THE REPUBLIC OF AZERBAIJAN

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ABSTRACT

of the dissertations for the degree of the of Doctor of Philosophy

DIRECTIONS FOR ORGANIZING ELECTRONIC SERVICES IN THE AGRIBUSINESS SYSTEM OF THE REPUBLIC OF AZERBAIJAN

Speciality:	5312.01 – “Field economy”
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GENERAL CHARACTERISTICS OF SCIENTIFIC WORK

Relevance and development of the topic. The technological revolution occurring in the global economy has led to a shift toward new socio-economic relations, based on the transformation of information and knowledge into a priority factor in various areas of public life worldwide. The formation and development of global information infrastructure has focused humanity's attention on solving important issues such as the emergence of new professions, virtualization of services, and digitalization of the economy. The attention given to the development of information and communication technologies (ICT) and electronic services in individual countries has ensured their current level of development and increased their share in the gross domestic product (GDP). The targeted socio-economic policy being implemented in our republic indicates that favorable conditions have been created for the development of entrepreneurship in all sectors of agriculture. The implementation of reforms in this sector of the economy is successfully continuing. As a result, fundamental changes have occurred in the sectoral structure of the agricultural economy. The level of development of the agricultural sector, one of the leading sectors of the non-oil economy, and the development of entrepreneurial activity in this sector, where up to 36% of the employed population of the country works (as of early 2024), determine the development of agriculture through the use of digital technologies. It should also be noted that the liberation of our lands, which were under Armenian occupation for almost thirty years, by our valiant army, has also created new prospects for the development of agriculture through digital technologies. The restoration of the liberated territories and the implementation of the «smart village» project there, as well as the development of infrastructures for the production, processing, supply, sale, and export of agricultural products using innovative technologies, and the improvement of financial and economic relations, already demonstrate the particular importance of electronic services. As in other sectors of the economy, there are certain problems in the agribusiness system. These problems are primarily national and global in nature and arise due to

shortcomings in the electrification of services at all levels. According to preliminary estimates, by 2050, the global population will exceed 10.0 billion people, which will lead to a significant increase in demand for food. At the same time, due to global climate change and environmental pollution, existing natural resources, including freshwater resources and fertile land, continue to diminish. Production is not the only factor causing concern at the moment: today, there is enough agricultural production in the world, yet despite this, 828 million people still suffer from hunger. The rapid development of urbanization and other similar processes also have a strong impact on food production and consumption patterns, defining fundamental challenges for the agribusiness system. The agri-food sector is very important in terms of employment and ensuring the standard of living. This sector employs 28 percent of the global workforce, about 1 billion people. To achieve the UN Sustainable Development Goals aimed at ending hunger by 2030, it is necessary to create more productive, efficient, sustainable, inclusive, transparent, and resilient food systems. This can be solved by improving existing agribusiness systems and applying digital technologies. A key requirement of the modern era is the full electrification of the industry through the use of modern information technologies to develop agribusiness. Therefore, there is a need to create interactive digital expert systems that collect comprehensive information about soil, water, and plants, as well as acquired knowledge, analysis results, cadastral data, and modern technologies.

Scientists from our country and abroad have conducted numerous studies on the conceptual study and assessment of issues related to the formation of the agricultural production environment, the impact of electronic technologies on agricultural efficiency, as well as the exploration of economic mechanisms in agriculture and factors influencing the investment attractiveness of the sector. These and other studies are ongoing.

One of the well-known economists of Azerbaijan, an academician Z.A.Samadzada, economic scientist E.A.Quliyev, B.X.Atashov, E.R.Ibrahimov, I.H.Ibrahimov, M.A.Ahmadov, I.Ş.Qarayev, R.A.Balayev, M.C.Huseynov, A.F.Abbasov, R.M.Aliquliyev,

E.A.Quliyev and foreign scientists V.Y Uzun, Y.V. Machalova, B.S.Kasaev, M.S.Lata, Ç.Juya, E.S.Nesternko and other addressed current issues of agribusiness, conducted research on improving the efficiency of electronic mechanisms in agriculture and regulating agricultural production, as well as enhancing government policy in this area. Regarding the significance of investments in ensuring global food security, it can be noted that scientists from our country, drawing on global experience, have addressed issues such as the diversification of the national economy structure, improvement of the production environment, and intensification of agricultural production. The Cabinet of Ministers of the Republic of Azerbaijan has adopted a comprehensive action strategy as one of the tools used to increase transparency in the management of the agribusiness sector. As a result, systems were formed that provide comprehensive electronic services for agribusiness activities. Issuance of licenses for agribusiness activities, tax reporting, payment of customs duties, and payments are carried out through the electronic service system. By the decree of the President of the Republic of Azerbaijan dated December 23, 2019, № 897, was approved the "Regulation on the Electronic Information System of Agriculture" (E-agricultural information system). After the adoption of the regulation E-agricultural information system, work in this direction was intensified and covered the entire agricultural sector. Agricultural producers actively use E-agricultural information system. It should be noted that the implementation of electronic services in the agribusiness sector is, to some extent, effective. The process of creating an electronic agricultural information system in Azerbaijan's agriculture successfully continues. This further demonstrates the relevance of the topic chosen for research. At the same time, the topic is relevant from the perspective of improving "Azerbaijan 2030: National Priorities for Socio-Economic Development" "Telecommunications and Information Technologies in the Republic of Azerbaijan," and the "Electronic Agricultural Information System".

Object and subject of research. The subjects of agribusiness, which play a crucial role in the development of the agricultural sector of Azerbaijan, were chosen as the object of study. The subject of the study is the level and opportunities for the digitization of production

and distribution processes in the agribusiness system under current challenges, as well as the principles and criteria for regulation and improvement in these areas.

Goals and objectives of the study. The aim of the study is to examine the theoretical foundations of electronic services in the agribusiness system, assess the current state of electronic services organization in the agribusiness system in Azerbaijan, as well as identify the directions for the digitization of service processes and the improvement of electronic information systems. To achieve this, the following tasks are proposed:

- the study of theoretical approaches to the mechanisms of forming and improving electronic services in the agribusiness system, considering current trends.
- The study of existing problems in improving the efficiency of electronic services in the agribusiness system;
- The implementation of modern electronic services and the identification of directions for economic development in the agribusiness system.;
- Study of the experience of economically developed countries in electronic services within the agribusiness system
- Analysis of the current state of electronic services in the agribusiness system in Azerbaijan and evaluation of the legal framework;
- Researching of the development potential of the agricultural sector in Azerbaijan and the prospects for the application of new technologies, including digital and 'smart' technologies, in agriculture
- Evaluation of the prospects for organizing electronic services in the agribusiness system and attracting investments in the liberated territories of Azerbaijan;
- Investigation of the mechanism for the digitalization and regulation of agribusiness in accordance with Strategic Roadmaps, development programs, and concepts;
- Justification of the implementation of electronic services in the agribusiness system and directions for improving efficiency in the context of global challenges.

Research methods. Various methods of economic analysis were used in the research process. First of all, a comprehensive and systematic approach was ensured to address the problems outlined in the structure of the study. Economic methods such as analysis and synthesis, correlation and regression, comparative analysis methods, as well as analyses and evaluations based on official statistical data, were used. In determining the theoretical and methodological foundations of the researched problem and making generalizations, references were made to the works of a group of Azerbaijani and foreign scientists At the same time, international and national legal acts, as well as methodological materials prepared by research institutes and scientific centers, were used to identify more optimal solutions for improving the efficiency of agribusiness through the application of ICT in global practice.

Main scientific statements submitted for defense. The initial theses submitted for defense regarding the research work consist of the following:

- ✓ In the context of integration into the globalized world economy, it is necessary to identify indicators that create the basis for efficiency in determining the environment and factors that necessitate the digitalization of services in the agribusiness system;
- ✓ Special attention should be given to the development of research directions on the role of electronic technologies in improving existing regulatory mechanisms and enhancing the efficiency of the agro-industrial complex;
- ✓ As part of the digitalization of the national agribusiness system, it is necessary to improve the application of modern electronic services and economic development directions within the agribusiness system;
- ✓ It is essential to consistently consider the need for the continuous digitalization of services in the agribusiness system and the identification of methods for applying “smart technologies” in accordance with international practice;
- ✓ The process of restoring and revitalizing agriculture in the liberated territories, along with large-scale digitalization

initiatives in these areas, should contribute to the creation of social and production infrastructure, the identification of opportunities for organizing and developing promising activities in the agribusiness sector, and the development of a cluster model;

- ✓ It is important to assess the opportunities and prospects for implementing electronic services in our republic that have proven effective in the agro-industrial systems of developed countries."
- ✓ In the context of global economic challenges, there is a significant need to develop proposals for addressing the issue of electronic services in the agribusiness system of our country.

Scientific novelty of the research: The scientific innovations discovered during the dissertation research can be generally presented as follows:

- The conceptual scientific foundations of optimal approaches to organizing electronic services in the agribusiness system during the period of globalization have been define;
- The impact of key factors on solving issues related to electronic services and efficiency in the agricultural sector within the agribusiness system has been assessed;
- The tasks and opportunities for achieving the goals of addressing organizational and economic issues of electronization have been identified;
- The necessity of expanding the application possibilities of artificial intelligence in the organization of electronic services has been substantiated.;
- In order to diversify the country's economy and enhance the investment attractiveness of regions, directions for improving electronic services for promising agribusiness development projects have been developed.

Theoretical and practical significance of research. The results of this research can be used to adapt electronic services within the agribusiness system to the current requirements of the state's agricultural policy, ensuring their appropriate enhancement in response to global influences. Additionally, they can aid in developing

mechanisms to improve agricultural production conditions, increase sector investments, and formulate and implement regulatory measures. The approaches, methodological elements, proposed mechanisms, and solutions to existing problems in the agricultural sector can play a positive role in enhancing efficiency, particularly in the formation and organization of a productive development environment. The theoretical propositions presented in the dissertation can be used in the preparation of textbooks, educational manuals, and methodological guides.

Approbation and application. The main scientific and theoretical provisions, conclusions, and proposals of the dissertation are reflected in 8 articles (including 1 published abroad) and 5 theses (including 1 presented abroad), published in reputable journals and conference proceedings recommended by the Supreme Attestation Commission under the President of the Republic of Azerbaijan. Among the conference materials, the following theses are noteworthy: "The Efficiency of Scientific and Technological Progress in the Agricultural Sector" (Baku, 2016), "Priority Directions of Electronics in the Effective Organization of Agribusiness" (Baku, 2022), "Efficiency of "Smart Village" Projects in Liberated Regions" (Baku, 2022), "Main Directions for Implementing Innovations in the Agricultural Sector" (Luxembourg, 2023), "Prospects for Developing the Organization of Electronic Services in the Country's Agribusiness System" (Baku, 2023). During the course of the research, the author also published articles titled: "Priority Directions for the Development of Science and Technology in the Agricultural Sector" (Baku, 2016), "Directions for Regulating Innovations in the Agricultural Sector" (Baku, 2016), "The Role of Electronic Services in Improving Economic Relations in the Agribusiness System" (Baku, 2020), "Electrification of Agribusiness and Its Development Stages" (Baku, 2020), "Main Conditions and Advantages of Applying Electronic Services in the Agro-Industrial Sector" (Baku, 2021), "Conceptual Foundations for the Formation and Development of Agribusiness in Azerbaijan" (Moscow, 2022), "Issues of Forming a Digital Environment and Intelligent Agricultural Sector in Azerbaijan" (Baku, 2023), "Directions for Improving Investment and Innovation Support for the Development of the Agricultural Sector" (Baku, 2023).

Name of the organization where the dissertation was carried out. Azerbaijan Cooperation University.

The total volume of the dissertation with signs, noting the separate allocation of structural sections of the dissertation. The dissertation work consists of an introduction, three chapters, a conclusion and a list of used literature, and has a total of 268778 marks. The introduction consists of 14055 marks, Chapter I consists of 73595 marks, Chapter II consists of 35387 marks, Chapter III consists of 92060 marks, the conclusion consists of 9405 marks, and the list of used literature consists of 24762 marks. The dissertation work consists of 224502 marks, excluding tables, figures, graphs and a list of used literature.

MAIN CONTENT OF THE STUDY

In the **introduction** of the dissertation, the relevance of the topic is substantiated, along with the degree of its development, the object and subject of the research, its aims and objectives, methods, main propositions submitted for defense, scientific novelty, and its theoretical and practical significance.

In the first chapter of the dissertation, the applicant examines the theoretical foundations of organizing electronic services in the agribusiness system. This chapter examines the scientific essence of applying information technologies in organizing competitive electronic services and developing agribusiness; electronic business in the agricultural sector and its stages of development; and provides a detailed theoretical analysis of the significance of organizing electronic services in improving economic relations within the agribusiness system. In this chapter, the author explains the essence of agribusiness and shows that the concept of "agribusiness" was introduced into economic theory in 1955 by Professor J. Davis from Harvard University in the USA. In his opinion, agribusiness refers to the set of operations aimed at the production and distribution of products necessary for supplying farms, as well as the entirety of industries engaged in the transportation, storage, processing, and

distribution of agricultural products. According to Professor J. Davis's approach: “Agribusiness includes all types of activities related to the supply of resources for agricultural production, the cultivation of crops and fiber, as well as the processing, storage, and distribution of the produced products”[1]. It is no coincidence that this approach emerged in the second half of the 20th century, as it was during this period that the U.S. economy experienced active integration processes affecting all areas of business. Subsequent research on the essence of agribusiness demonstrates not only the quantitative composition of its elements and their interconnection but also the main goals of this type of economic activity—meeting consumer needs and generating profit. V.Y. Uzun notes as a result of his research: “Overall, agribusiness is a rather broad and flexible term, as it encompasses various types of agricultural activities”.[2]

According to R.A. Askerov, “In the context of the diversification of industries that are an important part of the economy, the formation of the agro-industrial complex and the provision of necessary state support for its development play a significant role in ensuring the country's economic security. Although agro-industrial activity initially developed within the classical boundaries and understanding of the term at the early stages of its integration into economic circulation, as the development of productive forces and production relations in society accelerated, agro-industrial activity extended beyond its economic boundaries and encompassed a broader context”.[3] The intensification of competition due to the expansion of the market economy and economic integration presents challenges such as determining priorities within the agribusiness system, analyzing market conditions and responding promptly to their needs, using

[1] Organization of Agribusiness: A Short Course of Lectures / Compiled by M.Y. Rudnev. - Saratov– 2017. – 77 p.

[2] Uzun V.Y. Holdingization of Agribusiness in Russia / Uzun, V.Y. , N. I. Shaqayda, Y. A. Qataulina, Y. A. Shishkina. — Moscow: Publishing house "Delo" RANEPA (Russian Presidential Academy of National Economy and Public Administration), 2022. — 344 p.

[3] R.A. Askerov. Some issues of forming a business environment in the agricultural sector // News of ANAS. Economics series 2021 (September-October), p. 83 – 92.

advanced technologies and innovative developments in production organization, and establishing online relationships with partners.

Agribusiness entities, the state, and civil society must work together to build an inclusive and efficient food system. This, in turn, accelerates the integration of small farmers into small and medium-sized enterprises, ensuring their successful participation in agribusiness and value creation processes through the use of market access methods. To achieve these goals, the Food and Agriculture Organization of the United Nations (FAO) has established relevant principles and ideas based on factual data. The mentioned organization strengthens the state's capacity in the areas of sustainable development of the production and supply chain, institutional procurement, and the development of public-private partnerships. The main policy ideas of this organization can be classified as follows:

- It is necessary to strengthen interagency coordination and cooperation at all levels to create favorable conditions for the sustainable development of agribusiness and the production and supply chain;

- Increasing the efficiency of agricultural production through the processing industry creates significant potential for boosting employment and income, reducing poverty, and improving nutrition in the regions. The policies and mechanisms implemented in the agricultural sector, especially concerning small and medium-sized farms, have already proven their effectiveness in many countries;

- Activities aimed at developing a sustainable agribusiness and production-supply chain contribute to achieving the Sustainable Development Goals (SDGs) for the period up to 2030. When considering global goals, special emphasis can be placed on the objectives of eliminating hunger and promoting “responsible consumption and production”. Value chain projects financed under the **“**Enhancing Agricultural Competitiveness**”** project are essentially public investments in agribusiness. Public funds allocated for financing the project are aimed at strengthening weak links in the value chain. The project supports farmers in acquiring innovative equipment for agricultural production, providing water and agro-

technical tools for fields, as well as in packaging and marketing processed products. As is well known, agriculture operates in interaction with other sectors of the agrarian economy as well as with the national economy. The conditions for this are created by the fact that land is the primary factor of production in this sector, while at the same time, its influence on the price and exchange opportunities of agricultural products is significant. In this regard, to better meet domestic food needs, it is essential to widely utilize modern equipment and technologies, as well as to automate the production and processing of agricultural products.

More attention should be given to the digitalization of agriculture, the organization of the agro-industrial complex on a scientific basis, its management using modern technologies, and the provision of a modern service system for this sector. Since the implementation of electronic mechanisms in various areas of agribusiness and the consistent offering of a wide range of electronic services lead to the expansion of business activities and an increase in its economic efficiency.

It is proposed to systematize the organization of electronic services in agribusiness based on the following four important components:

- Production on farms, including the cultivation of plants or animals in interaction with soil, water, nutrients, and microorganisms;
- Supply, packaging, storage, processing, and sale of food products;
- Preferences, behavior, knowledge, health considerations, and budgets of consumers, individuals, and families;
- The presence of uncertainty and variability in all the above components, driven by human activities, biological factors (such as plant pathogens and diseases), and adverse climatic conditions.

It should be noted that artificial intelligence will play an increasingly significant role in these components.

Industrial Revolution and Digitalization in Agribusiness. The “Fourth Industrial Revolution” (Industry 4.0) is accompanied by the influence of blockchain, the Internet of Things, artificial intelligence, and similar “revolutionary” innovations across various sectors. The expansion of mobile technologies, remote sensing services, and data

exchange in the agricultural sector enhances small farmers' access to information, production resources, markets, financial resources, and training. Digital technologies create new opportunities for integrating small farmers into digital agri-food systems.[4]

The improvement and modernization of production and processing based on advanced technologies, the creation of new electronic services, and the application of innovative technologies enable achieving high results in agribusiness. In this regard, many important aspects were clarified in the Presidential Decree of April 16, 2014, "On Measures to Improve Public Administration in the Agro-Industrial Complex and Accelerate Institutional Reforms". This decree defines the directions for improving management within the structural subdivisions and subordinate institutions of the Ministry of Agriculture. The decree outlines measures to establish modern agro-parks in line with international practices, implement electronic reporting, and ensure transparency in state regulation of agribusiness.[5]

To successfully digitalize agriculture, it is important to address these issues by ensuring access to quality data and developing the skills of data analysts. It is important to be a professional analyst and specialist here, and this requires training in this area.

One of the main challenges of digitalizing agriculture in Azerbaijan is the understanding and interpretation of big data from both internal and external environments. Some of the key aspects of this problem can be classified as follows:

Data quality – data is often incomplete, inaccurate, or outdated. This makes it difficult to analyze and make decisions based on the obtained information;

Data analysis practices – experts in the field of agriculture do not always have the necessary knowledge and skills to work with big data.

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[4] https://www.secuteck.ru/articles/transformaciya-selskogo-hozyajstva-cifrovye-vozmozhnosti-razvitiya

[5] Decree of the President of the Republic of Azerbaijan on Measures to Improve Management in the Agricultural Sector and Accelerate Institutional Reforms – Baku, Decree No. 152 dated April 16, 2014.

This requires the implementation of educational programs and improvements.

Data interpretation – even with high-quality data, the correct interpretation of analysis results is crucial. It is necessary to consider specific conditions such as climate, soil, and other factors.

Confidentiality and security – processing large volumes of data requires compliance with security and confidentiality regulations, and failure to adhere to these rules may create additional problems;

When integrating technologies, it is necessary to ensure interoperability between different technological solutions for the efficient transfer and use of data across various systems.

The second chapter of the dissertation, titled **"Assessment of the Current State of Electronic Services Organization in the Agro-Industrial Complex of the Republic of Azerbaijan under Modern Conditions"** contains an analysis of the current state of agricultural production in Azerbaijan. It examines the application of modern electronic services, trends in economic development within the agribusiness system, and an economic-mathematical model for organizing electronic services in the agribusiness system.

Since the main goal of the research work is to determine the directions for organizing ICT in the agricultural sector, great attention is given to conducting analyses and assessments in all relevant areas. From this perspective, based on the factors identified during the research, it is possible to analyze the directions that play a significant role in the agricultural sector's activities, including certain general agricultural indicators and the level of self-sufficiency in essential types of agricultural products. Priority attention was given to studying the dynamics and conducting a comparative analysis of such indicators.

Table 1 presents the dynamics of gross agricultural production in Azerbaijan, which forms the primary raw material base for agro-processing enterprises and produces essential food products, for the years 2018-2023.

Table 1.

The gross agricultural output in Azerbaijan, categorized by economic sectors and presented in actual prices (million manats), for the years 2018 to 2023

Years	All categories of households			Agricultural enterprises			Individual entrepreneurs, family farms and households		
	Total	including		Total	including			including	
		crop production	livestock products		crop production	livestock products	Total	crop production	livestock products
2018	7010,0	3186,0	3824,0	660,9	262,1	398,8	6349,1	2923,9	3425,2
2019	7836,7	3751,2	4085,5	713,2	321,0	392,2	7123,5	3430,2	3693,3
2020	8428,9	4028,4	4400,5	834,5	438,3	396,2	7594,4	3590,1	4004,3
2021	9163,4	4511,0	4652,4	885,9	467,3	418,6	8277,5	4043,7	4233,8
2022	10984,2	5538,0	5446,2	1094,0	509,2	584,8	9890,2	5028.8	4861,4
2023	12210,6	5933,9	6276,7	1351,1	693,7	657,4	10859,5	5240,2	5619,3

Sorce: *https://www.stat.gov.az/source/agriculture/*

In recent years, extensive efforts have been made to deepen and expand the development trends of electronic services within the modern structure of economic relations in the agribusiness system of our country, based on the use of ICT. These processes are currently characterized by their intensity. Certain opinions on these matters have previously been presented in research materials. We have also made an effort to provide extensive analyses based on the dynamics of ICT indicators in our country over the past decade, express our perspective on them, and ensure the disclosure of existing resources and potential. In our country, the unstable dynamics of investment volumes directed into fixed capital over the past years attract attention (Diagram 1).

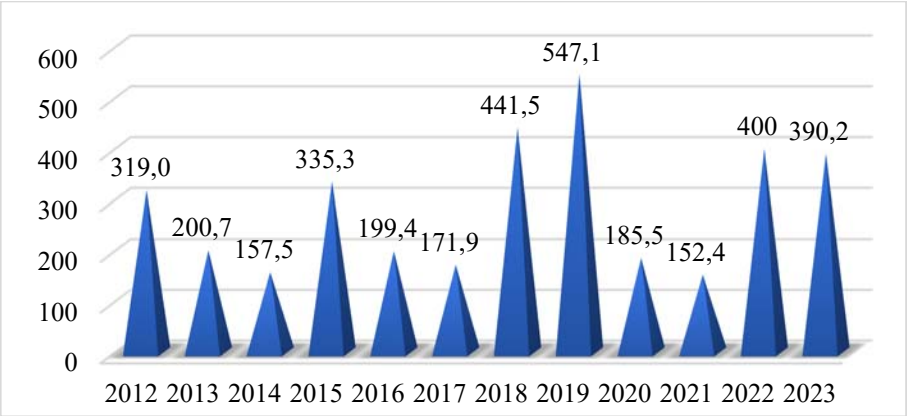

Diagram 1. The dynamics of volume investments in fixed capital within Azerbaijan's ICT sector from 2012 to 2023 mln. manat

Source: *Prepared by the author based on data from the State Statistics Committee of Azerbaijan. https://www.stat.gov.az/source/agriculture/*

The development of agriculture requires a comprehensive approach to problem-solving, including the modernization of equipment, the creation of efficient processing capacities, the improvement of logistics and production process management, as well as attention to environmental and social issues.

Investments in technology, education, and innovation can significantly improve the productivity and sustainability of the agricultural industry in the future. Indeed, in recent years, forestry and fisheries have been considered integral parts of the agricultural sector, due to the broad scope of agricultural activities and the diversity of its resource potential. The main goal of our research is to identify ways to improve the economic efficiency of ICT in the agricultural sector.

However, conducting and accurately assessing the results of a broad and comprehensive analysis is a highly complex task. In this regard, we primarily focused on analyzing the most significant areas of activity in the agricultural sector, including certain general agricultural indicators, the dynamics of such indicators as the level of self-sufficiency in essential types of agricultural products, as well as a comparative analysis. Table 2 presents the key indicators of ICT usage in enterprises in Azerbaijan for the years 2018-2023.

Table 2.

Key indicators of ICT use in enterprises of Azerbaijan in 2018-2023, in percent

Name of indicators	2018	2019	2020	2021	2022	2023
The specific weight of enterprises utilizing computers within the total number of active enterprises in the country	67,2	62,8	63,9	65,2	65,8	66,6
The ratio of the number of employees using a computer to the total number of employees of all operating enterprises	33,4	33,9	35,1	35,8	36,2	36,6
The specific weight of operating enterprises with Internet access in the total number of all enterprises	52,9	51,5	52,5	54,2	54,8	56,0
The ratio of the number of employees using the Internet to the number of employees listed in all operating enterprises	25,3	25,8	26,9	28,1	29,4	30,1
The specific weight of enterprises with a web page (web page, website) in the total number of all operating enterprises	12,3	9,8	9,9	10,2	10,5	10,6

Source: *https://www.stat.gov.az/source/digital_development/*

Table 3 shows the share of computers with Internet access in the total number of computers at enterprises located in the economic regions of Azerbaijan for the years 2018-2023. Despite the slow growth rates of the key ICT usage indicators in enterprises in Azerbaijan during the analyzed period, the total number of computers with Internet access in enterprises has increased.

Table 3.

The specific weight of computers with internet access in enterprises across the economic regions of Azerbaijan, as a percentage of all computers, from 2018 to 2023

By regions	2018	2019	2020	2021	2022	2023
By country	65,8	66,3	67,9	70,5	77,4	75,2
Baku city	73,9	73,9	74,7	76,2	83,0	83,7
economic regions						
Nakhchivan Autonomous Republic	74,9	75,0	82,1	83,5	92,2	85,8
Absheron-Khizi	47,4	48,0	50,8	55,8	63,5	64,7
Highland Shirvan	48,3	49,9	52,0	57,2	63,2	64,9
Ganja-Dashkasan	66,1	66,8	67,7	71.4	77,1	79,9
Karabakh	41,1	42,5	44,8	50,4	58,6	60,4
Gazakh-Tovuz	42,8	44,7	48,8	55,0	61,9	65,0
Guba-Khachmaz	53,1	54,7	55,5	61,3	66,6	71,0
Lankaran-Astara	44,3	46,6	49,6	55,3	63,3	64,9
Central Aran	53,9	55,6	57,7	63,1	71,3	73,2
Mil-Mughan	45,7	47,4	49,4	55,6	67,2	68,7
Sheki-Zagatala	44,3	46,4	48,9	54,7	63,2	65,0
East Zangezur	45,1	47,1	48,0	52,3	55,1	59,6
Shirvan-Salyan	60,2	61,5	62,4	66,8	76,9	79,2

Source: *https://www.stat.gov.az/source/digital_development/*

It should be noted that in 2023, the highest indicator was observed in the Nakhchivan Autonomous Republic (85.8%). However, this is 6.4 percentage points lower than in the previous year. The main reason for the decline was the cessation of operations of some enterprises in the Nakhchivan Autonomous Republic. At the same time, the highest growth trend of these indicators in 2023 compared to the previous year among most economic regions was achieved in the Guba-Khachmaz economic region, reaching 4.4%. It should be noted that placing significant importance on the use of ICT in economic regions plays a crucial role in accelerating economic development processes and increasing efficiency. This indicator has increased from 65.8% to 75.2% across the country. Meanwhile, in 2023, in other economic regions—excluding the Nakhchivan Autonomous Republic and the city of Baku—this indicator ranges from 59.6% (East Zangezur) to

79.9% (Ganja-Dashkesan).

Attracting investments is accompanied by new technologies, know-how, and prospects for entering new markets. Taking into account the impact of innovative factors, the priorities for agribusiness development have been set as follows.

1) Combating diseases and pests – preventing diseases and minimizing damage to local farmers in crop production, horticulture, livestock farming, poultry farming, and beekeeping;

2) Long-term agricultural loans – the inability of most farmers to obtain long-term agricultural loans with low-interest rates.

3) Education – the lack of sufficient knowledge and skills among farmers to improve the efficiency of agricultural activities significantly hinders the adoption of modern technologies;

4) Equipment and technology – the lack of access to high-quality agricultural machinery and modern technologies for a significant number of farmers;

5) Infrastructure development – one of the important needs of farmers is the improvement of essential roads and transportation infrastructure.

Agricultural innovations are of great importance in terms of implementing the principles of sustainable development. Currently, the innovative development of the country's agriculture is gradually gaining momentum. By leveraging innovative knowledge, entrepreneurs can make favorable decisions in their activities, accurately determine the direction of their business, and achieve goals such as expanding production, developing new products, and supplying the market with new goods and technologies.

The third chapter of the dissertation, titled **"Directions for Improving the Organization of Electronic Services in the Agribusiness System of Azerbaijan,"** examines the improvement of electronic service organization in the agribusiness system based on international experience. It identifies the directions for expanding the application of artificial intelligence in the organization of electronic services in the agricultural sector and explores the prospects for the development of the electronic service network in the agribusiness system.

It should also be noted that digitalization can transform all stages of the agri-food chain. The optimization of any system element, including resources, can be managed based on the principles of an individualized approach and logic. Based on data-driven hyperconnectivity, the system can operate in real-time. This will enable the creation of optimal models for comprehensive monitoring, coordination, and management of agricultural land, crops, and livestock within production and supply chains. Digital agriculture will enable the creation of new systems capable of predicting and adapting to changes, including those that may affect the climate, to achieve high productivity. This, in turn, can make a significant contribution to increasing economic efficiency, sustainable development, and ensuring food security.

Digital agriculture will enable the creation of highly productive, predictable, and adaptable systems that can respond to climate change-induced shifts. This, in turn, can lead to increased food security, profitability, and sustainability[6].

Taking into account the contexts that have developed in the agribusiness system of the Republic of Azerbaijan, there are several conditions that will determine the format of changes in the provision of electronic services:

- A set of minimum conditions that enable the use of innovative technologies includes key factors such as accessibility, connectivity, financial capabilities, computer literacy, as well as policy measures and programs supporting digital strategies (e-government);
- The supporting conditions for the provision of electronic services are related to factors such as the use of the Internet, mobile devices, and social networks, digital technology proficiency, support for an entrepreneurial and innovation culture in the agri-food sector, the development of talented programmers, hackathons (programming meetups), business incubators, and accelerated education programs.

[6] Dıgıtal Technologıes In Agrıculture And Rural Areas Brıefing Paper, Food and Agriculture Organization of the United Nations Rome, 2019 26 p. https://openknowledge.fao.org/server/api/core/bitstreams/885161de-dccf-45898376-07fe37b68799/content

With the help of electronic services, farmers can monitor various variables such as crop selection, planting dates, fertilizer application rates, pesticide application rates and intervals, as well as the usage and consumption of agricultural machinery. However, the interaction of numerous factors and the constant change of parameters can become a significant obstacle to achieving the optimal combination of input data.

The goal is to control transportation costs and achieve predictable market stability to ensure production growth. Moreover, many variables influenced by environmental factors are beyond farmers' control. By analyzing data from the current and previous years, farmers will find it easier to gather predictive and accurate information. Of course, the final product and production cost are the results of everyone's efforts during the growth period. By efficiently utilizing existing data, farmers working in the agribusiness sector can gain economic advantages. Information is collected electronically using equipment and field sensors that can import high-quality data on factors essential for crop production, such as soil variability and quality, water and nutrient availability, plant health and disease management, as well as crop growth and development. These highly variable and uncertain data are analyzed to complement the experience of farmers and operators. The analysis results serve as a database for making timely and favorable management decisions. In this chapter, the author demonstrated that the challenges arising in the field of environmental protection and global climate change necessitate the development of new electronic services in the agribusiness system of our country and their improvement based on the experience of developed countries.

By using artificial intelligence, we can integrate real-time electronic data from sensors, weather forecasts, and arable land models. Additionally, access to spatial data from drones and satellites is possible. Such priorities have been taken as the foundation for the developing agro-industrial system in the East Zangezur and Karabakh economic regions of our republic. This is possible through the creation of a climate-adaptive electronic management system that considers the temporal and spatial variability of soil conditions and crops in the

field. The electronic management system enables a prompt response to the formulated forecasts for ensuring the development of the agro-industrial complex.

In the "Conclusion" section of the dissertation, based on the conducted research, proposals and recommendations with scientific and practical significance are provided:

1. Our research shows that the conceptual scientific foundations of optimal approaches to organizing electronic services in the agribusiness system in the era of globalization can be considered from several aspects. This includes:

- Integration of information technologies;
- Electronic platforms and services;
- Training and government support in the field of electronic services;
- Regulation and establishment of standards for the provision of electronic services;
- Ensuring sustainable development and facilitating access to new markets in the context of globalization and competition.

The experience of developed countries shows that addressing all these issues creates the conditions for establishing a more efficient and sustainable system of electronic services in the agricultural sector. This, in turn, leads to increased productivity and improved quality of life in rural areas in the context of globalization. For example, the use of sensor monitoring and control systems for tracking soil, plant, and animal conditions through IoT (Internet of Things – the interconnection of various devices and objects via the Internet) is widely adopted. Predicting productivity and optimizing resources by making real-time decisions based on data analysis plays a crucial role in improving the efficiency of agribusiness operations.

For this purpose, we recommend implementing the following proposals to properly address the aforementioned issues:

- Creation of a unified digital ecosystem – this involves developing platforms for the interaction of all participants in the agricultural sector (farmers, processors, distributors) using blockchain technology to ensure transparency;

- Development and implementation of mobile applications in the agricultural sector – this will create extensive opportunities for specialists (especially agronomists) and farmers to respond promptly to changes and provide information and services related to agricultural activities.
- It is planned to organize professional development courses for specialists and entrepreneurs working in the agro-industrial complex, as well as to develop training programs for agricultural workers to help them adapt to new technologies and methods.

2. The impact of electronic services in the agricultural sector on the level of influence and efficiency issues, as well as the effect of key factors, can be assessed by comparing performance indicators before and after each service. The main applied directions in the field of electronic services can be classified as follows:

- Process automation – electronic services enable the automation of many processes, from planning and resource management to harvest collection and sales. This reduces the time and effort required to perform daily tasks;
- Access to information – specialists and entrepreneurs can obtain up-to-date information on land, weather conditions, market prices, and other factors, enabling them to make more informed decisions;
- Resource optimization – using data and analytics enables more efficient management of resources such as water, fertilizers, and seeds, reducing costs and increasing productivity.;
- Risk management – electronic services help predict and manage risks associated with climate change, plant diseases, and other factors. This enables farmers to better prepare for unforeseen situations.

3. The implementation of tasks and objectives aimed at addressing organizational and economic issues of electronics in Azerbaijan's agro-industrial complex largely depends on the high level of efficiency in managing the agro-industrial complex and the execution of functions such as planning, organization, control, and regulation. The execution of these functions requires farms and enterprises to continuously make decisions by choosing among known alternatives. For example, for many years, managers of large enterprises considered decision-making a “pure art” that could only be mastered through

years of experience, trial, and error. At the same time, these business entities paid more attention to the personal qualities, abilities, and skills of the manager rather than to quantitative methods based on a scientific approach. Currently, in the context of global climate change, new economic approaches, and increasing competition, managers are forced to operate in complex conditions. Over the past decades, business and its external environment worldwide have become extremely complex and continue to grow more complicated. Here, both political and socio-economic issues mutually influence all sectors. Another challenge is that in all business sectors, including agribusiness, the number of possible decision-making alternatives is increasing due to advancements in technology and communication systems. Secondly, the damage caused to businesses by incorrect decisions is increasing due to the automation of production, the complexity of commercial operations, and the "chain reaction" mechanism that such decisions can trigger in different parts of the business.

4. The development of a long-term strategy that includes goals and priorities for the application of electronic technologies in the agricultural sector, an assessment of existing technologies, and the needs of farmers for the efficient use of resources allows for the identification of the strategy and requirements for agribusiness electronics. It is necessary to provide the required infrastructure for the implementation of electronic systems, such as broadband internet and monitoring systems, as well as to develop training programs for farmers and agricultural workers on the use of new technologies. It should also be noted that effective field management through the digitalization of agribusiness can lead to a significant increase in productivity and business sustainability. The successful implementation of these functions can create an innovative and competitive agricultural and processing industry in Azerbaijan.

5. The need to expand the application of artificial intelligence in the organization of electronic services in Azerbaijan's agribusiness system has become even more relevant in recent times. For example, artificial intelligence technologies are widely used in agriculture in countries such as the United States, China, India, Canada, and Israel.

To ensure a high level of food security in these countries, it is projected that the market for high-tech products in the agricultural sector will increase several times in the coming years. Artificial intelligence technologies are widely used for monitoring and assessing soil quality, livestock productivity, sowing and harvesting operations, weed control, and predicting the yield of grain, fruit, and vegetable crops. According to the experience of developed countries, the use of artificial intelligence technologies in agriculture increases efficiency, reduces costs, and improves product quality. These technologies facilitate more accurate and well-founded decision-making, which is crucial for modern agriculture. Technological developments are becoming the foundation of progress in this field and the enhancement of agribusiness efficiency. Working with neural networks and big data enables us to model the potential occurrence of specific events or conditions and identify the most natural and optimal interconnections.

6. The main task in improving the production environment through the organization of electronic services in the agribusiness system and the digitalization of the agricultural sector in Azerbaijan is the collection, analysis, and efficient extraction of value from large volumes of data on internal and external environments. The foundation of such processes consists of cloud platforms and big data solutions, predictive analytics technologies, and decision support systems.

The digitalization of the agricultural sector contributes to increasing agricultural revenues through the following opportunities:

- Minimizing losses during cultivation, harvesting, and storage, as well as preventing spoilage and deterioration of products;
- Conducting sowing in accordance with high agrotechnical standards;
- Conducting real-time monitoring of croplands during the vegetation period;
- Protection of forest belts and pastures, efficient use of water resources, and reduction of losses;
- Cost-effective harvesting, efficient product distribution, and implementation of government support measures;
- Analyzing marketing advantages in the agro-industrial

environment and implementing new influence mechanisms based on this analysis;

- Establishing a seamless system for ordering and delivering products.

The use of sensor equipment, such as field sensors and monitors for controlling the condition of buildings, equipment, machinery, and animal health, enables farms and enterprises operating in the agricultural sector to collect and analyze data comprehensively and continuously.

7. The improvement of electronic services in the agricultural sector for the effective development of agribusiness also plays an important role in diversifying the national economy and increasing the investment attractiveness of regions. For example, in line with modern economic development, the creation of multifunctional digital platforms in the agricultural sector, as well as the unification of all participants in the agricultural sector and related industries (farmers, processors, distributors) into a single platform for information and service exchange, leads to the expansion of effective integration.This stimulates the development of electronic markets and various trading platforms for selling agricultural products, increasing their accessibility to consumers, and reducing costs.

8. When analyzing and assessing the efficiency of agribusiness, attention should be given to monitoring the implementation of electronic services, systematically analyzing the results, and adapting strategies based on the obtained information. Engaging farmers and other stakeholders in the process of improving services through surveys and focus groups helps further enhance the quality of work. This not only stimulates the creation of a modern and efficient system of electronic services in the agricultural sector but also plays a positive role in diversifying the economy, attracting investments to the regions, and generating interest in the industry among investors.

The main provisions of the dissertation work, the results obtained and conclusions are reflected in the following published scientific works:

1. R.S.Huseynov, A.A.Salimova, A.H.Mustafayev. Priority areas for the development of science and technology in the agribusiness sector. // – Baku: "Azerbaijani agricultural science" Scientific-theoretical journal., 2016, № 3. – p. 175-178.
2. R.S.Huseynov, A.H.Mustafayev, T.Q.Manafova. Directions for regulating innovative activities in the agribusiness sector. // – Baku: "Agricultural economics." Scientific papers of the Scientific Research Institute, 2016, № 2. – p. 50-58.
3. R.S.Huseynov, T.Q.Manafova. The effectiveness of scientific and technological progress in the agricultural sector./ – Baku: "Land reforms in Azerbaijan-20: achievements and prospects". Materials of the All-Republican Scientific and Practical Conference, 2016. – p. 361-365.
4. The role of electronic services in improving economic relations in the agribusiness system. // – Baku: "Cooperation" scientific and practical journal, 2020, № 4 (59). – p. 98-104.
5. Electronicization of agribusiness and its development stages // – Baku: News of the National Academy of Sciences of the Republic of Azerbaijan. Economic Sciences Series, 2020, № 5. – p. 154-158.
6. Basic conditions and advantages of implementing electronic services in agribusiness // – "Cooperation" scientific and practical journal, 2021, № 1 (60). – p. 113-118.
7. Conceptual foundations of formation and development of agribusiness in Azerbaijan // – Moscow: Financial Economy. Scientific and analytical journal, 2022, № 10. – p. 106-108
8. Priority directions of electronicization in the efficient organization of agribusiness // – Baku: V Republican Scientific-Practical Conference of Young Researchers. Azerbaijan University, 2022. – p. 128-130.
9. The effectiveness of "Smart Village" projects in the liberated regions. // – Baku: Republican scientific and practical conference on "The problems of resettling liberated territories and restoring

infrastructure.", 2022. – p. 74-176.

10. Issues of forming a digital environment and the smart agricultural sector in Azerbaijan. // – Baku: "Silk Road" journal, 2023, № 3. – p. 41-47.

11. The directions for improving the investment and innovation support for the development of the agricultural sector // – Baku: ""Western Caspian" news, 2023, № 3. – p. 112-117.

12. Main directions for the implementation of innovations in the agricultural sector. // – Luxembourg: III International Scientific and Practical Conference "Modern directions and movements in science", Grand Duchy of Luxembourg. 26-28 October 2023. – p. 180-184.

13. Prospects for the development of electronic services organization in the country's agribusiness system. // –, Baku International Scientific Conference on the topic "Heydar Aliyev and the Modern Turkic World" dedicated to the 100th anniversary of the birth of Heydar Aliyev. 02 may 2023.– p. 632-635.

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