Substantiation of business models in the agro-industry: The case of Kazakhstan and Central Asian countries

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Abstract. The purpose of the study was to investigate the key factors influencing the choice and effectiveness of business models in the agro-industrial sector of Kazakhstan and Central Asia. The research methodology included an analysis of statistical data, a comparative analysis of business models, and an assessment of the impact of external economic and climatic factors on the sustainability of agribusiness in the region. In the course of the study, the existing business models of agricultural enterprises were

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investigated and categorised, their key features and factors influencing their choice were identified. The dynamics of the total volume of agricultural production in Kazakhstan, Uzbekistan, and Kyrgyzstan was analysed with the conversion of indicators into USD, which helped to objectively assess the scale and trends of the agricultural sector. The total volume of agricultural production in Kazakhstan in 2023 amounted to USD 16.12 billion, in Uzbekistan – USD 35.26 billion, and in Kyrgyzstan – USD 4.44 billion. Investment projects in the agro-industry, including large investments in greenhouse complexes, processing of agricultural products and digitalisation of the industry, were considered in detail. Using the example of Atameken-Agro, a detailed financial analysis was carried out, fluctuations in profitability and the impact of economic factors on business profitability and sustainability were revealed. The results showed that digitalisation, the introduction of precision agriculture, vertical integration, and an export orientation for processed products are the key drivers of the region's agro-industry growth. Based on the identified trends, recommendations have been developed for the selection and adaptation of business models for agricultural companies in Kazakhstan and Central Asia. These include the development of cooperative structures, the introduction of sustainable agricultural technologies, increasing the investment attractiveness of the sector and the diversification of production. The conclusions of the study confirmed the need for an integrated approach to the development of agribusiness in a region where digitalisation, government support, and integration into global markets play a crucial role in increasing the competitiveness of agricultural enterprises

INTRODUCTION

The agro-industrial sector plays a key role in the economy of Kazakhstan and Central Asian countries, providing food security, employment, and a significant contribution to the gross domestic product. The region has a high potential for agricultural development due to its extensive land resources, favourable climatic conditions and growing global demand for agricultural products. However, despite these advantages, the industry faces a number of challenges, including a low level of technological modernisation, insufficient processing of agricultural products, limited access to investment, and weak integration into global value chains. In these conditions, the search for effective business models becomes an important task for ensuring competitiveness and sustainable growth of the agricultural sector. Existing approaches to agribusiness require revision, as conventional models demonstrate low efficiency in a changing economic and climatic landscape.

Many researchers have previously paid attention to the issue of choosing and adapting business models in the agro-industry. For example, D. Dentoni *et al.* (2020), investigated the impact of the institutional environment on the development of agribusiness and concluded that the lack of clear government support and effective financing mechanisms hindered the development of private agricultural enterprises. Their study showed that subsidised measures without accompanying structural reforms did not lead to long-term growth of the industry. S. Suieubayeva *et al.* (2022) analysed business models in Kazakhstan, revealing that farms integrated into international supply chains demonstrated the greatest resilience. They noted that companies working on contract farming had more stable incomes due to guaranteed sales of products.

The study by J. MacPherson *et al.* (2022) showed that digitalisation of farms has contributed to an increase in their efficiency. They analysed the implementation of agrotechnological platforms and found that farmers who used digital tools for soil monitoring and resource management increased yields compared to conventional methods. S.N. Ulakov *et al.* (2020) examined cooperative forms of agribusiness and found that in Kazakhstan such models faced problems of trust between participants, but with clear management mechanisms, they ensured higher competitiveness of small producers. They noted that successful cooperatives performed better in terms of access to credit and sales markets. M.Y. Arafat *et al.* (2020) investigated the impact of government policy on the development of agricultural entrepreneurship. The researchers concluded that the most effective support measures were subsidies for the purchase of innovative equipment and tax incentives for small farms. C.T. Nguyen and F. Scrimgeour (2022) analysed the impact of climate change on the business models of agriculture in the region and found that farmers who switched to adaptive technologies such as drip irrigation and sustainable crop varieties reduced their losses during dry years.

The study by S. Jeshari and M. Esfandiari (2022) considered the issue of agricultural exports, and noted that enterprises focused on foreign markets were more likely to implement quality standards and certification, which increased their competitiveness. B. Aibar-Guzmán *et al.* (2022) investigated the role of venture financing in agribusiness and found that investments in start-ups developing agrotechnological solutions were growing, but the lack of venture capital in the region remained a serious problem. R. Karabassov (2024) reviewed the prospects of organic agriculture and found that, despite the high demand for environmentally friendly products, farmers faced barriers such as complex certification and high initial costs. F. Carlucci *et al.* (2021)

investigated the impact of logistics infrastructure on the efficiency of agribusiness and concluded that the lack of modern storage facilities and processing plants significantly limited the ability of farmers to enter foreign markets. They noted that regions with developed logistics demonstrated higher profitability of agricultural production by reducing product losses and optimising supply chains.

Thus, previous studies have shown that the sustainable development of agribusiness depends on a combination of technological innovations, sound government regulation, and the adaptation of successful global practices to regional conditions. Despite a wide range of research in the field of business models of the agro-industry, a number of important aspects remain insufficiently studied. In particular, there is no comprehensive analysis of the adaptation of global business models to the specifics of Kazakhstan and Central Asia, considering climatic, economic, and institutional factors. The mechanisms for integrating farms into international supply chains have also not been fully explored, and the impact of digital technologies and innovative financial instruments on the sustainability of agribusiness requires further investigation.

The purpose of the study was to analyse effective business models of the agro-industrial sector in Kazakhstan and Central Asia, considering regional factors and technological capabilities. The objectives of the study were to conduct a comparative analysis of existing agribusiness business models in Kazakhstan and Central Asia, assess the impact of digital technologies and innovative financial instruments on the effectiveness of agro-industrial enterprises, and develop recommendations for adapting successful global business models considering the specifics of the region.

MATERIALS AND METHODS

The study of business models of agro-industrial enterprises in Kazakhstan and Central Asian countries was based on a comprehensive analysis of macroeconomic indicators, industry trends, and investment activity in the agricultural sector. The study used both quantitative and qualitative methods, which helped to comprehensively assess the current state of agribusiness in the region, identify key factors influencing the choice of business models, and offer recommendations for their adaptation in modern conditions. One of the main research methods was the analysis of statistical data, including indicators of the total volume of agricultural production in Kazakhstan, Uzbekistan, and Kyrgyzstan for 2014-2023. The data were taken from the Bureau of National Statistics of Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (n.d.), National Statistical Committee of the Republic of Uzbekistan (n.d.) and National Statistical Committee of the Kyrgyz Republic (n.d.). Data for 2024 has not yet been published at the time of research. The statistical

and mathematical method using the IBM SPSS Statistics software suite was used for data processing and analysis. Data from national statistical agencies were converted into USD based on the exchange rate for the corresponding years, which provided an objective picture of the scale and trends of the agricultural sector in the region. Using statistical analysis, it was possible to identify patterns of growth and decline, identify the main drivers and risks, and conduct a detailed comparison of the agricultural sectors of the three countries.

The study analysed key strategic documents that determine the development of the agro-industrial complex in Central Asian countries. In particular, the Resolution of the Government of the Republic of Kazakhstan No. 732 (2021), Decree of the President of the Republic of Uzbekistan No. UP-5853 (2019) и Resolution of the Cabinet of Ministers of the Kyrgyz Republic No. 574 (2024). Additionally, a comparative analysis of investment projects in the agroindustry of Kazakhstan and Central Asian countries was conducted. Within the framework of this study, large agricultural projects of strategic importance for the development of the sector were considered. Among them is the "cow-calf" model aimed at developing meat and dairy farming, which is being actively implemented in Kazakhstan and was helping to increase the production of high-quality beef and milk (Food security: The..., n.d.). The study examined the following major agricultural projects: construction of a greenhouse complex in the Turkestan region (Kazakhstan) (EastFruit, 2024a), creation of an agricultural engineering cluster in the Tashkent region (Uzbekistan) (Novikov, 2023), construction of plants for processing pears, nuts and tomatoes in Uzbekistan (Uzbekistan to create..., 2025), construction of agro-logistics facilities in Osh region (Kyrgyzstan), construction of a fruit and vegetable processing plant in Osh region (Kyrgyzstan) (Petchenko, 2023), opening of cold storage facilities and workshops for processing fruits and vegetables in Chui region (Kyrgyzstan) (EastFruit, 2024b).

For an in-depth analysis of business models, the case study method was used using the example of the region's leading agricultural enterprises. In particular, the activities of the Atameken-Agro company were considered in detail (Kazakhstan), one of the largest agricultural groups in the country. The analysis included a study of its financial performance for 2019-2024, allowing it to assess the dynamics of income, net profit, assets, and equity. The data was taken from the company's annual reports (Kazakhstan Stock Exchange, n.d.). An assessment of business sustainability was carried out, fluctuations in financial results and their dependence on external economic factors were revealed. The analysis of financial data provided conclusions about the company's profitability, the efficiency of the business model used, and its adaptability to changes in the agro-sector.

RESULTS

In the agro-industrial complex, the business model plays a crucial role in ensuring the efficiency, sustainability, and competitive advantages of enterprises. It covers strategic aspects of production, resource allocation, value chain creation, and market engagement (Donner *et al.*, 2021). Unlike conventional organisational structures, the business model focuses not only on production, but also on monetisation of the value created. In the agricultural sector, models vary significantly depending on the level of technological development, the scale of farms, climatic and economic conditions (Di Vaio *et al.*, 2020). The classic model of individual farming with family management and minimal use of external resources is still common in developing countries, including Kazakhstan and Central Asia. However, it faces low productivity, limited access to finance, and difficulties entering large markets.

One of the effective alternatives is a cooperative business model, which involves bringing farmers together to share equipment, organise sales, and attract investment. This reduces logistical and operational costs and strengthens farmers' positions in negotiations with purchasers and banks. A striking example is the Polish cooperative Mlekovita, which unites more than 8,000 farmers and supplies products to 160+ countries (Fiore *et al.*, 2020). In Central Asia, this model is limited by institutional distrust and a lack of management mechanisms. The vertically integrated model allows large agricultural holdings to control the entire production cycle, from cultivation to processing and marketing of products. This reduces transaction costs and improves quality control. An example is Arla Foods, Europe's largest dairy producer, which unites over 12,000 farms, with its own factories and logistics. The products are shipped to more than 100 countries (Hansman *et al.*, 2020). The disadvantage of the model is its high capital intensity and organisational complexity.

Digital business models are becoming increasingly relevant. These include platform solutions, the use of big data and precision farming technologies. This allows predicting the harvest, optimising the use of resources, and reducing costs. For example, the Swedish Dataväxt platform provides tools for soil analysis and crop monitoring. With its help, farmers reduced fertiliser and fuel costs by up to 20%, and yields increase by 10-15% (Wallander *et al.*, 2025). Contract farming is based on the conclusion of long-term agreements between farmers and processors or retailers, which ensures the sale of products and reduces market risks. A successful example is Danone's cooperation with farmers across Europe, which provides guaranteed sales at stable prices, allowing producers to confidently plan their activities (Chen & Chen, 2021). Against the background of growing interest in environmentally friendly products, organic agriculture is developing, eliminating the use of chemicals and targeting premium markets.

However, the barriers remain the high cost of certification and the need to restructure processes. In Thailand, the Green Net cooperative unites over 1,000 small farmers and undertakes the organisation of collective certification. This reduces costs and increases participants' incomes by 20-30% compared to conventional farming (Yanakittkul & Aungvaravong, 2020).

The choice of the optimal business model in the agroindustry of Kazakhstan and Central Asian countries is determined by a combination of economic, climatic, institutional and technological factors. Each of these conditions creates opportunities and constraints for agribusiness, affecting its strategy, competitiveness and sustainability. One of the key factors is the natural and climatic environment. Kazakhstan and most Central Asian countries are characterised by an arid climate, uneven distribution of water resources and risks of soil degradation. These conditions require the introduction of sustainable business models focused on efficient resource management, such as precision farming and agroecological production methods. The level of economic development and access to finance play an equally important role. Many agricultural enterprises in Kazakhstan and Central Asia face a lack of long-term investments and limited access to credit resources. According to the National Bank of Kazakhstan, as of November 2023, the total volume of bank loans amounted to KZT 12.2 trillion, of which only KZT 453.8 billion was allocated to the agricultural sector, which is about 3.7% of all loans. This situation is compounded by a shortage of collateral from farmers, which makes it difficult to obtain loans (What problems do…, 2023). High interest rates and stringent bank requirements make conventional forms of financing inaccessible to small farmers, forcing them to choose low-cost business models with minimal levels of mechanisation and innovation. However, large agricultural holdings with financial capabilities prefer vertical integration, which allows them to control the entire production and marketing chain.

The next significant factor is the institutional environment and government policy. In Kazakhstan and Central Asia, the agricultural sector is a strategically important area, but government support mechanisms do not always meet the real needs of businesses. Kazakhstan has government programmes to support the agricultural sector, such as the National Project for the Development of the Agro-industrial Complex for 2021-2025, which includes subsidising the purchase of machinery, crop insurance and export support (Resolution of the Government of the Republic of Kazakhstan No. 732, 2021). However, in practice, only about 30% of farmers can benefit from subsidies due to complex bureaucratic procedures. Uzbekistan is demonstrating more active government support for agribusiness, especially within the framework of the Agricultural Development Strategy for 2020-2030 (Decree of the President of the Republic of Uzbekistan No. UP-5853, 2019). The

government encourages the development of cluster and contract models through tax incentives and credit lines from the Fund for Reconstruction and Development. Several government programmes aimed at supporting the agricultural sector and farmers are being implemented in Kyrgyzstan. One of the key initiatives is the Programme for the Development of trade and logistics centres in the agro–industrial sector of the Kyrgyz Republic for 2024-2028 (Resolution of the Cabinet of Ministers of the Kyrgyz Republic No. 574, 2024). The purpose of this programme is to increase the competitiveness and export potential of Kazakh agricultural products through the creation and development of international trade and logistics centres.

Another important factor is the level of digitalisation and access to technology. In Central Asian countries, there is a digital divide between large and small producers: agricultural holdings are actively implementing modern technologies, while small farmers are limited in their automation and data analysis capabilities. The development of digital platforms and agrotechnological start-ups is gradually changing this situation, offering new models such as agricultural marketplaces and farm management services (Qin *et al.*, 2022). The implementation of such solutions allows even small farms to increase efficiency, reduce risks and enter new markets. The choice of a business model is influenced by market conditions and global trends. The growing demand for organic products, the development of export destinations and the need for sustainable food products are creating new opportunities for agribusiness in the region. Companies focused on the foreign market are forced to adapt to international quality and safety standards, which requires a restructuring of the business model and investments in certification, processing and logistics (Ahmad *et al.*, 2024). The agro-industrial sector of Kazakhstan and Central Asian countries represents a variety of business models, each of which has its own characteristics, advantages, and limitations due to climatic, economic, and social conditions. Figure 1 shows the total volume of agricultural production in Kazakhstan, Uzbekistan, and Kyrgyzstan.
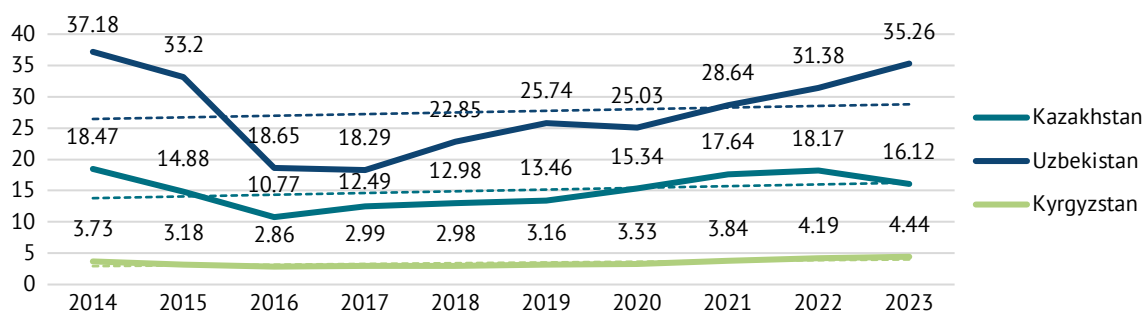

Figure 1. *The total volume of agricultural production in Kazakhstan, Uzbekistan, and Kyrgyzstan for 2014-2023, billion USD*
Source: *developed by the author based on data from the Bureau of National statistics of Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (n.d.), National Statistical Committee of the Republic of Uzbekistan (n.d.), National Statistical Committee of the Kyrgyz Republic (n.d.)*

The total volume of agricultural production in Kazakhstan, Uzbekistan, and Kyrgyzstan for the period from 2014 to 2023 demonstrated a variety of trends related to the economic and climatic conditions in these countries. There was a decrease in volume from 2014 to 2016, followed by an increase until 2023. Kazakhstan as a whole showed an increase from USD 10.8 billion in 2016 to USD 16.1 billion in 2023, due to improved infrastructure and increased investments in the agricultural sector. Uzbekistan, in turn, has demonstrated stable and steady growth, increasing the volume of agricultural products from USD 18.6 billion in 2016 to USD 35.3 billion in 2023, due to the expansion of exports and the introduction of modern technologies in agriculture. Kyrgyzstan, despite its smaller volume, is also showing steady dynamics, starting from USD 2.9 billion in 2016 and increasing to USD 4.4 billion in 2023, indicating a gradual improvement in agricultural performance, albeit at a slower pace compared to neighbouring countries. Regression analysis has shown that the growth rates of agricultural production in Kazakhstan (slope coefficient 0.274) and Uzbekistan (0.261) are at a comparable level. However, there has been a steady upward trend in Uzbekistan over the past four years, which is confirmed by a linear equation with a coefficient of determination ($R^2 = 0.95$). In Kazakhstan, since 2023, there has been a decrease in the total volume of agricultural products, while the trend line corresponds to the logarithmic equation ($R^2 = 0.82$). According to preliminary data for 2024, the volume will amount to USD 15.9 billion. The growth rate in Kyrgyzstan is less noticeable and amounts to 0.119. These results indicate a positive but uneven dynamic of the agro-industrial sector in the region. This may be due to differences in economic policy, the level of investment activity, the degree of implementation of innovative technologies, and natural crises such as water scarcity, especially in Kazakhstan (Fig. 2).
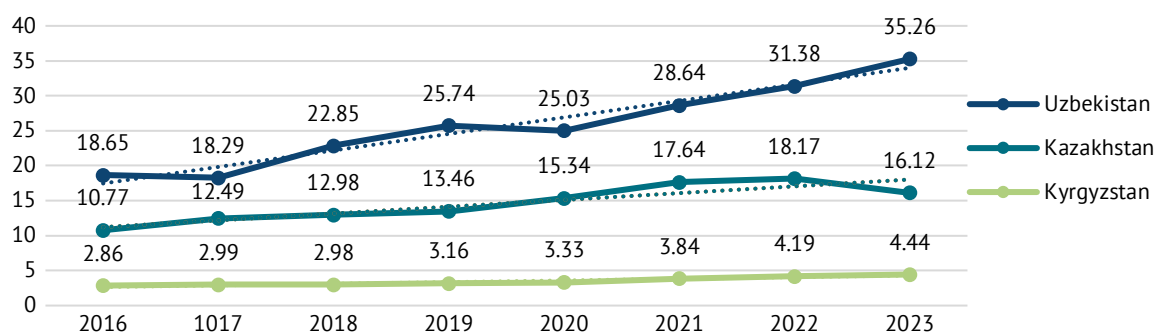
Figure 2. *Trend of the total volume of agricultural production*
in Kazakhstan, Uzbekistan, and Kyrgyzstan for 2016-2023, billion USD
Source: *developed by the author based on data from the Bureau of National statistics of Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (n.d.), National Statistical Committee of the Republic of Uzbekistan (n.d.), National Statistical Committee of the Kyrgyz Republic (n.d.)*

Organic agriculture is one of the rapidly developing business models in Kazakhstan, aimed at producing environmentally friendly products without the use of chemical fertilisers and pesticides. Kazakhstan is experiencing a dynamic growth in the area of land occupied by organic agriculture (Kuandykova *et al.*, 2023). In 2023, the area of organic farmland in Kazakhstan amounted to 191.3 thousand hectares, which is a significant progress compared to previous years (Bureau of National Statistics of Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, n.d.). This sector is supported by the National Project for the Development of the Agro-industrial Complex for 2021-2025, aimed at the development of organic agriculture, which is confirmed by the increase in the number of certified producers and the expansion of the product range (Resolution of the Government of the Republic of Kazakhstan No. 732, 2021).

Exports of organic products from Kazakhstan also showed positive dynamics. In 2022, the volume of exports amounted to USD 35 million, which is 10% more than USD 32 million in 2021, and significantly exceeds the figure of USD 10 million recorded in 2020. Kazakhstan actively exports organic products to the EU, where the main partners are countries such as Germany, the Netherlands, and Poland (Bureau of National Statistics of Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, n.d.). This confirms the high demand for Kazakhstani organic products and indicates a growing interest in environmentally friendly products on international markets. In particular, Kazakhstan is one of the largest producers of organic nuts, cereals and honey, which makes the model of organic agriculture promising in terms of export diversification.

The "cow-calf" model is widespread in Kazakhstan's animal husbandry, in which farmers breed breeding stock, raise calves and then sell them at the age of 6-8 months. This model is focused on meat production and is quite effective in a country with significant pasture lands. The optimal herd size for this model is about 100 animal units, which allows effectively managing resources and minimising costs. Important success factors are the pedigree of livestock and effective management of offspring, which allows for high rates of animal growth and improved meat quality. One of the popular areas is the use of beef cattle breeds such as Angus and Auliekol, which show high results at relatively low costs. However, animal husbandry faces challenges such as high dependence on weather conditions (dry years can lead to a shortage of feed), and difficulties in accessing markets and logistics, especially in remote areas of the country. Resource-limited models also face difficulties in providing veterinary care and livestock feed (Food security: The…, 2024).

In 2024, investments in fixed assets of the agro-industrial complex of Kazakhstan exceeded KZT 1.1 trillion. Of this amount, KZT 919 billion was allocated to agriculture and fisheries, which is 2% more than in the previous year, and KZT 181 billion was invested in food production, which is 15% more than in 2023. As part of the implementation of investment projects, 286 facilities were commissioned in 2024. Together with local executive bodies, a Roadmap has been developed for the implementation of investment projects in the agro-industrial complex for 2025-2027, within which it is planned to implement 632 projects worth KZT 2.4 trillion. 264 projects are scheduled to be commissioned in 2025, 249 in 2026, and 119 in 2027 (EastFruit, 2025). One of the largest projects is the construction of a greenhouse complex in the Turkestan region, implemented with the participation of the Ecokultura company. The total investment in the project is USD 1.3 billion. Within the framework of the project, a greenhouse farm with an area of 500 hectares will be built, which will significantly increase the production of vegetables and fruits, ensuring the domestic market and export supplies. The project is expected to create several thousand jobs and bring significant revenue to the local economy (EastFruit, 2024a).

Agricultural projects are growing in Uzbekistan. One of the largest projects in the agricultural sector is the creation of a cluster of agricultural machinery in the Tashkent region. In August 2023, the first universal tractor was produced within this cluster. The cluster is capable of producing up to 15,000 units of equipment per year, which will significantly improve the logistical support of farmers (Novikov, 2023). In addition, in 2025, it is planned to create plants for growing and processing pears, walnuts, and tomatoes with the support of investors from Italy (Uzbekistan to create…, 2025). Investments in the agro-industrial sector intensified in Kyrgyzstan in 2023. It is planned to implement projects for the construction of agro-logistics facilities in Osh region. A fruit and vegetable processing plant worth KGS 6.5 million will be built in the village of Kok-Zhar, Nookat district. A fruit juice production plant with investments of KGS 14.6 million will be opened in the Kulatov rural district. In addition, cold storage facilities for fruits and potatoes of various capacities will be created in the region. Moreover, in 2023, a new cold storage facility was opened in the village of Japalak, Osh region, built with the support of the United States Agency for International Development and the local Eco Azyk enterprise. The cost of the equipment amounted to KGS 6.9 million, and the warehouse is capable of freezing and storing up to 300 tonnes of fruits and berries for the domestic and foreign markets (Petchenko, 2023). In 2024, a fruit and vegetable processing plant in the Chui region, focused on the production of frozen products, was launched with investments of USD 20 million. This plant will help increase exports and create additional jobs in the region (EastFruit, 2024b). Table 1 shows the differences between business models in the agro-industrial sector of Kazakhstan, Uzbekistan, and Kyrgyzstan.

Table 1. *Comparative effectiveness of different business models in the agro-industrial sector of Kazakhstan, Uzbekistan, and Kyrgyzstan*

Business model	Kazakhstan	Uzbekistan	Kyrgyzstan
Cooperative model	As of 2023, about 1,200 agricultural cooperatives have been registered, but only 35% of them are actively operating. Main problems: poor coordination and low motivation of farmers	In 2022, more than 300 cooperatives were supported through the subsidy programme, especially in the Andijan and Ferghana regions. Subsidies of up to 30% of the cost of the equipment are provided.	By 2023, about 150 cooperatives have been created, but only 20% are registered as a legal entity. There is no clear legislation
Vertical integration	Atameken-Agro is an agroholding with a full cycle from grain cultivation to export. Manages 450 thousand hectares of land, exports to 7 countries	It is used in the textile industry: a cluster in Namangan region processes up to 100 thousand tonnes of cotton per year. Tomato and fruit processing clusters are also actively developing.	Vertical models are developing slowly. In 2023, 4 vegetable processing plants were opened in Osh and Chui regions. Investment volume – up to USD 30 million
Digital platforms and precision farming	The Digital Village project is being implemented. Drones and sensors are used in the pilot areas of the North Kazakhstan region and the Almaty region. Implementation at the level of 5-7% of farms	Implementation in greenhouses (Tashkent region). About 100 enterprises use digital climate and irrigation monitoring	Usage is limited. Less than 2% of farms use digital tools. Main reason is the lack of personnel and investments
Contract farming	Operates in the grain sector. KAZAGRO estimates that only 10-12% of contracts are of a long-term nature. Problems with their legal support	The cotton sector covers more than 80% of small producers. State programme guarantees the price and sales	At the initial stage. There are pilot agreements with Turkish and Chinese processors. An example is contracts for the supply of organic greens from the Chui region
Organic farming	In 2023, 191.3 thousand hectares of organic land were registered. Products are exported to the EU. Main barriers are certification (USD 2,000-3,000 per year)	Production of organic dried fruits and nuts (Samarkand, Bukhara). More than 50 farmers are certified. Export to Germany and China	Market is forming. About 20 farms with an organic profile have been registered. There is no government support for certification

Source: *compiled by the authors*

Vertical integration among large agricultural holdings is the most effective in Kazakhstan, while the co-operative model and digital solutions are developing slowly. In Uzbekistan, government support plays a key role in the success of cooperatives and contract farming, and in attracting investments in agricultural processing. In Kyrgyzstan, agribusiness remains less structured, but promising projects in processing and organic agriculture are emerging. These differences are explained by the different levels of government regulation, investment attractiveness, and institutional environment in each country. Atameken-Agro is one of the largest agricultural holdings in Kazakhstan and an example of successful implementation of a comprehensive business

model in the agro-industrial sector of the country. Based on the principles of vertical integration, the company covers the entire cycle of agricultural production, from growing crops to processing and marketing products.

This allows the company not only to control the quality of its products at all stages, but also to optimise costs, which is an important competitive advantage. Table 2 shows the main financial indicators of the company.

***Table 2**. Main financial indicators of Atameken-Agro for 2019-2024, million KZT*

Year	2019	2020	2021	2022	2023	2024 (9 months)
Income	26,768	28,599	41,646	54,608	44,662	22,343
Net profit	655	15,189	2,253	18,204	-10,796	11,031
Assets	73,676	84,932	90,806	111,896	107,795	132,464
Own capital	2,984	16,884	19,167	33,290	23,127	37,501

Source: *developed by the author based on data from Kazakhstan Stock Exchange (n.d.)*

In the period from 2019 to 2022, the company observed steady revenue growth, which is confirmed by an increase from KZT 26.7 billion in 2019 to KZT 54.6 billion in 2022. However, in 2023, revenues decreased significantly to KZT 44.7 billion, which may be due to external economic or climatic factors that affected production. Net profit also showed positive results in 2020 and 2022, but in 2023 a loss of KZT 10.8 billion was recorded, which requires additional analysis of the reasons for this decline. In 2024, the company returned to profit (KZT 11 billion), which indicates a possible stabilisation of the financial situation. The company's assets and equity, despite fluctuations in income and profit, show steady growth, which confirms the company's long-term development strategy and ability to attract investments and strengthen its financial position. Atameken-Agro's business model is based on the principles of integration and scalability. The company actively uses resources to create large agricultural complexes, which include agricultural production, processing and logistics. By 2025, Atameken-Agro is processing tens of thousands of hectares of land where the main crops are grown – wheat, corn, barley, oilseeds, and fodder plants. In addition, the company is developing livestock production, including dairy and meat farming. The company has about 500 employees, the company's land bank is 58.6 thousand hectares of arable land and 27 thousand hectares of pastures.

The company's business model features a focus on process automation and the introduction of innovative technologies in agriculture. The use of high-tech equipment for tillage, sowing, and harvesting can significantly increase productivity and product quality. It also helps the company to optimise production costs by reducing dependence on human labour, which is often one of the most expensive factors in agriculture. Since 2018, the company has begun the process of full digitalisation, cooperating with the Agrostream LLP to implement an analytical automated information system. This allowed optimising processes such as monitoring the operation of machinery in the field, grain accounting, crop planning, and fertilisation. The implementation of the system has led to significant results: in 2019, one of the holding's farms, the Shatilo & K LLP, set a record for winter wheat yields of 71.4 hwt/ha, with an average yield of 50 hwt/ha. The company is equipped with modern machinery, including sowing complexes with CLAAS tractors and 18 m wide seed drills. In 2022, CLAAS Trion 730 combine harvesters, Claas Xerion Leb 5000 sprayers, haymaking equipment, and baling trucks were purchased. On average, one sowing complex processes about 2 thousand hectares per day.

Another key component of Atameken-Agro's business model is the sale of products through its own distribution channels and participation in processing, which also contributes to an increase in added value at each stage of the production cycle. The company not only sells raw agricultural raw materials, but also creates processed products such as flour, cereals, and meat products, which significantly expands its market opportunities and increases profitability. Atameken-Agro has switched to the use of liquid fertilisers (liquid complex fertilisers and carbamide-ammonia mixture), which are applied before sowing, tillering, and bulking. Micro fertilisers such as sulphur, potassium-phosphorus, and boron are also used. For plant protection, preparations from various manufacturers are used, including the herbicide Select from United Phosphorus Limited, which is effective against weedy grass vegetation. However, despite numerous successes, the vertical integration model requires significant capital investments and resources. High initial investments in agricultural machinery, infrastructure, and processing facilities pose a risk to businesses in the face of volatile commodity prices and fluctuating foreign markets. On the other hand, the company actively enjoys government support in the form of subsidies, grants and tax incentives, which helps to reduce financial burden and increase economic sustainability.

Atameken-Agro company is a vivid example of the successful implementation of a comprehensive business model in the agro-industry of Kazakhstan.

Vertical integration, the use of innovative technologies and a focus on processing agricultural products allow the company to compete effectively in the market and ensure production growth. However, in order to maintain its competitiveness in international markets, the company must continue to develop new technologies and effectively manage the risks associated with economic instability and external factors. The choice and adaptation of a business model for an agricultural enterprise in Kazakhstan and Central Asia should be based on several key factors: natural and climatic conditions, market demand, access to finance, the level of technological development, and government support. Considering these aspects, several strategic recommendations for the formation of sustainable and profitable business models can be identified. One of the most promising ways for agricultural companies in the region is vertical integration, involving control of all stages of production: from growing crops and livestock to processing, logistics, and sale of the final product. This is especially true for Kazakhstan, where most agricultural products are exported in unprocessed form. For example, instead of simply growing wheat, it is advisable to develop the production of flour and pasta, which increases the added value. Companies can also integrate animal husbandry and crop production, effectively using production waste (straw, cake) as feed.

Another promising area is organic agriculture, which is gradually gaining popularity in global markets. For the successful implementation of this business model, it is advisable to create cooperatives that unite small farms for joint certification and access to international markets, and introduce government support mechanisms, such as subsidising the transition to organic farming. In addition, it is necessary to develop a logistics and export system so that farmers can receive a premium price for environmentally friendly products. Modern agribusiness cannot function effectively without the introduction of digital technologies. The introduction of management systems helps to analyse data on soil, climate, fertilisers, and automatically adjust the processes of sowing and irrigation. In addition, the development of yield forecasting programmes helps to minimise risks when planning production and sales. Automated irrigation systems, especially in conditions of water scarcity in Central Asia, can also become an important tool for improving efficiency. The export potential of the agricultural sector in Kazakhstan and Central Asian countries remains high, but requires the adaptation of business models to international requirements. To increase export efficiency, it is necessary to develop deep processing of products, creating added value and reducing dependence on fluctuations in raw material prices. Signing long-term contracts with foreign buyers will help to minimise price risks, and participation in international exhibitions and trade missions will expand the sales market beyond traditional destinations such as China and the EU.

Special attention should be paid to cooperation between small and medium-sized farms, since Central Asia is still dominated by small farms, which find it difficult to compete with large agricultural holdings. One of the solutions may be the creation of agro-industrial hubs – clusters that bring together farmers, processors, and logistics companies. This model makes efficient use of the shared infrastructure, including elevators, refrigerators, and storage facilities, and facilitates access to subsidies and credit programmes. In addition, cooperation improves the position of producers when concluding contracts with retailers and exporters, allowing small farms to receive more favourable sales conditions. Climate change and risk management are playing an increasingly important role in the development of the region's agribusiness. Central Asia is a region with a high level of climate risks, including droughts, sudden temperature changes, and water scarcity. To minimise losses, agricultural companies should switch to drought-resistant varieties of agricultural crops and adapted farming methods, and actively use crop insurance. In conditions of water scarcity, investments in drip irrigation and water-saving technologies are especially important, which will not only reduce water consumption, but also increase crop yields. Business development requires significant investments, but access to loans and external investments remains limited. One solution is to develop public-private partnerships, especially in infrastructure projects related to logistics and processing. Attracting foreign investors through the creation of joint ventures with international agricultural companies may also be a promising area. It is important to consider the potential of green finance by attracting investments in organic farming and sustainable farming projects, which will not only modernise production, but also meet global trends in the field of ecology and sustainable development.

Thus, the choice and adaptation of a business model for agricultural enterprises in Kazakhstan and Central Asia should be based on the diversification of production, the introduction of digital technologies, the development of export potential, cooperation, and sustainable farming methods. Companies focused on innovation and efficient resource management will be able to increase their competitiveness both regionally and internationally.

DISCUSSION

The agro-industrial complex is an important part of the economies of Central Asian countries such as Kazakhstan, Uzbekistan, and Kyrgyzstan. In these countries, agriculture is the main source of income for a significant part of the population. An analysis of business models in the agro-industries of Kazakhstan, Uzbekistan, and Kyrgyzstan has shown that the countries of the region

are actively developing various areas of agricultural production and processing, focusing on both the domestic market and exports. It has been revealed that the main drivers of the sector's growth are investments in infrastructure, the introduction of modern technologies and government support. The external economic situation has a significant impact on the development of the agro-industrial sector in Central Asia. Kazakhstan, Uzbekistan, and Kyrgyzstan are actively developing exports, but simultaneously remain vulnerable to external economic factors such as fluctuations in world prices for agricultural products, changes in exchange rates, and trade barriers. For example, rising prices for agricultural products or a change in demand for certain goods can significantly affect the profitability of agricultural projects (Bulgakov *et al.*, 2020). In this context, the creation of new business models aimed at risk diversification and the search for new markets is becoming an important step in strengthening the economic stability of the region. M. Donner *et al.* (2020) investigated the sustainability of various business models in agriculture and concluded that the most stable models are based on the integration of agricultural production and processing. In their opinion, closed cycles (for example, the production and processing of dairy products in one holding company) provide greater resilience to economic crises. G. Berti (2020), in turn, considered the principle of vertical integration, when the production of raw materials and their processing take place within the same holding company. Farms with their own processing plants can adapt more quickly to market changes and minimise the impact of fluctuations in raw material prices (Mamchur *et al.*, 2025). The current study partially confirmed this conclusion, as processing plants are also actively developing in Central Asia. However, commodity-based export models still prevail in the region, which makes them vulnerable to changes in the external environment.

Government support plays a key role in the development of the agricultural sector. Kazakhstan, Uzbekistan, and Kyrgyzstan have various government programmes aimed at stimulating agricultural production and attracting investments. However, despite the existing programmes, there is a need to improve legislation and strengthen support mechanisms for agricultural producers, especially small and medium-sized farmers. Problems with access to finance, insufficient infrastructure, and low willingness to adopt innovative technologies remain important barriers to growth (Hnatyshyn *et al.*, 2025). D. Laborde *et al.* (2021) analysed the impact of government subsidies on agricultural production growth. Their study showed that subsidies increase agricultural productivity, contribute to the modernisation of production, and reduce poverty among farmers. Current results also pointed to the importance of government regulation, but in Central Asia, support for farmers is less systemic.

One of the key aspects is the importance of introducing innovative business models into agricultural production. Examples from Kazakhstan, where organic farming projects are developing, and projects to introduce digital technologies into the agricultural sector, highlight the enormous potential for improving productivity and product quality (Akhmet *et al.*, 2025). In Uzbekistan and Kyrgyzstan, projects to create agro-logistics facilities and process agricultural products also confirm the high prospects of these business models. The study by R. Zhong *et al.* (2022) focused on the impact of digital technologies such as artificial intelligence, automation, and drone monitoring on agricultural efficiency. The researchers concluded that the introduction of digital solutions can increase productivity and reduce operating costs. The study by E. Duncan *et al.* (2021) examined cases of successful implementation of digital technologies in developed countries such as the USA and Germany, where agricultural enterprises widely use precision farming, automated irrigation systems, and drones to monitor soil and crop conditions. The conclusions partially coincided with the results of the current study, which also highlighted the importance of digitalisation. However, the use of such technologies remains limited in Central Asia due to a lack of investment and a low level of technical training.

Attracting foreign investment is one of the most important factors for the development of the agro-industrial sector in Central Asia. Projects with the participation of foreign investors are being actively implemented in the countries of the region, which allows improving the technological base and attract modern technologies (Nurekenova *et al.*, 2022). For example, the construction of greenhouse complexes in the Turkestan region of Kazakhstan and the creation of a machine-building cluster in Uzbekistan with the participation of international companies contribute to increasing production capacity and diversifying rural production. However, dependence on foreign investments can also be risky, especially in the context of global economic instability. S.R. Zeytoonnejad Mousavian *et al.* (2023) investigated the mechanisms of attracting foreign investment in the agricultural sector and came to the conclusion that the key success factors are a stable legislative framework, the availability of infrastructure, and partnership with international corporations. The current study has confirmed the importance of foreign investment, but there are serious barriers in Central Asia, such as complex bureaucratic procedures and an unstable economic environment, which is not always considered in the global context.

K. Đurić *et al.* (2021) investigated the impact of the integration of agricultural enterprises into cooperative associations on their financial stability and productivity. In their analysis, they compared the experience of cooperative agriculture in the EU, where small farms combine into agricultural cooperatives to share machinery,

storage facilities, and distribution channels. The current study also addressed the topic of cooperative business models in Central Asia, but regional specifics showed that their distribution was limited. The development of agricultural production should take into consideration environmental and social aspects. It is important that business models in the agro-industry not only contribute to increased production, but also ensure the sustainable use of natural resources and improve the living conditions of local residents (Sadovoy *et al.*, 2023). In Kazakhstan, for example, projects in the field of organic agriculture actively contribute to raising environmental awareness and producing environmentally friendly products. In Kyrgyzstan and Uzbekistan, there is also a tendency to improve social infrastructure based on agricultural projects, which contributes to job creation and improvement of living conditions in rural areas. T.C. Durham and T. Mizik (2021) investigated the impact of organic agriculture on the economies of countries actively developing this sector. The researchers concluded that the development of organic agriculture increases the export value of products, helps to preserve soil fertility and reduces environmental pollution. However, W. Łuczka and Kalinowski (2020) noted that the transition to organic production requires significant investments, especially for product certification, technology adaptation, and market development. The current study also highlighted the potential of organic agriculture in Kazakhstan, but unlike in more developed countries where demand for environmentally friendly products is steadily growing, the domestic organic market in Central Asia remains underdeveloped.

G. Özaydın and M. Direk (2022) investigated the impact of agricultural sector development on rural regions and concluded that successful agricultural projects contribute to reducing migration from rural areas and increasing the standard of living of the local population. The current study also highlighted the social role of the agro-industry, but rural migration remains a major problem in Central Asia, despite the development of agribusiness. This difference can be explained by the fact that the region still lacks social infrastructure and jobs with competitive salaries. Thus, the agro-industrial sector in Central Asia has significant potential for growth, but in order to realise this potential, it is necessary to effectively address existing problems and develop sustainable business models that will contribute to the long-term growth and prosperity of the region. Research confirmed the importance of key factors such as technological development, investment, and government support, but revealed some differences.

CONCLUSIONS

As a result of the conducted research, several key conclusions were drawn regarding business models in the agroindustry of Kazakhstan and Central Asian countries.

The study confirmed the existence of a variety of agribusiness models specific to the region, each of which has its own advantages and disadvantages due to socio-economic conditions, the level of technological development and natural factors. Analysis of statistical data showed that the total volume of agricultural production in Kazakhstan in 2023 amounted to USD 16.12 billion, in Uzbekistan – USD 35.26 billion, and in Kyrgyzstan – USD 4.44 billion. Although these indicators are growing compared to economic years, the dynamics is unstable, which indicates the influence of external economic factors and the need to adapt business models to changes in the market. The study found that the Central Asian countries are dominated by commodity-based business models focused on the export of agricultural products. For example, in Kazakhstan, exports of organic products in 2022 reached USD 35 million, which is 10% more than in 2021 (USD 32 million), but the domestic organic market remains underdeveloped. This is confirmed by the limited volume of the processing industry: although efforts are being made to build factories, such as a processing complex in the Osh region of Kyrgyzstan (USD 30 million in investments), the scale of transformation remains limited.

The financial condition of a large agricultural company in Kazakhstan, Atameken-Agro, was also analysed. Significant changes in net profit are indicated: from KZT 655 million in 2019 to KZT 18.2 billion in 2022, then a drop to KZT -10.8 billion in 2023 and a subsequent increase to KZT 11 billion in 9 months of 2024. This causes agribusiness volatility and the need to adapt to market changes. However, the company's assets grew steadily, which indicates the expansion of the business, despite financial fluctuations. Digitalisation of agriculture, despite its potential benefits, faces a number of obstacles. In Central Asia, the introduction of technologies such as drone monitoring and automation remains limited due to a lack of investment and a low level of technical training. However, the practice of using digital solutions is already actively implementing precision farming systems, for example, in Kazakhstan and Uzbekistan.

In addition, the analysis of complex projects showed the active development of the agro-industrial sector. Large-scale projects are being implemented in Kazakhstan, such as the construction of a thermal complex in the Turkestan region with investments of USD 1.3 billion, which will significantly increase the production of vegetables and fruits. Uzbekistan has a developing cluster of agricultural machinery, which introduced the first universal tractor in 2023, with a capacity of 15,000 units per year. A fruit and vegetable processing plant in the Chui region, focused on the production of frozen products, has been launched in Kyrgyzstan with investments of USD 20 million. Thus, in order to increase the sustainability of agribusiness in Central Asia, it is necessary to focus on the diversification of

business models, the development of processing capacities, the introduction of digital technologies, and the expansion of domestic consumption of products. In the future, it is advisable to conduct a more detailed analysis of the impact of digitalisation on the effectiveness of agribusiness and to investigate the sustainability of various investment strategies in the changing economic climate of the region.

CONFLICT OF INTEREST

None.

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Обґрунтування бізнес-моделей в агропромисловості: кейс Казахстану та країн Центральної Азії

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Анотація. Робота спрямована на вивчення ключових факторів, що впливають на вибір та ефективність бізнес-моделей в агропромисловому секторі Казахстану та Центральної Азії. Методологія дослідження включала аналіз статистичних даних, порівняльний аналіз бізнес-моделей, а також оцінку впливу зовнішньоекономічних і кліматичних факторів на стійкість агробізнесу в регіоні. Під час роботи було вивчено та класифіковано наявні бізнес-моделі агропідприємств, виявлено їхні ключові особливості та чинники, що впливають на їхній вибір. Проведено аналіз динаміки загального обсягу сільськогосподарського виробництва в Казахстані, Узбекистані та Киргизстані з перерахунком показників у долари США, що дало змогу об'єктивно оцінити масштаби та тенденції розвитку агросектору. Загальний обсяг сільськогосподарського виробництва в Казахстані 2023 року склав 16,12 млрд доларів США, в Узбекистані – 35,26 млрд доларів США, а в Киргизстані – 4,44 млрд доларів США. Детально розглянуто інвестиційні проєкти в агропромисловості, включно з великими вкладеннями в тепличні комплекси, переробку сільгосппродукції та цифровізацію галузі. На прикладі компанії «Атамекен-Агро» проведено детальний фінансовий аналіз, виявлено коливання прибутковості, вплив економічних чинників на прибутковість і стійкість бізнесу. Отримані результати показали, що ключовими драйверами зростання агропромисловості регіону є цифровізація, впровадження точного землеробства, вертикальна інтеграція, а також орієнтація на експорт переробленої продукції. На основі виявлених тенденцій розроблено рекомендації щодо вибору та адаптації бізнес-моделей для агрокомпаній Казахстану і Центральної Азії. Серед них – розвиток кооперативних структур, впровадження стійких агротехнологій, підвищення інвестиційної привабливості сектору та диверсифікація виробництва. Висновки роботи підтвердили необхідність комплексного підходу до розвитку агробізнесу в регіоні, де цифровізація, державна підтримка та інтеграція в глобальні ринки відіграють вирішальну роль у підвищенні конкурентоспроможності сільськогосподарських підприємств

Ключові слова: інвестиційні проєкти; регіональний розвиток; інноваційні технології; сільське господарство; економічний розвиток