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The management of gross output of the agricultural, forestry, and fishery sectors of Kazakhstan

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ORIGINAL ARTICLE

Abstract. The article analyses the management of gross output of agriculture, forestry, and fisheries in Kazakhstan as an important element of the economic structure. Current global challenges, including climate change, land degradation, and the reduction of natural resources require an effective management for ensuring food security and sustainable development of Kazakhstan's agrarian economy. The purpose of the research is to identify the factors affecting the production of agricultural, forestry, and fish products. Moreover, there is an attempt to develop proposals for improving management in these sectors through the integrated approach, including methods of quantitative and qualitative analysis, statistical data, etc. The analysis includes an assessment of the impact of government programs and policies on the development of agricultural sectors in terms of the climatic conditions, technological innovations, and demand. According to the results, the effective management of gross output is possible through the integration of innovative technologies, improved infrastructure, and coordination between public and private sectors.

Keywords: Kazakhstan's gross output; agricultural technologies; sustainable development; food security; climate change

JEL codes: R11, R53, Q58, Q55, Q14, Q16

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Introduction

The relevance of the study of gross output management in agriculture, forestry, and fisheries in Kazakhstan is determined by the importance of these industries for the national economic stability and food security. Agriculture, forestry, and fisheries are important sectors of Kazakhstan's economy. Moreover, they play a significant role in the socio-economic development of the regions, provide food products to the population, and preserve ecosystems. However, these industries face a number of challenges, including the negative effects of climate change, insufficient technological innovation, poor infrastructure development, etc.

The purpose of this research is to analyse the factors affecting gross output in these sectors and make recommendations for improving production management under changing economic and environmental conditions. The objectives of the research are as follows: 1) to identify the main issues of the agriculture, forestry, and fisheries in Kazakhstan; 2) to assess the impact of external and internal factors on production; 3) to draw up the specific recommendations on optimisation of management and improve interaction between the state authorities and the producers.

Moreover, the degree of scientific development on the topic of agricultural and natural resource management is quite high. However, there are still many challenges related to the optimisation of these processes in Kazakhstan. Theoretical significance of the research lies in the expansion of knowledge about the economic mechanisms of natural resources management in the agrarian sphere; practical significance is in the recommendations to improve management and introduction of innovative technologies in production.

The methodological basis of the research includes the use of the quantitative methods of analysis, statistical and SWOT analysis, comparative analysis with the international practice of agricultural production management. The results of the research ensure the development of the effective economic management mechanisms aimed at the development of Kazakhstan's agricultural sector.

There are several key approaches [1-15] devoted to the issues of socio-economic development of the agricultural sector and food security in the modern scientific literature.

1. Institutional and Governmental Approach

These researches focus on analysing the impact of the government policy and institutional regulation on agriculture and food security. For example, Berkinov B.B. and Saburova N.R. [1] consider the actual state and prospects of agricultural development in the Republic of Karakalpakstan, emphasising the importance of the improvement of the state mechanisms of support. The works by Omoshev T.T. and Kantoroeva G.K. [6] discuss the issues of functioning of the economic processes in the agricultural sector of the Kyrgyz Republic; Tikhonova T.B. [3] analyses the mechanisms of the regulation of the ecosystem services. The papers by Dambaulova G K. et al. [12] focus on the strategic development of the food sector in Kazakhstan.

2. Economic-analytical and Resource-based Approach

In this framework, the researchers analyse the economic and resource factors affecting the development of the agricultural sector. For instance, Abdiev M.J. et al. [2] study the food security of Kyrgyzstan through the prism of the agricultural development; Sabirova A.I. [10] considers the territorial organisation of the agricultural production in the various natural and climatic zones of Kazakhstan. The research of Ibraimov K.G. [13] focuses on updating the fixed assets of the agro-industrial complex; Rustembayev B.E. et al. [14] analyse the agrarian policy of Kazakhstan in terms of the integration with the EAEU.

3. Digitalization and Innovative technologies in Agriculture

The digitalisation and the technological development have become the important factors in increasing the efficiency of the agro-industrial complex. Ualieva M.A. and Maydirova A.B. [5] examine the processes of digitalisation in terms of the land policy of Northern Kazakhstan; Seitov S.K. [8] considers subsidies as a tool to stimulate the innovation in the agriculture. The research of Baidalinova A. et al. [11] confirms the contribution of the digital technologies in food security improvement in the context of economic integration.

4. Food market and Competitiveness

The studies on the agri-food markets analyses their structure, dynamics, and competitiveness factors. For example, Niyazbayeva A.A. and Imanbayeva Z.O. [9] examine the food market of the Aktobe region of Kazakhstan, identifying trends in its development; Abildaev S.T. et al. [7] assess the economic security of the agricultural exports in Kazakhstan; Kydyrbaeva E.O. et al. [15] investigate the sugar market, identifying criteria for its optimal functioning.

The analysis of the modern research allows us to identify four approaches to studying the problems of agriculture and food security: institutional, economic and analytical, digital, and market ones. Each of these approaches offers its own perspective on these problems addressing and strategic development of the agricultural sector in the different countries. In the future, the scientific research is supposed to focus on interdisciplinary approaches and the integration of the different tools to improve the sustainability of the agri-food sector.

Methods

The following methods and approaches were used:

Statistical analysis is an analysis of the dynamics and structure of gross output (services) of agriculture, forestry, and fisheries in Kazakhstan. It is based on official statistical data by the Bureau of National Statistics

of the Agency of the Republic of Kazakhstan for Strategic Planning and Reforms [16] and the Ministry of Agriculture of the Republic of Kazakhstan. Indeed, data for the last 13 years (2010-2023) allowed us to identify the trends and factors influencing changes in different sectors of the agricultural economy.

Qualitative analysis. It is the use of the content analysis method to assess the impact of government programs and strategies on the development of the agricultural sectors. It also allows ones to identify successful management practices in the certain regions of the country.

The comparative and SWOT analysis. It is a comparison of the results of the regions of Kazakhstan. These results allow ones to identify the strengths and weaknesses of the domestic agrarian policy and its management.

Interviews and surveys. These include conducting expert interviews with representatives of the Ministry of Agriculture, scientific institutes, and industry organizations, analysing research materials, reports, etc. They allowed us to understand the internal problems of the industries and draw the recommendations for their addressing.

These methods ensured a comprehensive approach to the study and identified the main factors affecting gross output of agriculture, forestry, and fisheries in Kazakhstan.

Results

The main results of the study show the current trends in the agricultural sector of Kazakhstan, and factors affecting the dynamics of gross output.

The total gross output (services) of agriculture, forestry, and fisheries in Kazakhstan in 2023 is KZT 7,625.2 bn tenge. This decline is related to several factors such as climatic conditions, an insufficient state funding of certain programmes in the agricultural sector, etc.

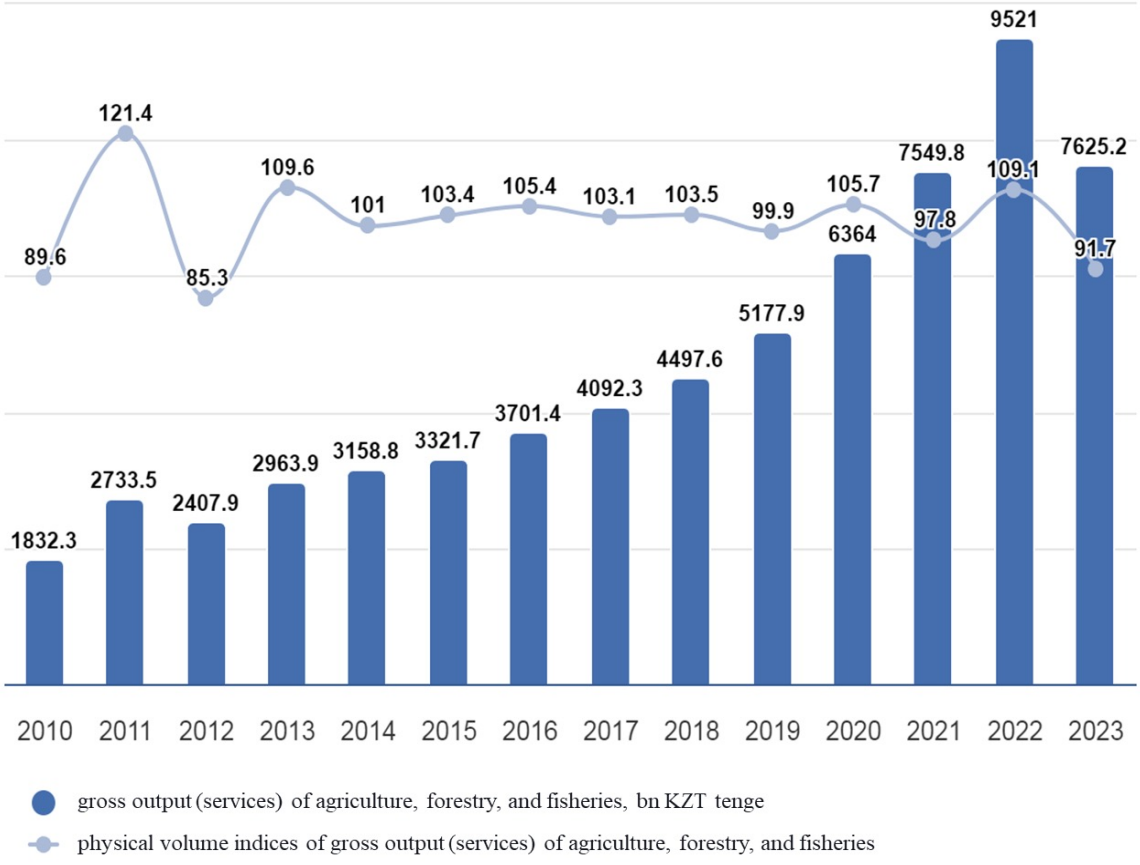

Figure 1. Dynamics of gross output (services) of agriculture, forestry, and fisheries

Source: Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan[1]

[1] *Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. Source: https://stat.gov.kz/ru (accessed on 10.04.2025)*

Table 1 – Economic analysis of gross output (services) of agriculture, forestry, and fisheries

Index	Value	Analysis and trends
The general trend	Growth until 2022, decline in 2023	Gross output of agricultural, forestry, and fisheries products (services) grew steadily in 2010-2022; it reached a peak in 2022 (KZT 9,521 bn tenge); it decreased by 20% in 2023 (KZT 7,625.2 bn tenge).
Average annual growth (2010-2022)	≈ 14%	Until 2022, there was steady growth in the sector. It indicates a positive trend in the development of agriculture.
Sharp decline (2023)	- 20%	In 2023, a significant decrease in output was recorded. Possible causes: a drought, the rising prices for fertilizers and fuels, the reduced government support, and inflation.
Physical Volume Index (2023)	91.7	A decrease in the index shows a drop in production volumes, not onle a decrease in the cost of the products.
Growth Factors (until 2022)	The government support programs, technology development, export demand	The increased yields, investments in the agriculture, and agricultural enterprises contributed to the growth of the industry.
Factors of decline (2023)	The climatic conditions, economic instability, rising production costs	The decline was caused by the external and internal factors, including the economic crisis, rising resource prices, and declining yields.
Forecast	The stabilisation is possible with government support.	To increase, the investments in the sustainability of the agricultural sector, diversification of agricultural products, and subsidising farmers are needed.

Source: Authors

Kazakhstan's agriculture has shown steady growth until 2022. In 2023, a significant decrease in output was recorded. The reasons for the decline are rising costs, climate (drought, frost, floods), and a decrease in production volume indices. To recover, it is necessary to strengthen the state support and invest in the modernisation of the industry. The main indicators of gross output (services) of agriculture, forestry, and fisheries for 2023 are shown in Figure 2.

Table 2 – Economic analysis of gross output of agricultural services, crop and livestock production

Index	Value	Analysis and trends
The general trend	The decrease in gross agricultural output in 2023 compared to 2022	In 2023, gross output amounted to KZT 7,576.5 bn tenge. It is 20% less than in 2022 (KZT 9,481.2 bn tenge).
Crop production	Decrease in production	In 2023, crop production decreased from KZT 5,808.3 bn tenge to KZT 4,552.4 bn tenge (-21.6%). The reasons are the unfavourable weather conditions, reduced acreage, or increased costs.
livestock production	Decrease in production	In 2023, livestock production decreased from KZT 3,658.8 bn tenge to KZT 3,012.5 bn tenge (-17.7%). Possible reasons include a reduction in livestock, rising prices for feed, and veterinary services.

Index	Value	Analysis and trends
Agricultural services	Volume reduction	In 2023, services decreased from KZT 14.2 bn tenge to KZT 11.6 bn tenge (-18.3%). It indicates a reduction in demand for agricultural services.

Source: Authors

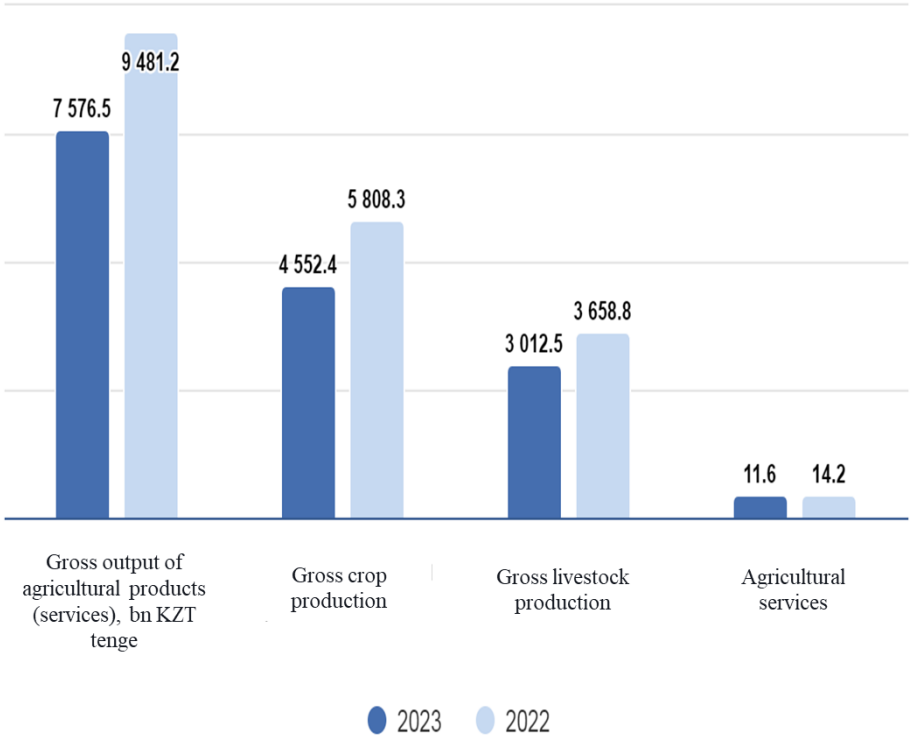

Figure 2. Gross output of agricultural products (services), bn KZT tenge
Source: Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan[2]

In 2023, there is a decrease in gross output of the agricultural production. The largest drop was recorded in crop production (-21.6%). Livestock production also showed a decline (-17.7%). The support measures for the industry are needed, including subsidies and modernisation.

Gross output of agricultural products (services) by region is shown in Figure 3.

Table 3 – An economic analysis of the index of physical volume of gross crop production

Index	Value	Analysis and trends
The general trend	The decrease in the physical volume of gross crop production by 14.1%	The average decrease in the country indicates challenges in agriculture. These are possibly related to weather conditions, lack of resources, or rising costs.
Regions with a positive dynamic	Abai (+5.6%), Kyzylorda (+5%), Mangystau (+3.7%), Astana city (+3.3%), Zhetisu (+2.5%), Turkestan (+1.7%)	In these regions, the cultivation technologies have improved; new methods of the agricultural production have been applied; the acreage has been increased.

[2] *Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. Source: https://stat.gov.kz/ru (accessed on 10.04.2025)*

Index	Value	Analysis and trends
Regions with a moderate decline (up to -10%)	Atyrau (-2.7%), Almaty city (-3.4%), Almaty (-3.9%), West Kazakhstan (-4.1%), Zhambyl (-6.2%), Aktobe (-7.9%), East Kazakhstan Region (-8.2%), Karaganda (-9.5%)	These regions showed a slight decrease due to the unfavorable conditions and temporary difficulties in the agricultural sector.
Regions with high decline (10% or more)	Shymkent city (-18.9%), Kostanay (-19.7%), North Kazakhstan Region (-20.3%), Pavlodar (-26.7%), Akmola (-38%), Ulytau (-60.2%)	However, there is a crop production crisis in these regions. The largest decrease is in Ulytau (-60.2%) and Akmola (-38%). It indicates serious challenges caused by the climate (drought, frost, floods), reduced yields, and a shortage of agricultural resources.
Factors of decline	Climate change (drought, frost, floods), reduced investment, rising prices for fertilizers and fuel	A significant drop in production volumes indicates systemic problems in agriculture. It requires the significant support.
Forecast	The further instability is possible without support measures.	To stabilise, the subsidisation programs, development of irrigation systems, and investments in agricultural technologies are needed.

Source: Authors

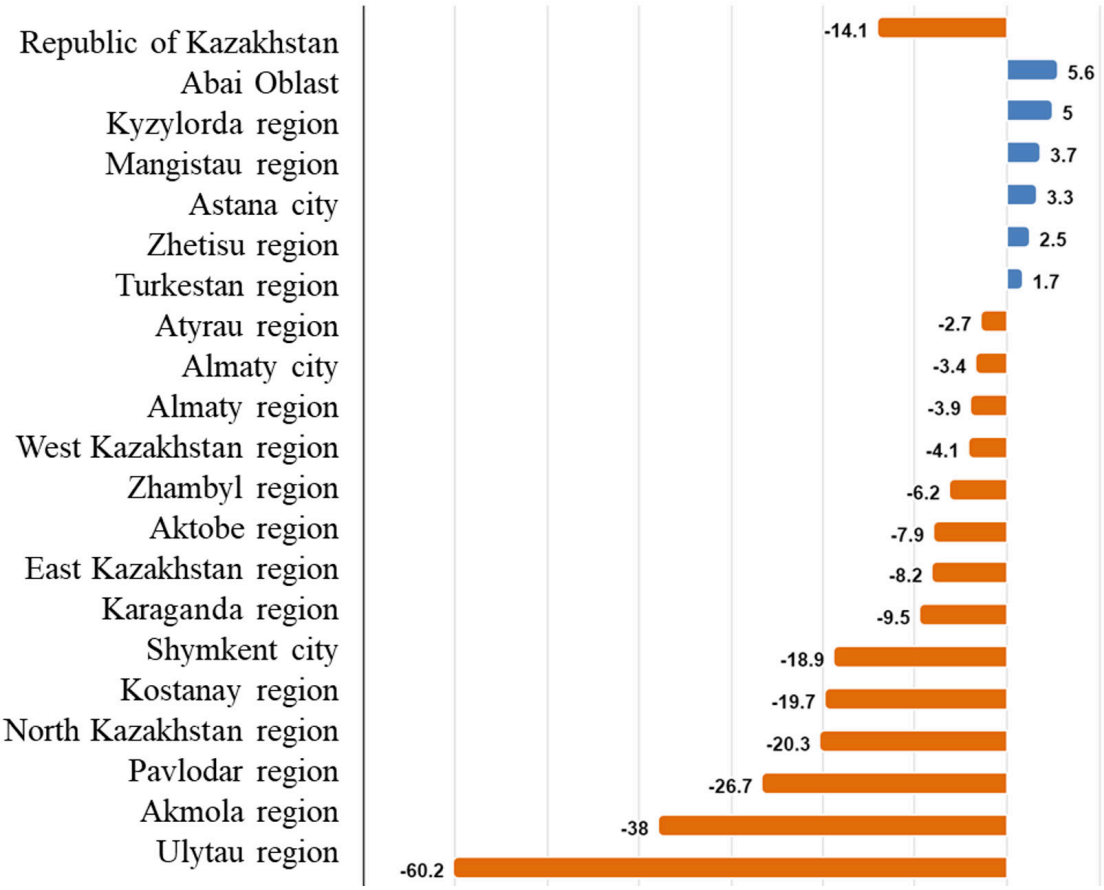

Figure 3. Index of the physical volume of gross crop production

Source: Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan[3]

[3] *Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. Source: https://stat.*

According to Figure 3, the decrease in crop production in the reporting year (by 14.1% compared to the previous year) is associated with a decrease in the production of cereals and legumes by 22.8%, and oilseeds by 31%.

The overall index of physical volume of crop production decreased by 14.1%. Ulytau (-60.2%) and Akmola (-38%) regions were the most affected. Indeed, only six regions showed growth. It indicates the possible influence of weather conditions and economic factors. The support measures are needed to stabilise the industry and prevent further decline.

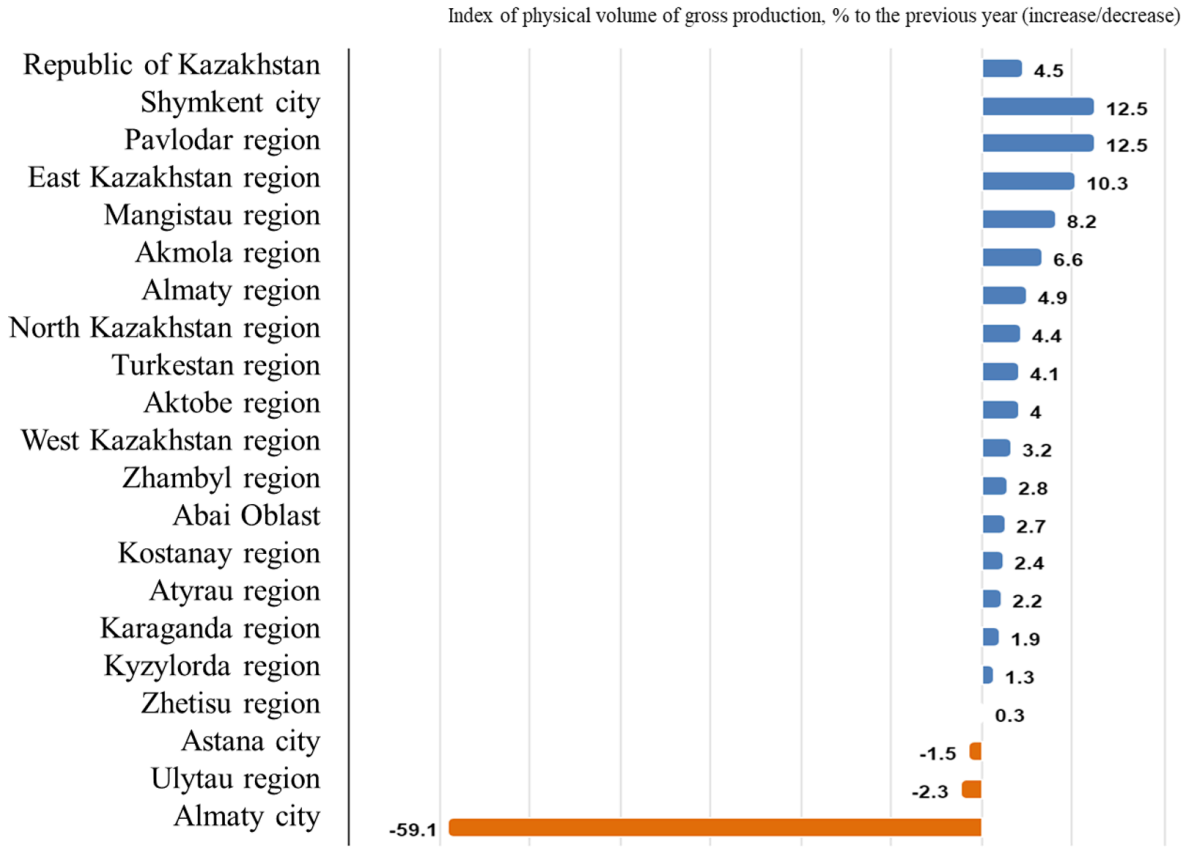

Figure 4. Index of physical volume of gross livestock production

Source: Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan[4]

According to Figure 4, the gross livestock production increased by 4.5%. It is due to an increase in production volumes by the types of economic activity such as «poultry breeding» by 11.7%, «dairy cattle» by 2.7%, «horses and other equine animals» by 6.7% and «other cattle and buffaloes» – by 3.1%.

Table 4 – An economic analysis of the index of physical volume of gross livestock production

Index	Value	Analysis and trends
The general trend	The growth of the physical volume of gross livestock production in the republic	The most regions showed positive dynamics. It indicates the stability and development of the livestock sector.
Regions with the highest growth	Pavlodar (+12.5%), East Kazakhstan Region (+12.5%), Mangystau (+10.3%), Akmola (+8.2%), Almaty (+6.6%)	This significant growth is due to the expansion of farms, an increase in livestock numbers, and improved feeding and veterinary care conditions.

gov.kz/ru (accessed on 10.04.2025)

[4] *Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. Source: https://stat.gov.kz/ru (accessed on 10.04.2025)*

Index	Value	Analysis and trends
Regions with a moderate growth (2%-5%)	North Kazakhstan Region (+4.9%), Turkestan (+4.4%), Aktobe (+4.1%), West Kazakhstan (+4%), Zhambyl (+3.2%), Abay (+2.8%), Kostanay (+2.7%), Atyrau (+2.4%), Karaganda (+2.2%), Kyzylorda (+1.9%)	These regions are showing steady growth. It indicates the gradual development of the livestock production.
Regions with weak growth (less than 2%)	Zhetisu (+1.3%)	The minimal increase is due to insufficient investment or infrastructure constraints.
Regions with a decline	Astana (-1.5%), Ulytau (-2.3%), Almaty (-59.1%)	The most serious decrease is in Almaty (-59.1%). It is due to the crisis, changes in the structure of agricultural production, or administrative activity.
Growth factors	Increased investment, expansion of farms, improvement of veterinary control	The main reasons for the increase in production are the government support, industry subsidies, and favourable weather conditions.
Factors of decline	Decrease in demand, increase in costs, change in the structure of agriculture in Almaty	In Almaty, there was a redistribution of land and a reduction in livestock production.
Forecast	The further growth in the most regions, industry stabilisation	In general, livestock production shows a positive dynamic. However, there is still a need in support.

Source: Authors

Overall, the livestock sector is growing; the most significant growth is in Pavlodar, East Kazakhstan, and Mangistau regions. Almaty (-59.1%), in the contrary, shows the negative dynamics. It requires the further analysis of the reasons. The livestock production is a stable and promising industry, but the individual regions need the additional support.

Table 5 – SWOT-analysis of management of gross output of products (services) of agriculture, forestry, and fishery of Kazakhstan

Strengths	Weaknesses
The importance of the sector: Kazakhstan's agricultural sector plays an important role in ensuring food security and socio-economic development of the regions.	The infrastructural constraints: insufficient development of logistics, transport, and processing infrastructure.
The government support: the availability of government programs and policies aimed at the development of agriculture, forestry, and fisheries.	The climate risks: the impact of climate change, land degradation, and reduced soil fertility.
The natural resources: rich land resources, availability of water resources, and favorable climatic conditions for agricultural production.	The low level of mechanisation: the limited automation of production processes, dependence on traditional farming methods.

Innovative technologies: the development of digital tools and agricultural technologies to improve the efficiency of the production management.	Financial barriers: limited access of small and medium-sized enterprises to investments and credit resources.
Export potential: the opportunities for expanding agricultural exports to the international markets.	Human resources challenges: the shortage of qualified specialists in the agricultural sector.
Opportunities	Threats
The global trends: the growing global demand for environmentally friendly and organic products.	The economic instability: possible macroeconomic crises, currency fluctuations, and inflation.
PPP development: the opportunities for expanding public-private partnerships (PPPs) in the development of the agricultural production.	The competition in the global market: increased competition from the other agricultural countries.
The integration with the international markets: expansion of the export opportunities through the participation in the international trade agreements.	The environmental factors: the threat of depletion of water resources, changes in precipitation and drought conditions, frosts, and floods.
The digitalization of the sector: the introduction of Big Data, artificial intelligence, and automated control systems.	The political risks: the possible changes in the government policy and tax regulation.
The improvement of support policy: the development of concessional loans, subsidies, and investment programs.	The social challenges: urbanization and the outflow of labour from rural areas.

Source: Authors

Table 6 – PEST-analysis of management of gross output of products (services) of agriculture, forestry, and fishery of Kazakhstan

Factors
Political
The government policy and programs to support agriculture.
The legislative regulation in terms of the land use and ecology.
The impact of the international trade agreements and sanctions.
The government measures to subsidise the agricultural production.
Economic
The impact of inflation and exchange rate fluctuations on production costs.
Availability of lending and investment in the agro-industrial sector.
Development of the export markets and the trade partnerships.
The cost of fuel, fertilisers, and farm equipment.
Social
Increasing demand for organic products and environmentally friendly production.
Demographic changes and rural population decline.
The level of education and training in the agricultural sector.
Changing consumer preferences and increasing requirements to product quality.
Technological
The introduction of digital technologies and artificial intelligence in agribusiness.
The automation of the agricultural production.
Development of the agricultural technologies aimed at increasing yields and resilience to the climate change.

Factors
The use of drones, IoT, and satellite monitoring.

Source: Authors

Table 7 – The improvement of the management of gross output of products (services) of agriculture, forestry, and fisheries of Kazakhstan

Index	Analysis of the current situation	The recommendations for improvement
The government policy	The existing agricultural support programmes contribute to the sector's development, but have weaknesses in implementation and the distribution of subsidies.	The development of the targeted subsidy programmes, strengthening control over the efficiency of funds allocation.
Technological development	A low level of mechanisation, insufficient implementation of digital technologies and innovative solutions.	The active implementation of the digital technologies (Big Data, IoT), and automation of manufacturing processes.
Financial support	The limited access of small and medium-sized enterprises to loans, high cost of borrowed funds.	The expansion of preferential lending programmes, state guarantees for the agricultural manufacturers.
The environmental challenges	The climate change, droughts, soil degradation, and water scarcity.	The development of the sustainable agriculture, land reclamation, modernisation of the irrigation systems.
Logistics and infrastructure	The insufficient development of transport and storage facilities, low availability of sales markets.	the investments in the creation of agricultural centers, expansion of the network of storage and processing.
Human resources potential	The shortage of the qualified specialists, aging of personnel in the agricultural sector.	Training and retraining programs, popularisation of the agricultural professions among young people.
Sales and export markets	High dependence on the export of raw materials, low proportion of processed products.	The development of the processing industry, expansion of export geography, support for the manufacturers.
Investment attractiveness	A low level of private investment in agriculture due to the high risks.	Stimulating of the private investment through tax incentives and the development of public-private partnerships.

Source: Authors

Conclusions

A comprehensive modernisation of the agro-industrial sector is required, focused on the digitalisation and innovation. The climate risks require adaptive strategies, including the development of a sustainable agricultural technology. Moreover, the climate risks require adaptive strategies, including the development of sustainable agricultural technologies. The logistics and export infrastructure requires an improvement to increase the competitiveness of the sector. The development of human resources plays a key role in the sustainable development of the agricultural sector in Kazakhstan. These recommendations will provide the efficiency of managing gross output of agriculture, forestry, and fisheries, and ensure the sustainable

development of the sector and strengthen food security in Kazakhstan.

The research is devoted to the analysis of the management of gross output of agriculture, forestry, and fisheries in Kazakhstan in the context of the climate change, land degradation and insufficient government support. Therefore, consideration of the alternative points of view presented in the scientific literature provides an objective assessment of the validity of the results obtained and their compliance with international research.

In particular, the approaches proposed correlate with the institutional theory of state regulation of the agricultural sector, presented in the works of Berkinov B. B. and Saburova N.R. [1], Omoshev T.T. and Kantoroeva G.K. [6], Dambaulova G.K. et al. [12]. These studies emphasise the urgency of the integrated agricultural policy management through the introduction of targeted programs and production incentive mechanisms. Additionally, the research focuses on the combination of state regulation with innovative production management mechanisms. It was highlighted in the papers by Ualieva M.A. and Maidyrova A.B. [5], who studied the role of digitalization in the management of the agricultural processes.

However, the alternative approaches presented in the research of Abildaev S.T. et al. [7] indicate the critical dependence of the agricultural sector of Kazakhstan on global food markets and export opportunities. In contrast, we consider the internal structural problems such as technological and infrastructural gaps. This expands the theoretical understanding of the factors influencing output in agriculture, forestry, and fisheries in Kazakhstan.

Therefore, this particular research confirms previously established patterns, and highlights new aspects requiring more in-depth study, such as the complex integration of innovative technologies and the development of the logistics system of agriculture.

The scientific novelty of the research involves an integrated approach to the analysis of gross output of the agricultural sector of Kazakhstan, combining quantitative and qualitative methods, as well as comparative analysis with international practice. In contrary to the most previous studies focusing on individual factors (state support, climate risks, or digitalisation), this research examines the agricultural governance system as a multi-component structure highlighting the macroeconomic conditions, technological modernisation, and the interaction between public and private sectors.

The conclusions of the research are substantiated by analysing the dynamics of gross output over the past 13 years (2010-2023), using SWOT and PEST analysis, and statistical data from the Bureau of National Statistics of the Republic of Kazakhstan. The comparative data by region allows us to reasonably identify structural imbalances and factors influencing a decrease or increase in the production volumes.

Therefore, the scientific significance of the work consists in the integration of the different methodological approaches. They provide a comprehensive study of the factors affecting the development of agriculture, forestry, and fisheries in Kazakhstan.

The theoretical significance of the research consists in the development of the economic and analytical approaches to the management of agro-industrial complex. The analysis provides a basis for further research in terms of the sustainable agriculture, state regulation of food markets, and digitalisation of the agricultural sector.

The practical significance of the study includes the development of the specific recommendations to improve the management of gross output. There are as follows: improving government support and subsidies for the agricultural sector; the introduction of the modern digital technologies for monitoring and planning agricultural production; development of the infrastructure projects in the rural areas; stimulating private investment in the processing and logistics of the agricultural products.

The results of the research may be applied in the development of strategies for the development of the agrarian sector of Kazakhstan, planning of state programmes to support agriculture, formation of educational programmes on economics and management of the agro-industrial complex.

The presented research expands scientific understanding of the mechanisms of agrarian economy management in Kazakhstan, confirms the importance of the integration of modern technologies and state support and could provide a basis for the further interdisciplinary research in this field.

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CONFLICT OF INTEREST
The authors declare no conflict of interest.

AUTHORS' CONTRIBUTION
Zhanna R. Ashimova – conceptualization, project administration, writing – original draft.
Amina M. Uristembek – writing – review & editing.
Zhanay J. Abitov – investigation.
Diana Z. Abitova – formal analysis.

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