industry in Kazakhstan will be self-supporting and develop with the help of innovation.

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2. Literature Review

Many questions related to the considered topic have become quite widespread in non-Russian scientific thought. In this connection, a review of the works devoted to studying the problems of the development of cotton production from the standpoint of innovation and developing programs was conducted.

Burkitbayeva, Qiam and Swinnen (2016) emphasize that the most successful genetically modified (GM) crop is probably that of cotton, especially among small-scale producers. More than two thirds of the total area of cotton is now covered by GM varieties. Nevertheless, none of cotton producers in Central Asia (Uzbekistan, Turkmenistan, Kazakhstan, Tajikistan) uses GM cotton. This is puzzling given that Central Asia is an important cotton producer and an exporter of the region. A number of possible reasons are discussed in the work, based on some hypotheses from the literature of political economy of GMOs. The authors believe that none of these hypotheses is convincing, and argue that the most likely explanation is limited local demand for Bt due to low pest infestation. This means that global Bt cotton introduction rates may already be close to 100% when considering real demand for insect-resistant varieties.

Petrick and Djanibekov (2016) believe that the prevalence of cotton in the irrigated areas of

Central Asia has long been criticized for its environmental impact on salinization and desertification. From an economic point of view, “this monoculture ties producers to state procurement, has led to the recurrent mobilization of manual labor during harvest campaigns and makes farmers vulnerable to water availability and crop failure”. Crop diversification and harvest mechanization have been proposed as strategies to mitigate this impact.

Pomfret (2008; 2008a; 2016) analyzes the prospects of agriculture in Central Asia up to 2050 and gives recommendations on what is needed to achieve the desired vision. The author believes that geography and climate “favor two major export crops, cotton in the south and wheat in the north, but a pressing issue is the appropriate amount of area to be devoted to these crops and how to produce them efficiently”.

Van Hoof (2014) argues that many organizations have recently been conducting life cycle assessments of their products to understand potential effects on the environment and prioritize innovation to create better products. The author presents the results of product innovation by comparing the older (2007) and the new (2013). The analysis included such categories as primary costs, global warming, raw materials, agricultural land, technology depletion, etc. According to Pandey (2013), over the past few decades, the regulation of biotechnology has posed significant challenges to innovation in the world. Innovation is becoming more relevant in the regulation of agribiotechnology, and is explained more often by the lack of necessary information. The Triple Helix of university-industry-government is regarded as a key to innovation and socio-economic development in general. The study is aimed to understand the interaction at the local level between the subjects of the Triple Helix as well as the ‘public’, claiming that a proper mechanism for such interaction can bring useful implications for innovation.

General issues of the economic essence of innovation, innovative activity and innovative development of socio-economic systems were addressed by Mensch (1979), Spartalis, Iliadis and Maris (2007).

Sadler (2006) considered a comparative analysis of vertical coordination in the cotton sector in Central Asia, which confirms the importance of competition as the main and principal factor that protects small farms against rent extraction by large producers.

In order to establish the prospective volume of cotton demand for the country, it is necessary to analyze the production of raw cotton in dynamics. According to Lerman (2010), the emergence of commercially oriented private farms was the basis of agricultural production recovery in Central Asia after the collapse of the Soviet Union. The author testifies to the excellent productivity of the land of private farms over large enterprises (Dries and Swinnen, 2004).

Borensztein, De Gregorio and Lee (1998) analyzed the impact of foreign direct investment on economic growth using a cross-country regression model and data on foreign direct investment flows from industrialized countries to 69 developing countries over the past two decades. The results of the study showed that foreign direct investment is “an important vehicle for the transfer of technology, contributing relatively more to growth than domestic investment”.

Binswanger and Rosenzweig (1986) introduced a theoretical framework that helps to analyze production relations in a rural area and forecast the effects on various exogenous institutional changes in production relations, productivity and income distribution.

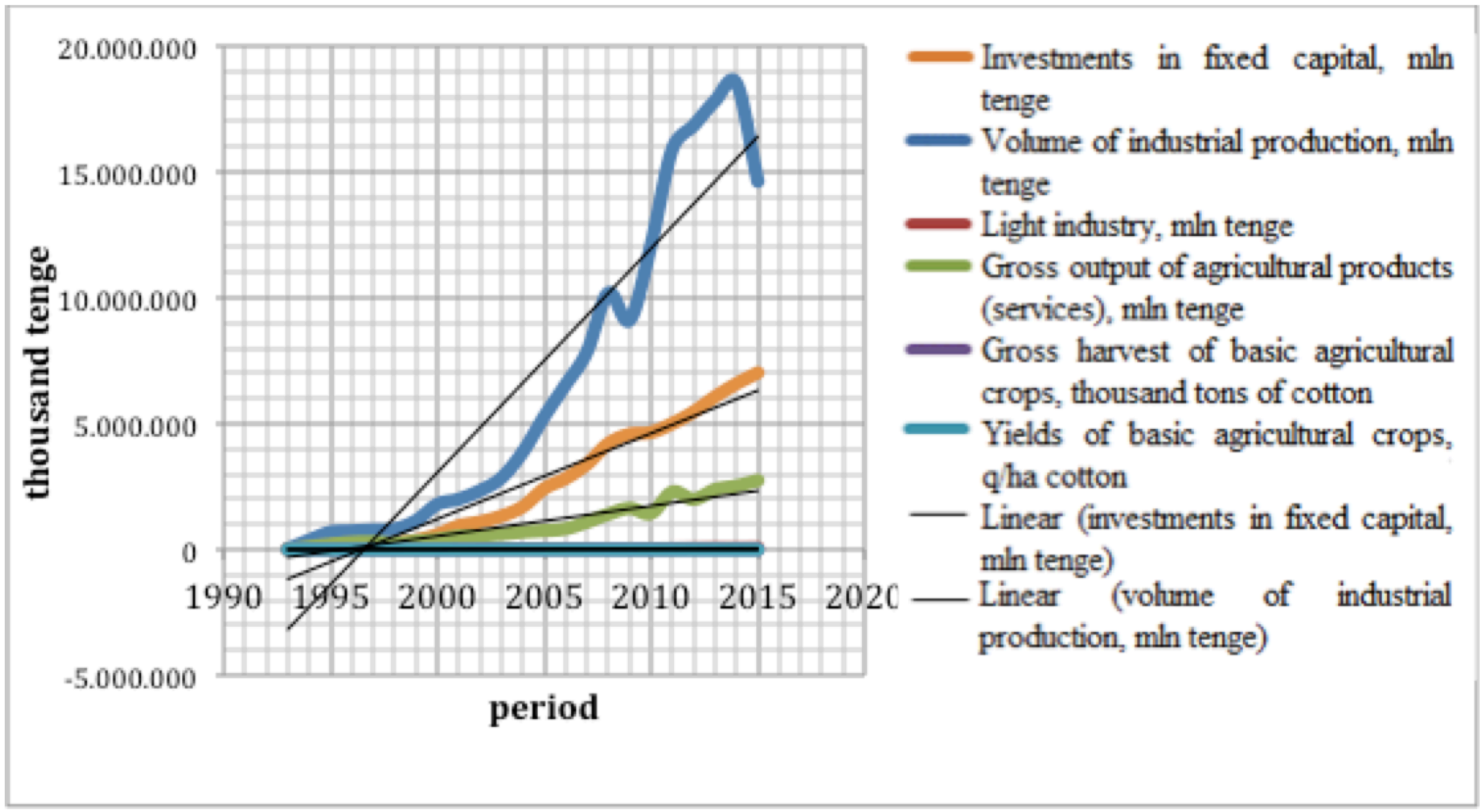
The statistical analysis of the dynamics and trends in the development of domestic agriculture is conditioned by the need to identify opportunities for ensuring the country's food security, competitiveness of domestic products, and sustainable development of rural areas. The growth of the share of domestic products in the total volume of products sold is based on improving the structure of production by categories of farms with different levels of marketability. The support of domestic agricultural producers will allow the country to reach a level of self-sufficiency and will have a beneficial effect on the development of rural areas (Gow and Swinnen, 2001).

3. Data and Statistical Analysis

In the study of the country's cotton complex, general methods of statistical research were applied, which are recognized by the general theory of statistics and economic science. The methodology framework helped to track the financial and economic situation in the cotton market. General methods of collecting statistical materials, their processing and further analysis, received specific content and to some extent were specialized in its study (Vandemoortele et al., 2012).

To carry out a statistical analysis of the impact of state support and investments on the development of light industry in Kazakhstan, this study uses materials from 1991 to 2016 (Figure 1).

Figure 1. Dynamics of key indicators of the cotton industry, 1991-2016



Note. Compiled by the author

The agro-industrial complex has the following tasks: to increase agricultural production, the output of export-oriented competitive products in the world market and to ensure the country's food security. The following data speak about the importance of these tasks. Thus, the gross output of agricultural production in 2015 exceeded 2.7 trillion tenge. In the structure of gross agricultural output, 55% falls on crop production and 44.6% on livestock production (Petrick and Djanibekov, 2015).

This means that the pace of the development of agriculture remains below its capabilities. This is due to the established structure of market entities in the countryside, when 189.9 thousand agricultural enterprises and 1,632.8 thousand households are engaged in agricultural production. Of the total number of agribusinesses, 96.2% are peasant farms. The size of most of these farms does not allow for extended reproduction on an intensive basis (Swinnen, 2015).

In addition, in the structure of gross agricultural output, the largest share belongs to the share of households – 45.2%. In the gross volume of domestic households, livestock products account for 75%. This is one of the main reasons for the low marketability of livestock. The preservation of small-scale production in the countryside remains one of the main issues. Peasant farms account for slightly more than 30% of gross output. Of these, 40% have approximately 10 ha of agricultural land. This means that small agricultural enterprises are not able to independently solve the problems of increasing the competitiveness of products and

introducing innovations. Not always they can afford services of highly qualified specialists.

Investors are reluctant to be engaged in agriculture. In the total volume of investments, its share does not exceed 2%. The lack of finance hinders the development of the material and technical base and the introduction of innovations in the countryside. At the same time, in developed countries, 50-90% of GDP growth is provided by technological progress and innovation (FAOSTAT, 2015).

In Kazakhstan, 220 million ha of farmland is 4% of all world resources. However, of them 9 million ha of fertile land is not used. Most of the unused land is in the state reserve, as a rule, it includes pastures. About 8% of lands are contaminated with industrial waste; therefore, the ecological problems of soil fertility conservation require special attention. In private ownership no more than 1% of agricultural lands are purchased. This process should not be forced, but it is extremely necessary to form a stable category of landowners according to the experience of developed countries. The redemption of lands should be allowed for those who have the appropriate knowledge, techniques and means. The procedure for land relations should be transparent, and the land acquired should be used rationally and for the purpose intended (Reardon et al., 2001).

Both in the entire world and in the Republic of Kazakhstan, agrarian production is the largest sphere of the national economic complex. In rural areas, about 8 million people live in 6,828 villages – 45% of the population. This is a huge staff potential, able to bring agriculture to the forefront in the context of scientifically based organization. Therefore, the further development of the agroindustrial complex urgently requires the reproduction of new knowledge, its introduction into production. In developed countries, innovative factors account for up to 85% of economic growth. In particular, intellectual property accounts for about 70% of the total market value of corporations, and, according to expert estimates, exceeds 20 trillion US dollars (Key and Runsten, 1999).

Therefore, in Kazakhstan, a huge role in reforming is assigned to science. In this regard, the leader of the nation Nursultan Nazarbayev put forward a fundamentally new model of science management and called it "the institutional basis for a breakthrough in the scientific field". The task was set to eliminate the disproportion in the financing of research and development (in higher education institutions, science accounts for less than 10%, research and development – for less than 70-80%, experimental production farm – for about 10%). New forms of science financing are being introduced, which correspond to world experience and contribute to increasing the activity of scientists. The number of organizations performing research and development is 392. The number of personnel engaged in research and development is more than 25 thousand people (Little and Watts, 1994).

By 2020, the share of science financing in the GDP structure will be 2%. The new model offers young people an understanding of the prospects in science and the possibility of self-realization. Open access to the largest foreign resources of scientific and technical information is provided.

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4. Conclusions

Kazakhstan has a sufficiently high economic potential for the development of agricultural production, the formation of the necessary food resources and the development of a raw material base for the processing industry in order to become one of the drivers of the country's economic growth. It will promote Kazakhstan’s integration into the world economy, its entry into the number of 30 leading countries of the world and the implementation of the Plan of the Nation "100 Specific Steps". Currently, Kazakhstan faces the task of continuing to rapidly develop those industries that have a multiplier effect. Agriculture is such a lever. For this purpose, it is necessary to solve a set of priority tasks that will open the way for innovative development.

Theoretical analysis of economic development in the developed countries of the West and South-East Asia after the Second World War showed that only those countries that have made a

big "breakthrough" in their economic development chose a strategy for not "catching up", but a strategy for accelerated introduction of new modern tools and technologies, innovations in strategically important sectors, which provided them with accelerated development and won, as a result, key positions in the world market.

The realization of strategic tasks of the industrial-innovative development of the Kazakh economy requires a significant upgrade of its structure and material and technical base. At the same time, special attention is paid to the modernization of industries that increase the stability of the national economy.

With the intensive expansion of world economic relations, the problem of their rationalization is actualized. In these conditions, for the developing market systems, such as Kazakhstan's economy, it is very important to maximize the approximation of its industries to international standards that allow for the full-fledged entry into the world market economy. In line with the implementation of these tasks, the modernization of the cotton processing industry, which occupies a special place in the life support system of society and which tends to increase the demand for its products, is of great importance.

Cotton is one of the most valuable types of raw materials for industrial and food production. In terms of its importance in the economy of the country, it is as valuable as bread and other important types of raw materials, since cotton serves as a raw material for the cotton ginning industry, and cotton-fiber – as a semi-finished product for textile, knitwear, shoe and other industries. Despite the emergence of positive results in certain constituent elements of the cotton processing industry, there is no comprehensive and systematic approach to the elaboration and implementation of a strategy for the development of the cotton and textile industry as a single system that can compete not only in the domestic market but also in the world.

In this regard, the issues of the economy and the organization of transfer of the industry to the “rails” of industrial and innovative development in the coming years are of special scientific and practical importance for the further development of the cotton-textile industry.

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