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ABSTRACT

Dissertation for the degree of doctor of sciences

PROBLEMS OF INCREASING INNOVATIVE ACTIVITY IN THE AGRICULTURAL AND PROCESSING INDUSTRIES OF AZERBAIJAN

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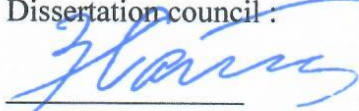
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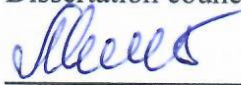
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GENERAL DESCRIPTION OF WORK

Relevance of the topic and knowledge of the problem.

Nowadays, agricultural production imposes new demands on managers, specialists and workers. First and foremost, there is a need for highly educated, competent managers and specialists who not only specialize in organizational and technological branches of modern production but those who are also able to deeply analyze and predict the results of economic activities, conduct business negotiations and conclude contracts, as well as resolve other issues related to economic activities. Over the past 18 years, the regulatory framework of the agricultural sector has been significantly strengthened. A number of laws, concepts and national priorities, State programs, Strategic Road Maps have been developed and approved, as well as numerous decrees and orders of the President of the Republic of Azerbaijan have been issued. These regulations reflect a set of measures of state support for the agricultural sector. As a result, the production and processing of agricultural products based on modern technologies have been expanded, the infrastructural provision of the agricultural sector, which is the driving force responsible for the development of the non-oil sector of the republic's economy, has significantly improved. These led to the successful implementation of the state programs over the past 18 years and the measures taken in this area have given impulse to the improvement of the business environment, the growth of investments, the opening of new enterprises and jobs. Food security has been considerably strengthened, and the level of self-sufficiency in basic products has elevated. Measures to issue preferential loans, subsidies, tax incentives, the provision of agricultural leasing services and other measures of state support were continued. Poultry, livestock, cereal-growing and viticulture enterprises, complexes for the production, harvesting, storage, processing and sale of agricultural products, agricultural services have been created. Measures have been taken to provide water and land reclamation. Domestic production for the number of food products has increased.

In order to carry out the production and harvesting of high-yielding seeds, the Center for Agricultural Science and Innovation and a wide network of innovative infrastructures (laboratories, services, offices), an electronic information system of agriculture for the register of land plots of farms have been created under the Ministry of Agriculture. In accordance with the amendments to the Tax Code, adopted on May 6, 2016 at a meeting of the National Assembly (Milli Mejlis), the import and sale of pedigree livestock, seeds and seedlings, fertilizers and pesticides, import and sale of laboratory equipment, machines for growing, cleaning, sorting and calibrating seeds, cereals and legumes, import of veterinary drugs for the prevention, diagnosis and treatment of farm animals and birds, as well as agricultural installations, machinery and equipment for irrigation and other purposes are exempted from VAT.

An export logistics infrastructure within the country and beyond the borders is in its formation stage, special export corridors for the accelerated export of fruits and vegetables are being created, and a set of measures are constantly implemented to advertise domestic agricultural products abroad. It also should be noted that a structure for managing agricultural parks and business incubators has been formed, and an agricultural insurance fund has been created. All these measures led to significant increase in the production and provision of the local consumers with these agricultural products.

However, these measures are based on the modernization of the agro-processing industry (API) using innovative approaches. The availability of a modernized system of science, education as well as consulting and information services in the agricultural sector (*in the age of widespread introduction of innovative production and management technologies at the global level*) is considered as the most important resource necessary to ensure competitiveness in this area. In this regard, the functions of the state to regulate innovative activities in Azerbaijan are still at the stage of formation.

One of the key reasons for the weak use of innovations in the agro-industrial sector is the low level of their transition into production, whereas the necessity is to not only use modern

equipment but also apply scientific developments integrated into technological processes.

The average level of appropriations for the civil scientific and technological sector in developing countries is up to 0.5% of GDP. Azerbaijan is not an exception in this case. The share of research and development costs in 2019 was 0.29%, the level of innovative agro-industrial products in GDP was 0.025%, and the share of value added, generated in the agricultural sector was 1.4%. These numbers reflect the low level of efficiency of agro-industrial production. According to the Global Innovation Index 2019, in terms of innovation Azerbaijan is in 84th place among other countries.

As per international standards, the share of innovation-active enterprises, in particular, industrial enterprises should be at least 50% of their total number. Only under such conditions, enterprises and the country's economy as a whole can be competitive in the world market of goods and services. The current level of implementation of innovations at the enterprises of Azerbaijani agro-industrial complex leaves almost no chance of a successful consolidation in the world markets for products of industrial processing of agricultural raw materials.

According to the State Statistics Committee of the republic, the volume of imports for the main groups of agro-processing products in 2015-2019 in Azerbaijan increased by 141%, while exports by only 101.3%. Their shares amounted to 13.5% and 3.9% - respectively. Over the years, the volume of innovative products in the food and beverages sector decreased 2.2 times and at the end of 2019 amounted to 1.51% of all innovative products of the manufacturing industry of the republic.

The analysis conducted showed that only with an increase in the volume of food and beverage production in 2015-2020 by 190%, the balance of finished products increased from 41 million azn up to 85 million azn and at the end of 2020, their share in the total volume of balances in the manufacturing industry reached 20.2%.

As reported by the State Statistics Committee of the Republic, the population's level of self-sufficiency for the: wheat - 57.1%, cereals - 34.4%, vegetable oil - 34.8%; sweet confectionery - 39.4%

pasta - 42.3% butter - 62.7% tea - 45.5% peeled rice - 14.2%. There is a serious problem of shortage of raw materials in the processing of agricultural products and the food industry. The weakness of the ginning and cotton spinning industry, the lack of skilled labor, the low capacity of institutions supporting the textile and garment value chain, and, most importantly, weak trade logistics all seriously hamper the development of this industry.

As per facts, there is no increase in the production of manufactured products from leather, wool, cotton, cocoon, wood, tobacco, which also belong to the agro-industrial complex. It is important to note that the total provision of fixed production assets for the above-mentioned industries has been steadily declining from 2507.1 million azn in 2000 to 41.2 million azn in 2019. The share of textile products in the total industrial output in 2005 was 0.4%, and 0.6% in 2019, tobacco growing - 0.36% and 0.5%, clothing - 0.2% and 0.2%, leather - 0.05% and 0.05%, wood products - 0.1% and 0.1%, securities - 0.04% and 0.2% respectively for the corresponding period of time.

According to the data of Azerbaijan Scientific Research Institute of Animal Husbandry, in agricultural organizations, 54.2 - 56.0 centners of fodder units including 21-22 centners of concentrated feed is consumed per forage cow with a productivity of 4841 kg of milk. Due to the imbalance of the protein diet, the total overexpenditure of feed per cow per year is 4.8-5.0 centners of feed units (11%) and concentrated feed -22.0%. As our studies show, the provision of livestock with grassy fodder in the republic is at the level of 15.8%.

The highest level of coverage of livestock needs is noted in Aran (99%), middle Guba-Khachmaz (66.4%) and Highlands of Shirvan (62.0%), as opposed to low levels of provision in Lankaran (36.3%), Sheki-Zakatala (40, 2%), Ganja-Kazakh (28.8%) regions of Azerbaijan.

Our calculations showed that the share of medium-tech production in 60 regions and cities of Azerbaijan is 11.8% and high-tech production is 5.0%. In order to build a competitive economy, it

is necessary to prepare a highly skilled workforce, develop high-tech production and produce high-tech products.

The aforementioned facts indicate that the strategic task of innovative development of agro-processing enterprises is to realize the innovative potential both directions: a) ability to realize the existing opportunities for innovative development, and b) activation of hidden opportunities that are currently not being used.

Actual socio-economic problems of the agricultural industry, in particular agro-processing areas, their role in ensuring food security, their role in the formation of entrepreneurship, issues of state regulation, structural transformation, modernization of the industry through the creation of innovative infrastructures, increasing the competitiveness of the industry, investment provision, employment, as well as sustainable development, innovation, increasing export potential and other aspects are considered in the works of well-known Azerbaijani scientists: Z.A.Samedzade; A.K. Nuriev; I.G. Aliev; I.G.Ibragimov; E.A. Guliyev; B.K.Atashov; G.A. Ganjiev; T.G. Huseynov; M.J. Huseynov; A.D. Huseynova; I.D. Abasov; I.M. Abasov; E.R. Ibragimov; A.D. Abasov; V.G. Abasov; T.N.Aliev; I.A. Aslanzade; E.M. Hajizade; V.A. Gasymlıy; F.G.Gasimov and Z.M.Najafov; R.M. Dzhabiev; F.A. Guliyev; S.I. Salakhov; MM. Huseynov; A.G. Tagiev and others.

The problems of innovation activity in the theoretical, methodological and sectoral aspects were studied by foreign scientists-economists: I. Schumpeter; M. Porter; P. Drucker; O.F. Bystrov; V.P. Barancheev; T.K.Blokhina; D.A. Belousov; V.G.Zinov; O.V. Mamaem; N.M. Morozov; V.M. Popov; A.A. Semenova; V.P. Soloviev; R.A. Fatkhutdinov and others.

Without diminishing the importance of the research performed by the aforementioned scientists-economists, it should be noted that the issues of practical use (development and implementation) of innovations in the production of the agro-processing industry have not yet been sufficiently studied. Meanwhile, the issue of studying the patterns and factors affecting the development of innovative processes in the agricultural sector, the problems of integrating science and agricultural production, ways to accelerate the

implementation of achievements in digitalization and best practices in agricultural production, the development of innovative infrastructure, increasing the innovative activity of each subject of agricultural production as well as questions of development of the market for innovations remain relevant. Additionally, studying innovative entrepreneurship requires considerable inputs.

Insufficient theoretical and methodological development of this problem determined the choice of the research topic and predetermined the list of priority tasks.

The object of study is the agro-processing industries of Azerbaijan with detailed development on the example of all regions of Azerbaijan.

The subject of the study is the problem of the development of innovative processes in the agro-processing industry, their improvement, as well as innovative developments that are being formed in agro-industrial organizations in market environment.

The purpose and objectives of the dissertation. The purpose of the study is to develop evidence-based methodological and practical recommendations for growing the innovative activity of the agro-processing industries in Azerbaijan, paying increased attention to financing of agricultural science, the widespread use of advanced technologies, the formation of infrastructures for innovative systems and, on this basis, the production of import-substituting and exported food products.

To achieve this goal, the following main tasks were set and successively solved within the dissertation:

- to discover the essence, content and functions of innovation, foreign experience and government regulation in the agro-industrial sectors;
- to discover features of industry and the status of innovative activity, analyze the volume, structure of production and sales of agricultural products;

Based on ready-made software packages, calculate the economic and mathematical modeling of innovative processes in the studied industry:

- to analyze and systematize trends and regularities in the development of innovation activity in Azerbaijan;
- to carry out a systematic and comprehensive analysis of the current state of innovation in the industry, further development of innovation processes and the agro-industrial industry;
- assess the level of innovative activity of the Azerbaijani regions and the manufacturing industries there according to the criteria of low, medium and high-tech production;
- to develop a methodology for building a mechanism for innovative activity, the introduction of digital technology in the agricultural sector and determine the prospects for the development of agrarian-integrated formations;
- to develop a set of organizational, economic and innovative measures to grow the export potential, increase the production of import-substituting, organic agro-industrial products.
- **Research methods** - in the process of research, methods applied were: comparative analysis, methods of matrix positioning and forecasting, economic and mathematical modeling, observation, statistical grouping, survey and expert evaluation.

The scientific and methodological basis of the study is comprised of the legislative and other regulations governing innovation activity in Azerbaijan. Additionally, the works of classic scholars of economic science, materials of international conferences and symposiums, reports of the International Bank and the United Nations on innovation indicators, materials of the State Statistics Committee of Azerbaijan, information on reforms and positive changes published in the periodical press, materials on the financial and economic activities of the agro-processing enterprises of Azerbaijan, as well as annual reports of their activities were also used.

The main provisions put forward for defense - according to the scientific novelty of the study, the following provisions were laid in the basis of the dissertation work, the solution of which will allow the country's economy to be taken out of the zone of predominant, export-oriented commodities development and maintain the high growth dynamics of the agro-processing industries, to a certain

extent ensure the competitiveness of Azerbaijan in world community:

- implementation of state assistance to the formation of scientific, educational, and production integrated structures focused on the serial production and sale of innovative products in cooperation with small high-tech enterprises;

- stimulating the attraction of domestic and foreign investments in the formation of the infrastructure of the innovation system, the system of regional and industrial venture funds;

- implementation of vertically integrated farming structures in the regions of Azerbaijan, bringing the practical significance and effectiveness out of the development of farmer cooperation;

- development of a mechanism for managing the innovation process of the agro-industrial sector, a mechanism for increasing the competitiveness of agricultural products in the domestic market, and improving management structures that control product quality in accordance with international quality standards.

The proposed model for applying the project approach at micro, small and medium-sized agro-processing enterprises with the involvement of innovative infrastructure resources, as well as the principal organizational structure of an industrial quarter operating on the value chain principle.

- Fully - designed structure for the development of an innovative mechanism in the agro-processing industry of Azerbaijan based on international experience;

- Designed algorithms for identifying enterprises in the agro-processing fields that have the greatest potential for the development of exports and import substitution, as well as an algorithm for the actions of executive authorities to assess the innovative activity of enterprises in the agro-processing industries;

- Scientifically based recommendations on the development of innovative infrastructures in the agricultural sector of the Azerbaijani economic regions for the period up to 2030;

- Boosting motivation of entrepreneurs to develop innovative activities by purchasing their innovative products for public needs;

- Improving the leasing system for unique, scientific, technological and production equipment;
- Creation of a sustainable database in the field of innovation activity on the main indicators of the development of the innovation system.

The scientific novelty of the dissertation lays in the development of theoretical proposals and specific recommendations for the development of innovative processes in the agro-industrial sector through the development of the organizational and institutional grounds of the innovative infrastructure, the use of marketing, economic and sociological tools. To add more, more use will be acquired through scientific justification of the effectiveness of the system for selecting and implementing innovative developments in agricultural organizations. The most important results containing scientific novelty are:

- Considering conditions of the industry, the author gives definitions for the terms of "innovation", "innovation process", ensuring their effective management;
- Author gives argumentation for reasons behind the underdevelopment of non-food agribusiness as a potentially profitable industry;
- A comparative analysis of the food consumption level per capita and the level of wages in the agro-industrial sector based on the subsistence minimum was carried out;
- The main directions of livestock production in the agro-food market, livestock productivity and the reasons for the lack of feed were determined;
- trend models to analyze and forecast some indicators of the agro-industrial industry and an econometric model that describes the dependence of the volume of production of the agro-processing industry on such indicators as: the volume of investments, value added, innovative products and the value of fixed assets in the industry were designed; forecasts were developed for these indicators for year of 2025;
- efficiency from the introduction of organic products used by the population, as well as agricultural production of innovative

developments based on digital technologies were scientifically proved and economic efficiency was calculated;

- a schematic diagram that reflects the role of high-tech clusters and techno-parks in shaping the innovative activity of the agro-processing industries, as well as a fundamental organizational chart for the work of an agro-industrial sector operating on the principle of a value chain have been developed;

- the perspectives for the development of innovative infrastructures in the agricultural sector of the economy up to 2030 were determined;

- the structure of the innovative mechanism of the country's agro-processing industry is proposed while the main directions of its development highlighted;

- the factors hindering the development of innovative processes, taking into account the added value, have been identified, the profitability of the production and harvesting of walnuts has been calculated;

- the positive and negative factors of Azerbaijan's entry into the WTO were determined, specific characteristics were highlighted;

- for the sake of assessment of the innovative activity levels in the regions of Azerbaijan, manufacturing industries are classified into low, medium and high-tech industries, whereas the analysis revealed that most enterprises in this industry are low-tech.

The theoretical and practical significance of the study lies in the development of the main directions and specific recommendations, the use of which will improve the development of innovative processes, both in the public administration system and at the level of individual organizations in the agro-industrial sectors. The theoretical basis of the study lies within the works of domestic and foreign scientists-economists who researched the problems of the theory of innovation, innovative activity, development of innovation processes in the agro-industrial sectors, special and general economic literature, encyclopedic sources, periodical literature.

The recommendations and conclusions drawn in the dissertation can be used in several directions.

a) As a theoretical basis for further research of problems in the development of innovative processes in the agro-industrial sectors,

b) To make a set of applied recommendations to the State Statistics Committee on the implementation of innovations in agro-industrial enterprises necessary to improve the efficiency of agricultural production through accelerated implementation of innovation based developments in production, creation of competitive products at all stages of production.

Testing and implementation of the results. The main provisions, theoretical summary, practical dissertations, determined in the course of this research work, were laid down in the following republican and international conferences:

a) at the 8th international scientific and practical conference "Actual issues of technical, economic and humanitarian sciences" (Georgievsk, 2012);

b) International Scientific and Practical Conference "World Science and Modern Society; actual issues of economics, sociology and law" (Saratov, 2013);

c) International Scientific and Practical Conference "Education, Science, Business: Development and Prospects" (Saratov, 2013);

d) 4th International Conference "Development of Science in the XXI century"(Kharkiv, 2016);

e) 8th International Scientific and Practical Conference "Economics and Jurisprudence: Theory and Practice" (St. Petersburg, 2016);

f) 8th International Scientific and Practical Conference "Science in the Modern World" (Kyiv, 2016);

g) International Interuniversity Congress "Higher School": Scientific research (Moscow, 2020);

h) International Scientific Forum: Science and Innovation, Modern Concepts (Moscow, 2020);

i) 7th International Scientific and Practical Conference (Simferopol, 2020);

j) Interuniversity International Congress "Higher School": Scientific Research (Moscow, 2021);

k) Kazan International Congress of Eurasian Integration - 2021 (Kazan, 2021).

In addition, the results of the research within the topic of this dissertation were accepted and approved by the State Agency for the Protection of Intellectual Property of the Republic of Azerbaijan, registration number 04/C-11795-21 dated 05/21/2021.

The dissertation work was carried out at the Center for Agrarian Research under the Ministry of Agriculture of the Republic of Azerbaijan.

The volume and structure of the dissertation. The total volume of the dissertation work is 464,722 characters. Chapter I - 74,194 characters; Chapter II - 102,950 characters; Chapter III - 104,982 characters; Chapter IV - 91,072 characters, conclusion - 14,800 characters; list of used literature - 31,007 characters. The volume of the dissertation without tables and figures, as well as the list of references is -415,961 characters.

SUMMARY OF THE WORK

In the first part of the dissertation investigates the theoretical foundations of innovations and sectoral features of the agro-processing industry. While exploring ways to improve the efficiency of innovation and determine methods for its evaluation, it should be considered that science today determines not only the process of social development, but also the conjuncture of the techno - sphere, the environment, as well as the direction of the evolution of humanity as a whole. The dynamics of scientific and innovative development is largely depends on how transfer of knowledge and technology is being organized. These processes are generally called "technology transfer". The term "technology" refers to not only production processes, but also processes of social development, market relations, management in the political sphere, etc. It is obvious that an attempt to understand the methodology of technological transfer requires methodological study of not only the technogenic core of this process, but also study of side - effects and infrastructure.

A "chaotic" technology transfer cannot always play a positive role in ensuring the necessary rates of the country's economic growth. It is essential to consider that the transfer, purchase, sale of technologies becomes an effective factor in economic growth only if the corresponding actions are performed with consideration of the national priorities of scientific, technological development and innovation activity. Since not all positions of national priorities can be realized through national innovation, scientific and technological potential, it is necessary to include mechanisms for the transfer of technologies within the country, as well as between countries, in the interstate technology market. Technological exchange or transfer of technologies is perceived as a fairly wide range of both interstate and domestic economic relations of a market origin. In particular, it could be the purchase and sale of patents, licenses and know-how, trade in goods, the provision of services such as "engineering", preparing specialists in civil and military specialties for the required qualification level and etc. It can be also perceived as the transfer of technology, which is formalized by an agreement between two or more individuals or legal entities. As a result of this agreement, the property rights and obligations of the subjects regarding the transferred technology go through a change.

An analysis of the nature of these processes and mechanisms indicates that technology transfer under certain conditions can become a source of a chain reaction for the manifestation of factors that contribute to the innovative development of the economy. Examples of such factors are: accelerated replacement of obsolete technologies and equipment, automation and computerization of scientific research, automation of design and construction of production processes, etc. The "chain reaction" effect associated with the abovementioned factors is prompted by two facts. On the one hand, solving the problem of accelerated equipment renewal requires automation of the development cycle of new technologies, and on the other hand, automation is a tool that makes it possible to fundamentally accelerate the transfer of scientific achievements to production. Which leads to accelerated process of transition to an innovative model of economic development.

Based on the achievements of science, the process of systemic interaction and interconnection of various technologies leads to the emergence of the “effect” that has a multiplier nature. This means that any innovation (particularly technologies) introduced in a certain part of the production system stimulates innovations in other parts of it, as a result of which the economic efficiency of innovation is constantly growing and multiplying. The overall effect from the innovative overload in complex technological systems has a pronounced synergistic nature, which significantly exceeds the total effect of the innovative development of individual parts of the system. The multiplier effect from technology transfer has an integral core and therefore contributes to a positive economic effect in production, which is usually accompanied by positive shifts in the development of education, science and in the social sphere generally. Presence of such effects allows to assert that in a market economy, scientific and technological progress becomes the main factor contributing to the most rational use of human, material and financial resources, and allows the most efficient use of economic, political and social levers of control. This in turn enables us to take a fresh look at the general economic environment as a whole, understand the priority needs for legislative regulation economy-wide and optimize the corresponding structure of legislative and regulatory state acts. Since the majority of agricultural processing enterprises are small businesses, they usually face a high dependence on the external environment and experience serious risks associated with financial investments and innovations. The growth of business’s scale increases its stability and level of innovative activity, however, surveys have shown that small manufacturing companies in the regions have practically no incentives and resources for business consolidation. All this creates an insurmountable barrier to increasing the production of innovative products, and, as a rule, local resources of regional innovation systems are not enough to overcome this barrier. To eliminate these shortcomings, it is necessary to apply a project approach involving the resources of an innovative infrastructures’ network. In this regard, we have attached a schematic diagram of interaction used to applying the project approach

To transfer micro, small and medium-sized enterprises of the agro-processing industries to an innovative path, it is necessary to solve managerial problems caused by a lack of their own competencies. It seems that with the creation of the Center for Transfer and Commercialization of Innovative Technologies in the system of agrarian processing industries, this problem can be resolved.

The second part of the dissertation discusses and analyzes the current state of the agro-processing industry. The agricultural sector is one of the key sectors of the Azerbaijani economy that can ensure food security and sustainable development of rural areas. According to the State Statistics Committee, for the years of 2015-2020 the total number of enterprises in agricultural sector increased by 6.6 times, or by 54 thousand units, and in the manufacturing (processing) industry by 7.2 times and by 35.9 thousand units respectively. Over the years, 5755 units of new enterprises were created in these two areas with the simultaneous termination of 369 enterprises. As a result, the share of liquidated enterprises in two areas amounted to 4.5% (Table 1)

Table 1. Demographics of enterprises in agricultural and manufacturing fields in Azerbaijan

Years	In agricultural sector			In manufacturing (processing) sector			Share of terminated enterprises in two areas (in %)
	Total number of enterprises	Created within a year	Terminated within a year	Total number of enterprises	Created within a year	Terminated within a year	
2015	9561	333	24	5799	206	29	0,9
2016	9977	452	48	6125	356	40	1,2
2017	10436	538	35	6454	395	34	0,8
2018	10775	498	34	6979	561	39	0,9
2019	11192	475	36	7820	836	17	0,5
2020	11553	369	13	8500	736	20	0,3
Total for 2015-2020	63494	2665	190	41677	3090	179	4,5

Source: The table was compiled and calculated by the author on the basis of monthly statistical data collection of the State Statistics Committee "Social, economic growth" for 2015-2020.

During the specified period, the number of agricultural - processing enterprises significantly increased and by the end of 2020

reached 862 units, of which 56.5% are engaged in the production of food products; 15.2% - drinks; 13.0% - garments; 10.3% - textile industry; 3.5% - in the production of leather, leather goods and footwear, and 1.5% - in the production of tobacco. Of the total number, 59.2% are micro, 20% are small, and 20.8% are medium and large enterprises.

Calculations showed that the share of micro and small enterprises in the fields of agrarian processing industries, with the exception of enterprises for the production of tobacco products, ranges from 69.7% to 92% (Table 2)

Table 2. Number of functioning agro-processing enterprises in Azerbaijan sorted by categories in 2020

Name of sub-sectors	Total	Of them:			Share of micro and small enterprises (in %)
		Micro	Small	Medium and large	
Food production	487	289	87	111	77,2
Beverage production	131	70	37	24	81,7
Tobacco products	13	7	-	6	53,8
Textile industry	89	47	15	27	69,7
Garment industry	112	80	23	9	92,0
Manufacture of leather, leather products and footwear	30	17	10	3	79,1
Total for the agro-processing industry	862	510	172	180	

Source: Compiled and calculated by the author on the basis of data from the statistical collection "Industry of Azerbaijan". Baku "State Statistics Committee", 2021, p.15

The data provided sheds light on that fact that with a high proportion of micro and small enterprises, it is difficult to implement a set of organizational and technological measures to increase innovation activity. Project approach or the implementation of startup projects should be considered as an exception. Consequently, demographic condition described above negatively affects the production of innovative products, as well as the overall performance of the agro-processing industries. At the same time, the main performance indicators of agricultural production and the efficiency of agricultural producers signify the need to take additional measures to increase the volume in the production of competitive agricultural products. According to official statistics from 2020, 90% of the total agricultural production accounts for the share of individual

entrepreneurs and family farms, whereas agricultural enterprises comprise on 10%. Calculations have shown that almost the same ratio is replicated in livestock and crop farms (Diagram 1.)

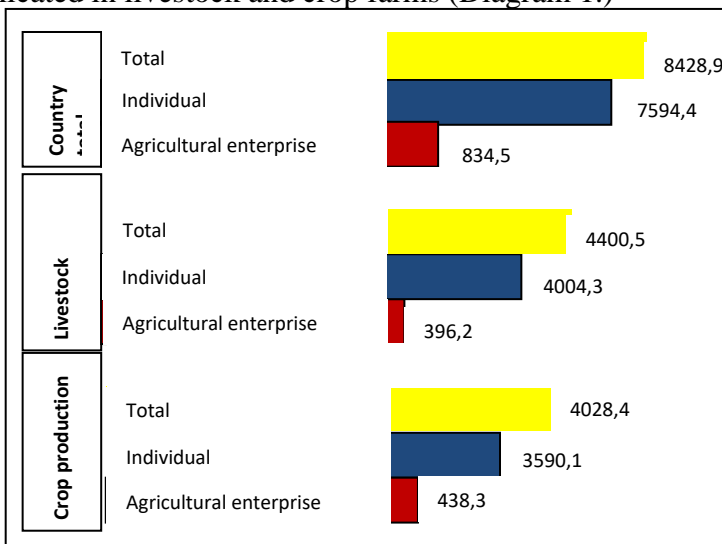


Diagram 1. The volume of agricultural products by category of farms, in 2020, (million azn) [25, p.27]

As can be seen from the data in Table 3 the share of the population employed in agriculture decreased from 38.7% in 2005 to 36.3% in 2020.

Table 3. The share of agriculture in the innovative economy (in %)

Indicators	2005	2010	2015	2016	2017	2018	2019	2020
Share of the population employed in agriculture	38,7	38,2	36,4	36,3	36,4	36,3	36,0	36,3
Share of agriculture in GDP	9,1	5,5	6,2	5,6	5,6	5,2	5,7	6,9
Share of investments in agriculture	0,7	4,4	2,2	2,1	3,5	4,4	4,2	3,1
The share of fixed assets in agriculture in their total volume	8,8	7,6	5,1	4,1	3,9	2,9	5,6	3,6
The level of wages in agriculture to the average in the country	33,6	48,3	52,6	50,7	49,4	43,0	51,0	61,2

Source: Table was compiled by the author based on State Statistics Committee data for 2020.

The share of agriculture in GDP also decreased over the specified period from 9.1% to 6.9%. However, the share of

investments in agriculture increased from 0.7% to 3.1%. Despite the increase in the share of investments in agriculture, the share of fixed assets in their total volume decreased from 8.8% to 3.6%. The level of wages in agriculture during this period increased from 33.6% to 61.2%. As noted, agriculture is an important source of food supply for the population.

However, agricultural production in a number of industries is lower than per capita consumption. In accordance with the standards adopted by international organizations, in order to ensure the country's food security, the share of imported food in total consumption should not exceed 20%. In Azerbaijan, the share of food imports for some types exceeds this indicator. Meat consumption per capita can to a certain extent show the degree of development of agriculture in general and indicate the standard of living of the population, since food category is considered as one of the most expensive food products. According to the threshold values in recent years have been consistently exceeded only for five types of products - cereals, sugar, vegetable oil, vegetables, melons and fruits; the population is significantly undernourished expensive food products, replacing them with cheaper ones. For other types of food, numbers are as follows: meat 58.5%, milk and dairy products 76.8%, eggs 63.4%, fish and fish products 42.2%, potatoes 86.3%; there is a shortage of food. Poverty criteria in different countries differ significantly. For example, in European countries, the criterion of poverty is the average wage (for example, if the wage of an employee is less than the national average per 1 employee, then this family is considered poor). There are three concepts of poverty: absolute, relative and subjective. Absolute poverty is a situation when a person is not able to satisfy even the minimum needs for food, clothing, housing, nor is able to satisfy only the minimum needs that ensure biological survival with his income. Relative poverty is a situation where a person is not able to maintain some standard of living accepted in a given society (in relation to other people). Subjective poverty is based on personal assessments of people who feel that they do not have enough to live on, whereas they determine the level of poverty for themselves.

In 2005, the share of wages of agricultural workers in the average wages within the republic amounted to 33.7%, while in 2020 it accounted for 61.2%, which characterizes positive change in the standard of living of rural residents.

In developing countries, the poverty threshold is set at \$2 a day per person, while in underdeveloped countries it is \$1. In Azerbaijan, the level of poverty is determined by the value of the consumer basket (the cost of which is constantly changing as a result of inflation). If the consumer basket value per 1 member of the family is less than the subsistence minimum, then the family is considered destitute, and if at the level of the subsistence minimum, then poor.

Poverty criteria in different countries differ significantly. For example, in European countries, the criterion of poverty is the average wage (for example, if the wage of an employee is less than the national average per 1 employee, then this family is considered poor). In the United States, the poverty threshold is determined by the cost of a consumer basket equal to \$ 300 per month per person. Meat consumption per capita can to a certain extent show the degree of development of agriculture in general and indicate the standard of living of the population, since food category is considered as one of the most expensive food products.

Despite the fact that milk yield increased by 3.3%, milk production in 2019 accounted for only 217 kg, which was not a fulfilling result, since per capita consumption was at the level of 246 kg. The same applies to meat, where per capita consumption in 2019 was 41 kg, and volume produced summed up to 34 kg (7 kg of underconsumption), fish and fish products produced 6.4 kg, while consumption was 7.6 kg. In regards to the State Statistics Committee, the number of cattle in 2015 and 2019 amounted to 2669.2 and 2601.9 thousand tons accordingly (which shows a decrease of 0.9%). Imports for the same years amounted to 5059.3 tons and 8810.5 tons respectively (increased by 1.7%), poultry meat increased by 5.1%, which in actual numbers makes 7372.7 and 37713.4 tons respectively.

The meat products market holds a special position in the country's economy, since it represents the economic interests of not

only producers, but also consumers. At the same time, it is a fundamental food category when it comes for ensuring the country's food security, which gains a special importance in the framework of import substitution. As for the meat market across the country, tariff protection plays an important role in its stability and saturation with locally produced products, which is widely implemented practice in foreign countries. For example, in Switzerland the import duty on beef is 270%, while in Azerbaijan - only 15%. Preferences granted to a number of countries (Georgia, Ukraine, Brazil, India, Paraguay, Uruguay) lead to losses for domestic producers.

Uneven provision with technological equipment is one of the pressing problems of the industry: there is a tendency to increase processing capacities, while the growth in the production of cattle meat is insignificant. Therefore, industry face a situation when modern processing complexes are not fully exploited due to the lack of raw materials. For the development of the industry, it is necessary to reorient investments in the production sector: create additional conditions for increasing the number of specialized beef cattle herds. Beef production using specialized livestock breeds is many times more efficient in terms of transforming feed into high-quality meat. In the leading beef producing countries, beef cattle make up about 80-90% of the total structure.

A significant increase in the efficiency of the process in current conditions can be achieved through the organization of mass production lines and the mass use of rod conveyors. Rod conveyors have a number of advantages in comparison with other equipment - their cost and energy density are lower, reliability is higher, they provide manure evacuation of any humidity. The use of integrated mechanization and resource-saving technologies will ensure the production of high-quality products with a unit cost of working time as follows: per 1 centner of milk 1.0-1.5 man-hour, livestock growth - 5.0-6.0 man-hour, profitability of production not lower 25-30%.

In recent years, the terms "innovation" and "innovativeness" and their other interpretations are widely used in agricultural enterprises and reports without sufficient understanding of their essence and meaning. It is quite often that minor improvements in

machine designs, replacement of one model of equipment with another without a deep analysis of its impact on the economy, production efficiency, are considered innovative. Indicators of innovative technology are those, which inflict the increase in production, improve product quality, reduce costs, increase crop yields and animal productivity, the duration of the productive use of cows, etc.

At the same time, the growth of agricultural production demands an increase in the use of basic production resources. Qualitative development of the resource potential, which can be implemented only on an innovative basis, is as important as a quantitative increase in resources for production. For more than ten years, 60% of tractors, 45% of grain harvesters and 43% of forage harvesters have been in operation. At present the acquisition of new tractors, combines and other equipment is 1.5-2 times less than the write-off of old machines, as a result of which there is an annual absolute reduction in the number of units of equipment used in agricultural production. So, according to the commonly accepted standards, 1 tractor usually serves 50 hectares of land suitable for sowing, but in fact in 2019 1 tractor served 59 hectares (2056.5:35). Here, 35 (thousand) shows the number of tractors units, and 2056.5 (thousand ha) shows the total area of land suitable for sowing, If we divide 2056.5 by 50 hectares it equals to 41 which indicates the number of tractors (thousand) required according to the standard, i.e. 6 thousand tractors are missing. And this shortage affects the irrational use of equipment and timely sowing and harvesting. The agro-processing industry adds value through recycling, providing longer product shelf life and reducing waste. Locating these industries in industrial parks in rural areas, closer to farms, can improve efficiency and create non-agricultural jobs in rural areas.

The main results of the econometric models are presented in Table 4.

According to the constructed trend models, it can be argued that in the period of 2000-2019 in the studied industry:

- Over the years, the volume of production grew by an average of 9.59% per year (in current prices);

- The volume of fixed assets grew by an average of 7.58% per year (in current prices);
- The volume of investment grew by an average of 15.58% per year (in current prices);
- The volume of added value created in the industry grew by an average of 11.68% per year (in current prices);
- The volume of innovative products decreased by an average of 48.23% annually from 2011 to 2019.

Table 4. Information base of a number of indicators of API, million AZN (in current prices)

Years	Volume of agro-industrial products	Investments in API	The volume of fixed production assets	Volume of innovative products	Volume of added value
2000	736,6	41,0	6943,3	-	-
2001	811,2	15,6	7884,3	-	-
2002	839,3	7,2	9110,2	-	-
2003	1063,4	13,5	11380,7	-	-
2004	1098,6	81,3	14198,9	-	-
2005	1265,8	42,8	1022,9	-	254,8
2006	1374,9	63,4	985,7	-	224,0
2007	1509,8	83,3	1071,1	-	282,0
2008	1669,6	82,0	1448,4	-	302,9
2009	1794,1	73,7	1615,8	-	540,8
2010	2225,7	96,4	2084,7	-	582,7
2011	2452,5	220,6	2186,7	3,9	644,4
2012	2923,1	203,1	2169,2	18,2	724,6
2013	2742,0	214,9	2139,8	8,9	719,2
2014	2879,1	190,9	2274,7	7,0	757,3
2015	2742,4	162,7	2344,8	0,7	719,7
2016	3543,4	96,8	2617,8	18,5	830,9
2017	3738,0	200,5	2651,3	0,5	959,6
2018	3914,2	400,1	2711,4	0,8	993,6
2019	4874,9	322,9	2919,5	0,3	1224,3

Source: official data of the State Statistics Committee of the Republic of Azerbaijan [25].

Based on the constructed trend models, forecast values for a number of indicators in the specified industry for 2020-2025 were built. Data presented in Table 5.

The regression equation describing the dependence of the volume of agricultural processing products on the volume of fixed assets and investments can be interpreted as follows:

- increase in the volume of fixed assets in the industry by 1 million AZN will lead to an increase in the production of agro-processing industries by 0.054%;
- An increase in investment by 1% will lead to an increase in production by 0.10% with a delay of 1 year;
- changes in the volume of fixed assets and the volume of investments cause changes in the volume of industry products by 95.93%.

Table 5. Forecast values of a number of indicators of API, (million AZN) at current prices

Indicator	2020	2021	2022	2023	2024	2025
Volume of products in API	5750,44	6329,84	6967,62	7669,66	8442,44	9293,09
Volume of fixed assets in API	3675,90	3965,51	4277,92	4614,94	4978,52	5370,74
Volume of investment in API	516,42	603,48	705,21	824,10	963,03	1125,38
Volume of value added created in API	1475,91	1658,78	1864,30	2095,29	2354,91	2646,68
Volume of innovative products	0,16025	0,09893	0,06108	0,03771	0,02328	0,01437

Source: The table was composed by the author on the basis of trend models for a number of indicators of API

Modern business task management often requires the development of extraordinary solutions, which are based on accurate mathematical calculations. Practice shows that those entities, which widely use mathematical modeling tools in the areas of production and labor organization, marketing, financial and economic assessment and regulation, production and technological planning, anti-crisis management and strategic forecasting achieve great success and occupy leading positions in different business environments.

These trends have recently become particularly popular and promising in the field of API. Modern scientific research in the agro-processing industry is increasingly based on various mathematical calculations. In practice, economic and mathematical models are of particular importance. These methods and approaches have gained special value and distribution in the production field. However, in present conditions of production and economic activity, more and more sectoral economic entities face challenges in applying mathematical models in order to improve the efficiency of

investment resource management. Trend models, based on econometric modeling, were built for the following indicators:

- products of the agro-processing industry;
- volume of fixed assets;
- volume of investment;
- value added.

The third part of the dissertation determines the directions for the implementation of innovative activity in the agro-processing industry. To this point, the industry was studied, analyzed in detail as well as specific steps proposed to improve innovative activity in the regions for the production of value-added products. A necessary factor in the development of organic agriculture is the availability of an efficient system of certification bodies. It should be noted that from the point of view of distribution and impact on health, the most dangerous food contaminants are toxic metals, radionuclides, pesticides, their metabolites and their metabolic decay products, nitrates and nitrosamines, polycyclic aromatic hydrocarbons, growth stimulants of agricultural animals (hormones, antibiotics) and other compounds. The share of products that do not meet the requirements of the regulatory documents according to which they are produced remains high and tends to grow. One of the reasons for the occurrence of this situation is that the process of pre-certification of products is carried out by the enterprises themselves, companies and firms, which must submit a whole bunch of documents related to the consumer properties of exported products (physical and chemical characteristics, composition, safety requirements, term validity, etc.) to the certification body.

In addition, the modern practice of trade relations, as a rule, includes evaluation and verification of supplier's quality management system by the customer, which is considered as an additional guarantee of the stability of the quality of supplies. At the same time, the quality system must comply with the international ISO 9000 standards, which represent a modern level of quality management and include a list of proven elements necessary to ensure quality.

It should be noted that the certification process in Azerbaijan has been liberalized since 2012 and, according to international certification, is carried out by private structures. Today, the number of such companies in Azerbaijan is thirty. Each of them issues certificates for goods and services in a specific area. For example, Azsert specializes in the certification of food products, Texnosert - goods and services in the field of construction and engineering. The enterprise itself provides the certification body with data (physical and chemical characteristics, composition, safety requirements, shelf life, etc.) for products, i.e. the manufacturer himself decides whether his products will comply with international ISO standards or not. Further, the verifying party conducts laboratory studies of product parameters and, if they comply with the declared characteristics, then issues a certificate with which a certified company can enter foreign markets. The private company issuing such a certificate takes the responsibility to coordinate product safety issues with the Ministry of Health.

An increasing number of farms in the United States, Japan and across all EU countries began to run their farms on the basis of an environmental recommendations. This technology of farming acts as an alternative to traditional (industrial) farming. As for the prospects and the market for organic products in Azerbaijan, the demand for such products is satisfied for only 10%. According to the State Statistics Committee of Azerbaijan, 55% (4.74 million hectares) out of the total territory of Azerbaijan (8.64 million hectares) are agricultural lands. Azerbaijan is among the countries with limited land resources. Although the land and climatic conditions of Azerbaijan allow expanding the areas of land to 3.0-3.5 million hectares, the implementation of this idea is not possible due to lack of water resources. According to the UN, organic farming increases farmers' incomes by up to 300%, even with reduced productivity. As a rule, organic agriculture is a closed production cycle where manual labor is used. Farmers do not depend on the supply of antibiotics, growth hormones, plant protection chemicals, fertilizers, which makes their farms more sustainable. There are some challenges in adopting organic production methods.

Firstly, the high cost of organic agricultural projects. The financial costs required for the introduction of these technologies are estimated at \$200-1000 per 1 ha for cereals and \$5000-8000 per 1 ha for fruit cultivation. Secondly, the lack of certified land (comprise only 0.002% of the area of all agricultural land). Thirdly, the increase in time spending and costs for the production of environmentally friendly products, which are several times higher than the time expenses for the production of conventional products (for example, it takes 2 years to grow organic wheat, and 6 months to breed organic chicken). Fourthly, pre-sale preparation of goods, their storage and shipment. Since the volumes of organic products are still relatively small, it is necessary to ensure that there is no risk of mixing them with other non-organic products. As for the prospects and the market for organic products in Azerbaijan, the demand for such products is satisfied for only 10%.

Textile 0.4% - 0.6%, tobacco - 0.36% - 0.5%, clothing - 0.2% - 0, 2%, leather - 0.05% - 0.05%, wood products - 0.1% - 0.1%, paper - 0.04% and 0.2% (for the mentioned years respectively).

It should be noted that more than 90% of irrigation and drainage-collector networks run along earth channels and are open-type networks. Cases of significant water loss, rise of mineralized groundwater to the crop layers and salinization of adjacent lands are usually faced. In addition, in agriculture, traditional methods of "surface" and "flood irrigation" are used as the main method of irrigation. The introduction of Geographic Information Technologies (GIS technologies) can help in solving this issue. The use of GIS system will increase productivity, reduce the cost of agricultural production, reduce risks from dangerous environmental situations, and stabilize the financial condition of agricultural producers. An example of GIS technologies usage is the use of a drip irrigation system. This technology works as follows: special sensors are installed in the soil that send data on the condition of soil moisture. As soon as a lack of moisture is detected, the computer automatically turns on the irrigation system. The use of this irrigation technology allows minimizing costs and obtaining the maximum benefit from reclaimed lands, primarily saving water resources, as well as

avoiding an excess of moisture in the soil, which can lead to crop death. Another example that needs to be implemented in API is the use of a navigator systems for agricultural machinery. It might be useful when spraying plants, applying mineral fertilizers, measuring the distance traveled, maintaining cultivated areas, measuring agricultural areas in the course of land processing.

In agriculture, crop losses are very common due to an overabundance of various chemicals, or a lack, since without the use of GIS technologies, agricultural machinery is physically unable to track strips treated with solutions. Therefore, a situation is inevitable when some part of the crop will be processed several times, and some part of the crop will not be sprayed and fertilized at all. This situation leads to various yield losses depending on the processing error. In this case, it is possible to trace the irrational use of materials used in spraying or fertilizing. Accordingly, the cost of production increases, and the profits of agricultural producers are reduced. The use of GIS technology allows minimizing costs and increasing the profitability of products.

Considering aforementioned information, it would be advisable to conduct monitoring and qualitative assessment of agricultural land in the liberated territories of Azerbaijan in order to determine the possibility of their use in organic agriculture and assess the duration of the conversion (transition) period using GIS technologies. Geo Information technologies (GIS) make it possible to carry out full-fledged monitoring studies with the combination of all the indicators of interest. It should be noted that maps of soil-agrochemical indicators compiled in GIS most fully reflect the level of development of soil-forming processes, especially in conditions of complex terrain. As a result of conducting agro-ecological survey, farmers will receive information that allows them to assess the potential of lands, determine the real boundaries of land use and increase the agronomic efficiency of production in general. Efficiency is achieved by increasing the biological activity of the soil. As a result of a decrease in the volume of organic and mineral fertilizers, a decrease in the natural fertility of soils occurs. Unfortunately, no statistical bulletins mention the share of organic

products in the total volume of agricultural production nor there is data about organic consumed by the population. Thus, in the EU countries, farmers are motivated to engage in organic production by receiving 900 euros per hectare, depending on the type of crops grown, while traditional agriculture is subsidized at the rate of 300-400 euros per hectare.

Studies show that a 1 percent increase in a person's height results in a 1.4 percent increase in productivity, while a 1 percent decrease in the example of iron, results in a 1 percent decrease in average productivity. In other words, exporting products to export markets without assessing and using the value-added potential of products will bring more benefits to global companies operating in world markets than to the actual producers.

Farmers and their families are forced to meet their most basic needs considering their small incomes. However, in the context of the value chain, balancing the income of farms and household plantation will also aid and increase their ability to optimize their diets and adhere to basic nutritional criteria, as well as the availability of food. It is known that the workers of the agricultural sector of other countries not only have a stable and reliable protector in the face of the government (state support for Western farmers is 330 euros per hectare of arable land, while in Azerbaijan - in some farms - 6-10 dollars per hectare of arable land), but also domestic farming entities, contributing to the formation of added value. It would be fair to ask if the growth of the country's export potential justified? The answer is unequivocal - justified if we want to have a competitive agricultural sector and integrate into the global agricultural market. But it is necessary to increase exports promoting goods of deep processing, getting added value and creating jobs in your country. The export potential of agriculture and food products of the regions of Azerbaijan is mainly consists of hazelnuts, chestnuts, saffron, olives, but can be supplemented with olive oil, various jams, the cultivation, collection and processing of which will also contribute to solving employment problems and developing territories. One of the most popular crops for export is persimmon. This tasty and healthy fruit does not grow in many countries, so in

other countries it is quite exotic. For the six months of 2020, Azerbaijan exported 17,947 tons of fresh persimmons worth \$26 million, which is 30% less than in the same period in 2019.

If funds are available, imports are the most accessible way to eliminate the accumulated backlog and increase the competitiveness of domestic production in a relatively short time. If domestic production achieves competitiveness, it displaces imports in the domestic market. There is an opportunity for the development of exports. Azerbaijan is a country of great agro-food potential. Exports are dominated by fruits - 336.3 thousand tons, vegetables - 221.2 thousand tons, potatoes - 61.7 thousand tons. The main import products in Azerbaijan in 2019 are: mineral fertilizers 335553.0 thousand tons, cattle meat 8810.5 tons, potatoes 193016.70 tons, fruits 110327.1 tons, vegetables 19457.8 tons, canned fruits and vegetables 20265.7 tons, rice 48654.6 tons, tea 14095.9 tons, corn 71068.9 tons, vegetable oils 141474.0 tons, poultry meat 37713.4 tons, fish 37713.4 tons, milk 9022.7 tons, eggs 20576.0 thousand pieces etc. Despite the fact that a carbamide plant for the production of mineral fertilizers has been opened in Sumgayit, however, farmers prefer foreign saltpeter to domestic carbamide. According to the Ministry of Agriculture of Azerbaijan, in 2019, the resource dependence of domestic agricultural production on imported tractors was 66%, grain harvesters - 21%, forage harvesters - 21%, sugar beet seeds - 75%, corn - 45%, sunflower - 44 %, vegetable crops - 34%. High import dependence of agricultural production is observed not only in terms of machinery and seeds, but also in such structural elements of the resource potential as plant protection products, feed additives, genetic material, veterinary drugs, ingredients for the food industry, without which sustainable development of production and provision of innovative models of functioning of the agro-food complex is impossible. One of the most important indicators of the inclusion of the national economy in the international division of labor is the import intensity. This term has several definitions. First, the import intensity of GDP is the ratio of the volume of imports to the volume of the country's GDP.

Given the limited possibilities for increasing production quantitatively in the API, the task of transitioning agriculture to a new quality of economic growth, i.e., increasing production per unit of resources expended, comes to the fore. As the extensive growth factors of agricultural production are exhausted, the role of qualitative transformations and the introduction of fundamentally new technologies for tillage and crops, new types of machinery and equipment, expanding the chemicalization of agriculture while reducing the environmental impact on the environment, increasing the productivity of the livestock sector and the use of high-quality feed increases. Under the conditions of climate change on the planet, great demands are placed on such characteristics as resistance to adverse natural factors, especially droughts, diseases and pests, the efficiency of individual crops or technologies in the use of water and other resources, the digestibility of nutrients, the high quality of agricultural raw materials in terms of content protein, trace elements, oils. In the conditions of limited resource potential of agriculture, the task of stabilizing and growing agricultural production can only be carried out on an innovative basis. The problem of increasing the resource potential of agricultural production, introducing innovations is aggravated in the face of a depreciation of the manat against the dollar and the euro. Instead of modernization, in many cases there is a process of transition to the production of lower quality finished products or individual components, which affects the entire production chain. This is due to the fact that many API sub-complexes are highly dependent on imported technology, which leads to an increase in the cost of imported machinery, equipment, spare parts, and other production components.

Solving the problems of ensuring food security and import substitution of food products, increasing the volume of production in agriculture determine the entry into world markets, the development of exports of agricultural products and foodstuffs from Azerbaijan. It is also explained by the urgent need for import substitution, the dominant importance of the agricultural sector in the structure of the economy at the macro level, and the constant need of the population for food. It should be noted that food accounts for approximately

30% of all goods and services that determine the consumption of the population and are called household consumption in the system of national accounts. This is more than 15% of the value of GDP.

Today, 70% of the international trade turnover of agricultural products in value terms falls on ready-to-eat products and only a third of goods that are agricultural raw materials for further processing. At the same time, global trends require an increase in production opportunities and further exports of precisely finished products and, thereby, a simultaneous decrease in the share of agricultural raw materials in international trade. In the structure of domestic agricultural exports from international promising areas of development, the situation is completely opposite. The vast majority of exported goods of agricultural origin are presented in the form of raw materials and products of low level of processing.

In the fourth part of the dissertation, the author proposes a scheme of innovative activity of the regions in the agro-processing industry, low, medium and high-tech industries in these regions, the development of proposals in this regard is an important element of technology transfer to the agro-processing industry in the new economic conditions of digitalization.

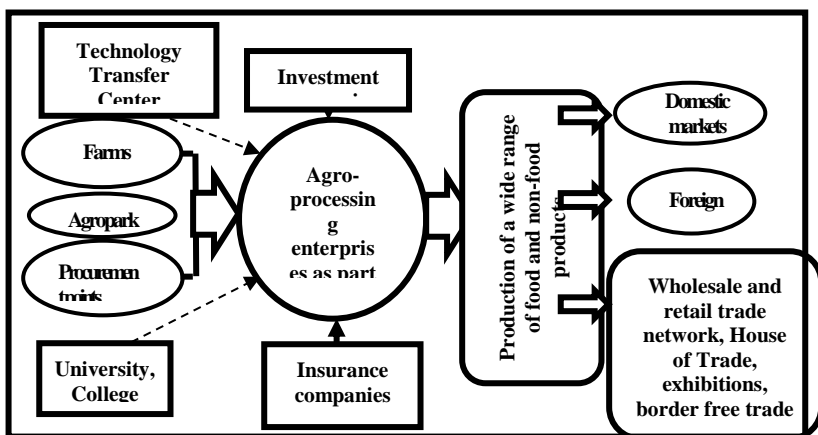
Taking into account the differences between regions in terms of the level of socio-economic development, the highest innovative activity is acquired by those regions in which medium and high-tech industries of the manufacturing industry are effectively implemented. It should be noted that the agro-processing industry is characterized by the fact that its products are mainly low-tech production. As for medium and high-tech production, these technologies produce most of the equipment for agro-processing production. From this point of view, it is necessary to increase medium and high-tech production. However, it should be noted with regret that the share of medium-tech production in 60 regions and cities of Azerbaijan is 11.8% and high-tech production is 5.0%. The share of high-tech production in the country's GDP in 2019 amounted to 1.1%. (965.1 thousand AZN). The cost of innovation in the agro-industrial sector in 2019 amounted to 27.8 thousand AZN, and the value added in the entire industry in the same year amounted to 33845.0 million AZN. If we

calculate the share of costs for innovations in the agro-processing industry in value added, then in 2019 it amounted to 0.08%. Today, in order to be a competitive economy, it is necessary to create a highly skilled workforce, develop high-tech production and produce

In this regard, labor productivity in APO in 2019. amounted to 75 manats (the value added of food in 2019 amounted to 746.5 million AZN / population 9981.5 people), the share of the value added of APO formed in GDP was 0.9% in the same year. Taking into account the differences between regions in terms of the level of socio-economic development, the highest innovative activity is acquired by those regions in which medium and high-tech industries of the manufacturing industry are effectively implemented.

As an assessment of the level of innovative activity of the regions of the republic in these regions, the manufacturing industries are classified into low, medium and high-tech industries. Here there are different methodologies of a number of countries for the classification of manufacturing industries and the criteria for their evaluation - low, medium and high-tech industries.

The total volume of the low-tech industry in 2019 amounted to AZN 5200.9 million, of which -3298.1 million AZN fell to the share of the food industry in all regions in 2019, the share of the food industry in low-tech industries amounted to 173.3 %. This suggests that the low-tech industry is formed mainly through food production. To this it must be added that in some regions, in general, other than food production, no other products are produced. In the total volume of low-tech production, the share of leather and fur products is AZN 13,569.4 million, or 0.7%. Processing of leather and wool of livestock production is not actually used. The reason for the insufficiently high degree of integration of this industry lies in the cost structure for technological innovation. In 2005, by types of innovation, 3.9 million AZN were spent on the agro-processing industry, and in 2019 - 27.8 million AZN - all costs amounted to the production of the tobacco industry, however, the profitability of tobacco in 2019 amounted to only 51%. Azerbaijan mainly exports raw products rather than highly processed products with high added value.



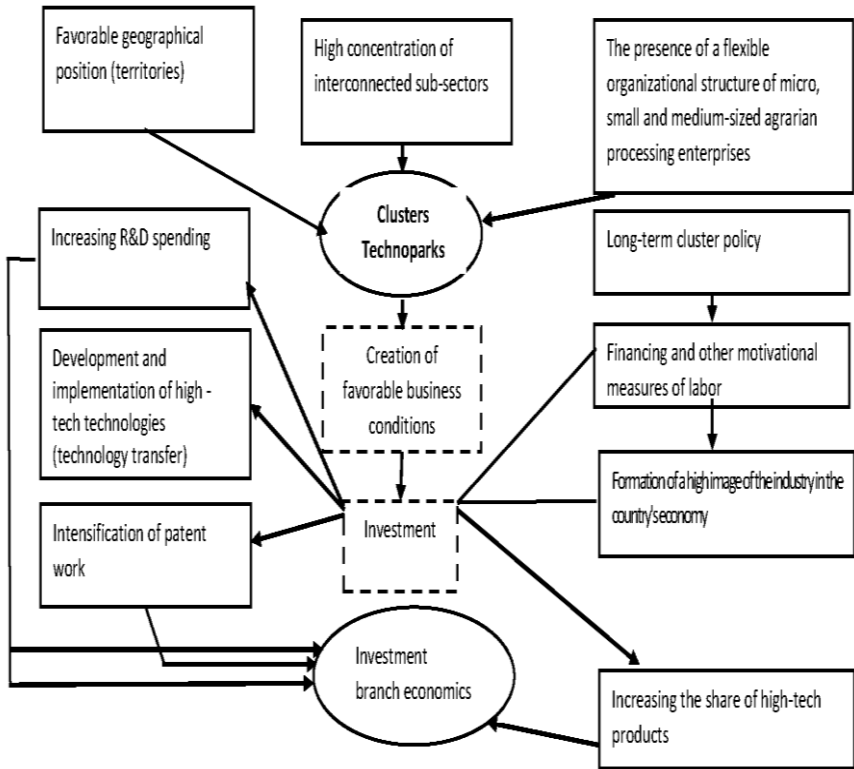
Scheme 1. Principal organizational chart of the work of the agro-processing industrial quarter, operating on the principle of the value chain (developed by the author).

Thus, we reduce the profitability of export activities and strengthen the positions of our competitors in the world market, processing Azerbaijani raw materials, and not only in tobacco, this also applies to the cultivation of leather, wool, textiles and clothing.

It should be noted that the agro-processing industry is characterized by the fact that its products are mainly low-tech production. With regard to medium and high-tech production, these technologies produce most of the equipment for agro-industrial production. From this point of view, it is necessary to increase medium and high-tech production. However, it should be noted with regret that the share of medium-tech production in 60 regions and cities of Azerbaijan is 11.8% and high-tech production is 5.0%. Today, in order to be a competitive economy, it is necessary to create a highly skilled workforce, develop high-tech production and produce high-tech products.

No doubt, clusters and technology parks play an important role in the process of innovative activity of enterprises in API. If we look at the created agro-parks of the republic, the network of these infrastructures seems extremely insufficient. Considering that there are shortcomings in their preparation, both in methodological and practical ways, we recommend the following principal structure of

clusters and high-tech technoparks in the formation of innovative activities of API (scheme 2.).



Scheme 2. Principal structure of clusters and high-tech technoparks in the formation of innovative activities of API (developed by the author).

It should be noted that the rise in world prices has now affected domestic pricing due to increased production costs, because imported goods account for up to 50% of the consumer market and their inflated prices increase the inflation rate. There is a paradox in Azerbaijan that does not exist in the world economy. It lies in the fact that in well-known practice, imports of relatively cheap goods are used to curb inflation, while in our country, prices for imported goods are inflated by resellers due to the lack of both market competition and legal regulation of trade margin limits. More than ever, today individual entrepreneurs, heads of family farms in rural

areas need methodological assistance in increasing the innovative and export potential of their enterprises. We believe that the algorithm proposed can be a valuable management tool in solving these issues. The principal structure of such an algorithm is shown. It is known that the role of local executive bodies in the implementation of regional innovative and socio-economic development programs is undeniable. They provide practical assistance to entrepreneurs in the implementation of the proposed projects. Today, the implementation of startup projects is still relevant. It seems that the algorithm of actions of the executive authority proposed by us to assess the innovative activity of enterprises in API can serve as a methodological prerequisite in this important issue.

Based on the results of our study, the structure of the current innovative mechanism in the agro-processing industries of the republic is proposed. It consists of 10 directions. In the first place, implementation of these areas will make it possible to rationally use the mechanisms of state partnership in order to actively attract capital and advanced technologies for the complete modernization of the agricultural sector in the regions. Using foreign experience, we believe that in the settlements of the administrative regions, where the working population exceeds 1000 people, it is possible to organize an industrial quarter with an agrarian and processing bias. On the other hand, in the large administrative units which includes three or more villages with an employed population of 250-500 people, it is possible to organize about 290 agro-parks according to the value chain principle. The creation of these infrastructures will contribute to obtaining a high synergistic effect and the creation of numerous new jobs. In addition, in 14 economic regions it is possible to organize 42 joint ventures, 15 clusters, 11 technology parks; 8 free economic zones and border trade zones by 2030 (Table 6.). Guided by the Decision of the Cabinet of Ministers of the Republic of Azerbaijan dated December 21, 2018 “On the criteria for entrepreneurial entities”, and also taking into account the real situation of innovative infrastructures operating in the regions of the republic, we calculated the expected socio-economic effect from the

creation of new agricultural parks, joint ventures, clusters, technology parks and others entites (Table 7.). Calculations showed that until 2030, with the phased creation of 434 infrastructure units, it is possible to generate 35,550 new jobs, including highly paid jobs and receive additional products (services) with an added value of 5,872 million AZN.

Table 6. Development perspectives of innovative infrastructures in the agricultural sector of the Azerbaijani economy, up to 2030

Name of economic zones (regions)	Innovative infrastructures					
	Agroparks	Joint ventures	Industrial service quarters	Clusters	Technoparks	FTZ, FEZ
Absheron-Khizi economic region (Sumgayit city, Absheron and Khizi regions)	26	5	7	2	3	-
Highland-Shirvan economic region (Aghsu, Ismayilli, Gobustan and Shamakhi regions)	26	2	5	2	-	-
Ganja-Dashkesan economic region (cities of Ganja and Naftalan, Dashkesan, Goranboy, Goygol and Samukh regions)	16	3	5	-	1	-
Karabakh economic region (Khankendi city; Aghjabadi, Aghdam, Barda, Fuzuli, Khojaly, Khojavend, Shusha and Terter regions)	45	9	10	2	2	1
Gazakh-Tovuz economic region (Agstafa, Gadabay, Gazakh, Shamkir and Tovuz regions)	18	3	10	1	-	1
Guba-Khachmaz economic region (Khachmaz, Guba, Gusar, Siyazan and Shabran regions)	30	3	3	-	-	1
Lankaran-Astara economic region (Astara, Jalilabad, Lerik, Lankaran, Masalli and Yardimli regions)	24	2	3	2	-	1
Central Aran economic region (city of Mingachevir; Aghdash, Goychay, Kurdamir, Ujar, Yevlakh and Zardab regions)	21	2	4	3	2	-
Mil-Mugan economic region (Beylagan, Imishli, Saatli and Sabirabad regions)	20	3	5	-	-	1
Sheki-Zagatala economic region (Balaken, Gakh, Gabala, Oguz, Sheki and Zagatala regions)	18	2	3	2	1	1
East Zangezur economic region (Jabrail, Kalbajar, Gubadli, Lachin and Zangilan regions)	28	5	4	-	1	1
Shirvan-Salyan economic region (city of Shirvan; Bilasuvar, Hajigabul, Nefchala and Salyan regions)	18	3	3	1	1	1

Source: The table was compiled and calculated by the author, taking into account the economic and geographical characteristics of the regions and the best practices of foreign countries in creating innovative infrastructures

* FEZ-free economic zone; FTZ - border free trade zone

All aforementioned will result in the following benefits: migration of the population will decrease, their well-being will improve, possibilities to produce import-substituting products will arise, prices on the domestic market will get lower, the number of exported products will increase, and many regions will switch to self-financing. Without diminishing the importance of the ongoing reforms and the results obtained in the API, we should consider that there are still difficulties in using innovative opportunities for modernization and integration of the production of the agro-industrial sector. It primarily happens due to the fact that so far it has not been possible to clearly formulate and consistently implement the balanced agrarian social - economic program.

Table 7. Calculation of the expected economic and social efficiency from organizing new innovative infrastructures in the regions of Azerbaijan

Innovative infrastructures	Recommended number of infrastructures	Normative value (criteria)		Recommended value		Expected socio-economic effect	
		The volume of products and services produced, thousand AZN	Average annual number, pers	The volume of products and services produced, thousand AZN	Average annual number, pers	Calculation of production volume and provision of services mln. AZN	Creation of new, incl. high paying jobs
Agroparks	290	200÷3000	11-51	6000	50	1740	14500
Joint ventures	42	3000÷30000	51-250	26000	75	1092,0	3150
Industrial service quarters	68	3000÷30000	51-250	30000	150	2040,0	10200
Clusters	15	More than 30000	More than 250	35000	250	375,0	3750
Technoparks	11	More than 30000	More than 250	35000	250	385,0	2750
Border free-trade and free-economic zones	8	3000:30000	51-250	30000	150	240,0	1200

Note: The table was compiled and calculated by the author on the basis of the criteria, proposed by the Cabinet of Ministers of the Republic of Azerbaijan dated December 21, 2018 for the organization of entrepreneurial entities.

This means that in a competitive environment, in order to increase the innovative activity of enterprises in API, it is necessary to:

- master the production of fundamentally new types of products and technologies,
- on this basis, expand sales of domestic goods in foreign markets,
- ensure an increase in gross domestic product,
- develop scientific and technical potential,
- form modern technological structures in the industry,
- displace obsolete ways and increase the competitiveness of the economy.

Failure to use new technologies leads to the loss of up to 40% of the grown crop. Experts recognize that it is necessary to overcome the technological gap with developed countries and consistently increase the market share of digital technologies in agriculture, as well as the processing of agricultural products. Using modern methods of control with the existing monopoly in the field of marketing of agricultural products, the range of services provided for agricultural producers is quite narrow at high tariffs. High monopoly tariffs for storage and transportation services lead to the fact that producers receive a lower price for their products, and at times - to the loss of part of the crop. With a small number of trade and purchasing enterprises in the vegetable and fruit market, producers are forced to

MAIN CONCLUSIONS

In the context of overcoming the economic crisis, it is especially important to determine the development prospects of enterprises on the basis of innovation policy, because it is the innovative activity that allows to extend the life of the enterprise. It has been proved in the world practice that a production enterprise can qualitatively move to a new level of development, then find a new idea, technology and high-quality product that is more attractive to the consumer. Today, the processes of globalization literally affect all sectors of the economy, including agriculture and processing industry. The modern innovation structure is an effective model of the interaction between science, education and, of course, production. For the agricultural sector, this means maximizing the natural and biological potential of agricultural animals and plants,

upgrading technical infrastructure, and introducing new technologies at all levels of management and administration. In this regard, one of the priorities in the field of innovation of NPPs is undoubtedly innovations that help meet the needs of the domestic market with high-quality, relatively inexpensive food products of national production. In fairness, it should be noted that over the past 18 years, huge organizational and economic reforms have been carried out for the development of agriculture and its organic direction in the agro-processing industry. Extensive agrarian reform has been carried out, numerous farms, agro-parks, agricultural processing enterprises have been established, and the infrastructure of the agrarian sector has significantly improved. Concessional loans, subsidies, tax incentives, agro-leasing services and other organizational measures of state support have been implemented. Within the framework of the implementation of numerous state, sectoral and regional programs, road maps, concepts, a wide network of poultry, livestock, grain, viticulture, as well as complexes for the supply, storage, processing and sale of agricultural products have been established; agricultural services, land reclamation measures were implemented. As a result, the number of agricultural enterprises will increase 12.1 times in 2005-2020 the number of individual entrepreneurs increased 4.3 times, the volume of production increased 4.6 times, including livestock 5.1 times, crop production 3.8 times. During this period, the volume of investments in fixed assets in industry increased by 12.7 times, the value of fixed capital increased by 10.3 times. Despite the high results achieved, the innovative activity of the agro-industrial sector lags far behind the threshold accepted in world practice. Today, the level of innovative agro-industrial products in GDP is 0.025%, and the share of value added in the agricultural sector is 1.4%. The share of agricultural products in the total volume of imports in the country is 13.5 percent, and in the volume of exports - 3.9 percent. In 2015-2020 alone, the volume of innovative agricultural and processed products decreased by 2.2 times. Over the years, the balance of finished products of the NPP has more than doubled, totaling 20.2% of the total volume of industrial waste. According to the official data of the State Statistics Committee, the

level of self-sufficiency of the population in many food products is low and ranges from 34.8% to 62.7%. The problem of shortage of raw materials has arisen due to the unsatisfactory organization of procurement and logistics in the processing of agricultural products and the food industry. Innovative infrastructures in the studied industry are not well developed. The share of high-tech production in the processing of agricultural products located in the regions of the country is only 5.0 percent, and the share of medium-tech products is 11.8 percent. In addition to the above, it should be noted that the economic literature does not yet have a universal model and strategy for the implementation of innovative measures in the agricultural sector. As can be seen, therefore, the content of the innovation process management strategy is unique, and the methods used to implement this process are not typical of other innovative products. All these facts indicate that in order to increase innovative activity in the API of the republic, it is necessary to develop and implement scientifically sound, theoretical, methodological and practical recommendations. According to the results of our study, those recommendations can be formulated as follows:

1. Summarizing the different points of view on the essence of innovation, let's recall that each sector of the national economy, including the agro-processing industries, is characterized by its own specifics in the organization of innovation. In the mentioned industry, innovation is an organizational and technical solution of an industrial, administrative and commercial nature, the sum of which contributes to a significant improvement in the structure and quality of production. The subjects of innovation activity should include all economic bodies that generate, promote, use and support innovations.

2. There is no active process of development of a national innovation system (NIS) in Azerbaijan, the constituent elements of which are scientific potential, innovative entrepreneurship and innovation and financial infrastructure. In our opinion, NIS should be designed in two directions:

- a) implementation of investment into innovation projects on a basis of public-private partnership;

b) stimulation of the innovation process in small and medium-sized enterprises, including the technology transfer system.

3. Innovation policy at the regional level should be understood as a set of established goals and priorities for the development of scientific and innovative activities in the region, ways and means of achieving them based on the interaction of executive bodies. The paper outlines the essence of the main principles of the state innovation policy at the regional, sectoral and local levels, as well as at the level of agricultural processing enterprises.

4. Today, in the agrarian processing industry, about 80% out of the total number of enterprises are among micro and small businesses. These enterprises in the regions do not have incentives and resources to increase the production of innovative products. To increase their activity in this process, we propose a model of interaction used for the application the project approach while involving the resources of the innovative infrastructures network, which can be created in the API system - the Center for Transfer and Commercialization of Innovative Technologies.

5. The low innovative activity of enterprises in API strongly emphasizes the importance of borrowing the foreign experience. In this sense, the dissertation studied and systematized the experience of economically developed countries in the field of innovation. These countries are prominent winners because they have a developed innovation infrastructure in the conditions of global competition. There is no doubt that the development of such infrastructures in the agro-processing industry of the republic will lead to their innovative activity.

6. The main barrier in the development of a marketing system for organic products is the lack of a single coordinating center at the regional levels. It seems that the resolution of this issue is possible through the organization of "Regional Industrial Associations" and a wide network of harvested points, regional production clusters, as well as the implementation of the system of **"collection of agricultural products - processing - logistics - marketing"** in a single space. As a result, organic products will become a donor of innovative techniques and solutions for intensive API. However, to

implement those suggestions, it is necessary to bring domestic standards to the level of international ones based on a high-tech innovation base.

7. The intensive development of the non-oil sector requires a change in the approach to the export policy in order to diversify it. The agrarian processing industry should be actively involved in this process, since processed products, when sold on the domestic and foreign markets, provide high profits and reduce the volume of identical imported products. In our opinion, a comparative advantage in this process should be given to peeled hazelnuts, walnuts, tomato paste, wine products, persimmons, fresh fruits, canned fruits and vegetables, juices, cotton, saffron, etc.

8. Azerbaijan is not ready to join the WTO yet. First of all, for Azerbaijan it is necessary to achieve the level developed countries; on the other hand, the shares of imports and exports in the volume of external trade turnover should be equalized; the dependence of the economy on the oil factor should be reduced to an acceptable level; regulation of the customs tariff in favor of Azerbaijan.

9. To determine the manufacturing industries, we have developed a classification of industries according to low, medium and high-tech industries. It was revealed that the low-tech industry is formed mainly due to food production, therefore, among the exported products, the share of this product group is only 0.7%. This means that in the future this industry will have to be transferred to a group of high-tech industries that produce innovative products with a high degree of processing and added value.

10. The influx of investments in the API and its state support improved the conditions for the existence of integrated structures, initiated their significant growth and production volumes. Such integration had a positive impact on the country's food security, providing stable jobs and incomes of the population. Vertical integration with the creation of holdings and agricultural parks has become widespread. Industrial quarters were created in some areas. However, their number is not enough. Therefore, considering the experience of foreign countries and the real situation in the regions, the feasibility of developing innovative infrastructures for

agricultural sector in economic regions for the period up to 2030 is substantiated in the dissertation. We propose to organize 290 agro-parks, 42 joint ventures, 15 clusters, 11 technology parks, 68 industrial service quarters both in free economic zones (FEZ) and free border trading zones (FTZ). Calculations showed that over the forecast period with the phased creation of these infrastructures, it is possible to create more than 35.5 thousand new jobs and receive additional products (services) in the amount of 5.9 billion AZN. As a result, many administrative regions will be able to forego subsidies and switch to self-financing.

11. The paper substantiates the expediency of organizing an industrial quarter in API, operating on the principle of a value chain with the real concepts proposed.

12. Seeing the need for methodological assistance to individual entrepreneurs, heads of family farms, as well as expanding the possibility of implementing startup projects, an algorithm for the actions of executive authorities to assess their innovative activities is proposed. An algorithm to identify enterprises in API that have the greatest potential for export development and import substitution has also been developed.

13. With the use of economic and mathematical modeling, trend models were built, which aim was to analyze and predict the main indicators of API. The predicted value until 2025 of the following indicators was calculated: the volume of production, investment, fixed assets, value added and innovation.

14. A set of organizational and economic measures has been developed to accelerate the process of introducing digital technologies in the APO of the republic.

15. A 10-stage structure for improving the innovation mechanism of API in Azerbaijan is proposed.

Field enterprises of the Ministry of Agriculture, with the involvement of the Scientific Research Institute of ANAS, are developing purposeful innovative programs for each half of the agricultural sector for the period up to 2030;

It is expedient for the Ministry of Economy of the Republic to develop a strategy for the development of the agricultural processing

industry, taking into account foreign experience, with the involvement of the above-mentioned scientific organizations.

The following practical recommendations are necessary for the development of innovative activities of enterprises in the processing of agricultural products:

- determination of the optimal structure of plants according to the volume of production of agricultural crops by regions;

- expanding the scope of activities of private seed farms and nursery farms, stimulating and encouraging the application of advanced technologies in this field;

- providing scientific and methodological assistance to small businesses to expand the production of greenhouse vegetables;

 - modernization of agrochemical laboratories;

- creation of insurance fund for reproduction of elite seeds and seeds of I-II reproduction, creation of state seed reserves, stimulation of activity of private seed farms for production of original, super elite seeds, support of activity of private seed production. manufacturers and the establishment of a certification system in this area;

- establishment and operation of a seed bank, organization and expansion of the regional network, etc.

Establishment of new agricultural processing enterprises for the production of import-substituting and exported products according to special recipes.

Provision of agricultural processing enterprises with modern equipment and technology, laboratories and measuring instruments.

Expanding the network of business entities providing private agribusiness services.

To strengthen the resource base of nuclear power plants, the development of breeding animals and birds, honey, durum wheat, beets, vegetable oil, tea, cotton, wool, cocoons, tobacco, animal skins, etc. need to stimulate production.

Establishment of new meat and dairy farms in the regions of the republic on the basis of pilot projects.

Expansion of the poultry production segment on an industrial basis.

Establishment of large livestock complexes in the regions of the republic, including small and medium enterprises for the production of meat and dairy products.

Establishment of confectionery enterprises on the basis of local raw materials.

Expanding the capacity of tea packing factories, expanding tea plantations.

Establishment of cotton, wool and leather processing enterprises for the production of relevant import-substituting products.

Reducing the volume of imported tobacco, expanding production at the expense of local raw materials.

On the basis of public-private partnership - "Green Market", "Trading House", "Farmer's Store", etc. that meet international standards. network expansion.

Training of highly qualified specialists and professionals for nuclear power plants.

The main provisions of the dissertation work and the main conclusions and proposals obtained as a result of the study are reflected in the following scientific works:

1. Economics of organization and management of enterprises, industries, complexes^{8th} international scientific and practical conference "Actual issues of technical, economic and humanitarian sciences". Georgievsk, 2012, p. 33-38.

2. Entrepreneurship in Azerbaijan, International Scientific and Practical Conference "World Science and Modern Society; actual issues of economics, sociology and law". Saratov, 2013, p. 5-8.

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