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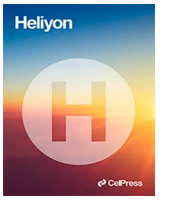

Research article

Corporate strategies in agricultural enterprises: Adaptation and development in the COVID-crisis environment

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ABSTRACT

The purpose of this study is to examine the impact of the COVID-19 crisis on changes in agricultural enterprise corporate strategies. The study also aims to identify their potential implications in the context of the COVID-19 pandemic's spread. The most important research method is monitoring. The results of monitoring reflect the efficiency of agricultural production processes before and during the COVID-19 crisis. The studied country exemplifies agricultural business development under favorable natural resource conditions. In the context of the ongoing COVID-19 pandemic, the corporate strategies of Kazakhstan's five largest agricultural enterprises were analyzed. The materials for the analysis were the databases of these enterprises' official websites. The analysis rested on a forecasting model based on a trend line. The results suggest that the efforts to adapt corporate strategies to the COVID-19 imperatives aim to balance and restore the economic activity of agricultural enterprises. This task requires strategies for reducing secondary costs, investing in high-growth areas, micro supply chains, and management system transformation. In practice, the findings can be useful for policymakers and managers in the agricultural sector of the economy. The study presents additional information on how to better support agricultural enterprises during and after the spread of the COVID-19 pandemic.

1. Introduction

The COVID-19 pandemic has had a detrimental effect on Kazakhstan's domestic economy and businesses on a global scale. In the context of demand, there was a decrease in population consumption and purchasing power [1]. As for the aspect of supply, the crisis caused temporary production halts, supply chain disruptions, and labor shortages due to movement restrictions [2]. Thus, agricultural enterprises suffered significant revenue losses as a result of decreased demand for agricultural raw materials, mobility, and labor migration. Consequently, the economic impact of their activities has become negative [3]. Despite the ongoing COVID-19 pandemic, which affects both supply and demand simultaneously, agricultural production contributes to the economy in general. Between 2018 and 2019, agriculture's global real value-added increased by 2 %, reaching USD 3.5 trillion in 2019. Notably, Asia was the main source of value-added in global agriculture. Asia accounted for 64 % of global volume in 2019, followed by America (14 %), Africa (12 %), Europe (10 %), and Oceania (9 %). China, India, and Kazakhstan were the three largest Asian economies in terms of agricultural value-added in 2019. Kazakhstan, however, receives priority in terms of arable land per capita (1.62 ha). By this indicator, the country is the first in Asia and the second in the world [4]. The global contribution of agriculture to gross domestic product (GDP) decreased from 0.18 % to 0.04 % in all regions of the world during 2019. As a result, the global indicator remained stable at 4 % and did not

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change compared to the previous year, as noted by experts [5–8]. Despite its relatively small economic size in terms of GDP, this sector is critical to agricultural value chains at enterprises and the efficient use of natural resources. Aristov [5] defines an agricultural enterprise as an enterprise focused on farming or a conscious activity aimed at profiting from the creation of socially useful goods. The success of this activity depends on the right technological choices in terms of production, management, accounting, and marketing. Agricultural enterprises of all sizes (micro, small, medium, and large) are critical for the national economy in both developed and developing countries. The contribution of agriculture is critical in diversifying national revenue streams, enhancing competitiveness, and promoting economic development. Additionally, these enterprises increase the food economy's adaptability and sustainability [6], particularly by developing agricultural business clusters [7]. The clusters enable the production of a wide range of products and services based on a group of companies. In addition, the clusters allow for competition management through the effective use of time and distance in product manufacturing. Subsequently, an enterprise spends less money on production and marketing [6]. The cluster structure is created collaboratively by.

- agricultural business entities;
- traditional agricultural sectors (micro, small and medium-sized enterprises);
- agricultural owners;
- research and development sector entities;
- public organizations involved in agriculture and food production.

Pandemic policy, such as quarantine and social withdrawal, was the response to the COVID-19 pandemic's initial spread [8]. Measures also included numerous incentives to support agricultural businesses and job creation [9]. Two years later, the COVID-19 pandemic still impacts the global economy [10]. According to, Chiemela et al. [3] under current conditions, agricultural enterprises can grow and rely on online technologies that are affordable to almost all businesses, regardless of their size. The recommendations of Pakpahan [11] for agricultural enterprises are two models of adaptation to the COVID-19 pandemic crisis: short-term and long-term strategies. Short-term strategies include financial assistance, such as concessional loans or direct monetary assistance. These strategies concern both the public and private sectors. Long-term strategies imply the adoption and application of digital technologies in the agricultural business. In another study [6], deliberate strategies are those aimed at an enterprise's sustainable development [11–14]. Sustainable development affects the outcomes of intentional innovations (process innovations, organizational innovations, and product innovations) and emerging innovations, i.e. deliberate strategies. In the real world, intentional and emerging strategies function jointly. As noted by Tadesse and Tolla [15], agricultural enterprises that lack access to loans and financing are more exposed and vulnerable to pandemic shocks. This feature is related to the strategy of halting business operations. The researchers identified five different survival strategies within this framework. Four of them are protective strategies.

– a diversification strategy;
– a cost-cutting strategy;
– a business shutdown strategy; and
– an asset reduction and withdrawal strategy.

The fifth one, a closure strategy, is a no-action strategy.

The study by Chiemela et al. [3] suggests that the survival strategies used by agricultural businesses mitigated the negative impact of the COVID-19 pandemic. Specifically, these strategies included the following.

– remote management of activities;
– sale on credit;
– flexibility and loyalty to regular customers;
– additional processing of goods to extend the product life; and
– a focus on basic products [3].

The study by Papadopoulos et al. [16] corroborates this thesis. According to the researchers, digital technology strategies are necessary to maintain survival and business continuity, as well as to mitigate the impact of the COVID-19 crisis. However, the study leaves room for further research. It is necessary to deeply analyze specific strategies and their impact, as well as expand the research scope to different regions and types of agricultural enterprises. It is also important to pay more attention to measuring the success of strategies and developing practical recommendations for agricultural enterprises in difficult conditions of economic instability. Besides, according to the analysis, existing research on corporate strategic management at an agricultural enterprise mainly relies on survey data or indirect indicators. Therefore, the results can be subjective. This study recommends using statistically available empirical data to fill the identified practice gap. In this case, it is necessary to conduct statistical analysis, which entails a shift away from qualitative indicators and toward quantitative ones, with an emphasis on Kazakhstan. The Republic of Kazakhstan was the research subject due to its natural resource advantage over other Asian countries for agricultural development. Asia has risen to prominence as a global agricultural leader in the COVID-19 pandemic aftermath.

The novelty of this research is a developed model for the selection of corporate strategies. This model can allow enterprises to choose an optimal strategy that does not require additional time to test its significance or adequacy. Another important contribution of the study is revealing the impact of the crisis on the agricultural sector and identifying the adaptable and flexible strategic aspects of

management. The study aims to scrutinize the pandemic's impact on the corporate strategies of agricultural enterprises and determine their potential implications in the context of COVID-19.

The research tasks are as follows.

1) monitor the results of the agricultural production process;
2) examine the impact of the COVID-19 crisis on changes in the corporate strategies of agricultural enterprises;
3) provide an economic forecast for the success of corporate strategies in the context of the COVID-19 pandemic.

2. Material and methods

This study examined agricultural statistics in the context of COVID-19, laying the groundwork for analyzing the corporate strategies of agricultural enterprises. Part of the study used data from the annual report of international organizations: СФЕРА (SFERA) [17]; statistics of national accounts [18,19]; materials from the official websites of agricultural enterprises of JSC KazAgroFinance [20], and ElData [21].

The analysis criterion was the agricultural territories of Kazakhstan, which is the leader in the Asian region in terms of agricultural land area [4]. The analysis covered the period from 2019 to 2022. Analytical review, monitoring, audit analysis, and statistical analysis were used to summarize and interpret the obtained data. The research methodology included three stages.

The first stage involved monitoring the economic results of Kazakhstan's production processes from 2010 to 2021. This stage used the physical volume of GDP in the agricultural sector [16,22]. Data analysis showed the volume of production in the agricultural sector in terms of available resources and technologies. The article contains a diagram to illustrate monitoring results. The diagram shows changes in each indicator over time (by year), before and after the COVID-19 crisis.

The study of corporate strategies was the focus of the second stage. In this stage, the study involved the five largest agricultural enterprises in Kazakhstan.

- JSC Atameken-Agro [23];
- JSC Alel' Agro [24];
- JSC KazAgroFinance [20];
- Kazrost Engineering Ltd [21];
- JSC Aitas KZ [25].

The third stage used economic forecasting to prioritize changes in corporate strategies due to the COVID-19 pandemic. For the forecasting, a trend line model created in Excel was utilized: Column B1:M1 contained annual periods; Column B2:M2 forecasted the indicator values based on previous data. This study forecasts the performance of agricultural enterprises, which reflects the corporate strategy of business units. Forecasting in this context refers to the expansion of current trends over several periods. Forecasting is possible to perform since economic phenomena are inertial, which means that current trends tend to continue. Table 1 shows the input data (taken from Kenshimon [22] and Statistics of National Accounts [18,19]) for a strategic forecast of possible consequences in practice.

Initially, the diagram was constructed as a bitmap with markers. An added trend line function forecasted the phenomenon shown in the diagram. Excel's polynomial dependency was the default parameter. In general, the forecast is a hypothesis about the nature of the relationship: the indicator polynomially depends on the period. In the trend line format window, there were two necessary options: *Show the equation on the diagram* and *Show the actual approximation value of R^2 on the diagram*. The approximation value of R^2 can range from 0 to 1. In the selection of corporate strategies for agricultural enterprises, the interval from 0 to 1 in fuzzy logic allows for modeling the correspondence between input parameters, such as the risk level and planned objectives, and the selected development strategy. The values in this interval indicate the relation to specific categories or strategies, ensuring the flexibility and adaptability of the model to real conditions and uncertainties. This approach reveals the risks and benefits of different strategies and allows for effective decision-making in the face of uncertainty. After that, the forecast window was configured for three periods, and the diagram showed the indicator's trend for the subsequent three forecast periods. The analysis of Kazakhstan's agricultural market leaders showed how these businesses adapted corporate strategies during the COVID-19 crisis. The study defines seven categories of strategies.

- revolutionary strategies;
- progressive strategies;
- formative strategies;

Table 1
Input data for forecasting the strategic identification.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	–	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
2	Number of operating agricultural enterprises, units	88.4	126.5	82.6	111.2	101.3	103.5	105.4	103.2	103.8	99.9	105.9	97.6

Source: created by the author.

- strategies for further development;
- support strategies;
- growth strategies;
- reduction strategies.

The proposed classification system has several advantages over the existing ones. It classifies strategies according to the degree of progressive innovation, reflecting both risk and success. All existing development strategies were summarized using a single holistic criterion. Choosing within groups is an alternative to similar strategy options while choosing between groups is essential.

It is argued that the strategies of different groups are possible to implement only if there is an appropriate level of potential, the external environment in general, and market trends in particular. Another important step in the proposed method of choosing a development strategy for an agricultural enterprise is determining the model's parameters and evaluating an enterprise. Thus, the first sub-stage of the proposed method involved measuring the integral development of an agricultural enterprise. This stage used factor analysis and generalizing the criterion. Based on the obtained values of the integral development indicators for 2016–2020, it was possible to analyze its trends at all the studied enterprises.

The final stage of the proposed methodological approach was the development of a fuzzy set model for determining the corporate strategy of an enterprise. The Fuzzy Logic toolbox package in the MatLab package served as a software environment for developing fuzzy logic and classification systems. This toolbox allows enterprises to choose the appropriate corporate strategy by applying the established heuristic rules. This program is suitable even for engineers with no experience in fuzzy sets or computer science due to the user-friendly graphical interface used for data exchange. Table 2 shows the parameters of the fuzzy system. These parameters allow the users to understand the inputs and outputs of the system, the specified membership functions for fuzzy variables, and the system rules.

Thus, the fuzzy system is modeled for seven corporate strategies that serve as input variables. The following output variables affect the strategy selection process.

1) the current stage of enterprise development and planned goals (P);
2) the risk that an enterprise takes using available financial resources (R);
3) an enterprise's ability to adapt to the external environment (A).

In addition, the study provides explanations for the proposed classification of corporate strategies of agricultural enterprises. These explanations serve as a basis for a system of rules for selecting and justifying seven corporate strategies of agricultural enterprises. Thus, this approach excludes the scenario of enterprise development in which rapid growth entails a high level of risk. The latter implies a situation where a company faces a crisis and stable growth is impossible.

The weighting factors of each rule are equal to 1. The logical operation "if" (condition) links input parameters (the element of fuzzy rule antecedents). Table 3 contains a detailed explanation of the proposed base of fuzzy rules for choosing a comprehensive development strategy.

The market trend forecast based on time series analysis is critical in the proposed approach. This stage allows for a more comprehensive and conceptual approach to the choice of corporate strategy for an agricultural enterprise among a specific group of integrated strategies. The study also discusses the parameters of the fuzzy system used to select the corporate strategy of an agricultural enterprise. These parameters are necessary when using the Fuzzy Logic Toolbox (Table 4).

Thus, the study created a fuzzy system for modeling development strategies (components of corporate strategies), which were input variables. To select a development strategy according to market trends, it is proposed to use the following input variables (Fig. 1).

1) Market Size (MS);
2) Competition Level (CL);
3) Product Life Cycle (PLC).

The membership function, timing, and range of values for input and output variables were also adjusted.

Table 2
Fuzzy system parameters for selecting a corporate strategy for an agricultural enterprise development.

Parameters	Explanation
Input variables	Indicators by which the development strategy is selected (the value varies from 0 to 1)
Output variables	Comprehensive enterprise development strategies (value varies from 0 to 1)
Type of membership function	*gaussmf* (Gaussian) – for input parameters; *trimf* (trapezoidal) – for initial parameters
Number of terms	3
Fuzzy knowledge base	Expert survey data
Knowledge base rules	Mamdani type rules
Defuzzification method	Centre of gravity method

Source: created by the author.

Table 3
A fuzzy rule base for adapting an agricultural enterprise's corporate strategy.

"If' (condition)	"Then" (consequence)
(P = high), (R = low) and (A = high) or (P = high), (R = acceptable) and (A = high)	Revolutionary strategies
(P = high), (R = low) and (A = medium) or (P = high), (R = acceptable) and (A = medium)	Progressive strategies
(P = medium), (R = low) and (A = high) or (P = medium), (R = acceptable) and (A = high)	Formative strategies
(P = medium), (R = low) and (A = medium) or (P = medium), (R = acceptable) and (A = medium) or (P = low), (R = low) and (A = high)	Further development strategies
(P = medium), (R = low) and (A = low) or (P = medium), (R = acceptable) and (A = low) or (P = acceptable), (R = acceptable) and (A = low) or (P = high), (R = low) and (R = low); A = low) or (P = medium), (R = high) and (A = high)	Support strategies
(P = low), (R = low) and (A = Medium) or (P = low), (R = acceptable) and (A = medium) or (P = low), (R = acceptable) and (A = high) or (P = low), (R = low) and (P = low); A = low) or (P = low), (R = acceptable) and (A = low) or (P = medium), (R = high) and (A = medium)	Growth strategies
(P = low), (R = high) and (A = low) or (P = medium), (R = high) and (A = low) or (P = low), (R = high) and (A = high) or (P = low), (R = high) and (R = high); A = medium) or (P = high), (R = high) and (A = high) or (P = high), (R = high) and (A = medium) or (P = high), (R = high), (R = high); high) and (A = low)	Reduction strategies

Source: created by the author.

Table 4
Fuzzy system parameters for selecting an enterprise's corporate strategy.

Parameters	Explanation
Input variables	Indicators by which the development strategy is chosen: - MS – market size (growing, shrinking stable market); - CL – level of competition (monopoly, oligopoly, monopolistic competition); - PLC – product life cycle (origin, growth, maturity, decline).
Output variables	Development strategy of the enterprise: - R (revolutionary) – R1 (conglomerate diversification collaboratively with backward vertical integration); - R2 (conglomerate diversification collaboratively with forward vertical integration); - R3 (conglomerate diversification collaboratively with horizontal integration); - P (progressive) – P1 (a new product supplied from a new production facility that uses new technology in the existing market with a different structure); - P2 (conglomerate diversification); - P3 (a new product supplied from an existing production facility that uses new technology in a new market with a different structure); - P4 (a new product supplied from a new production facility that uses the existing technology in a new market (with a different structure); - F (formative) – F1 (a new product in the developed market with the existing structure supplied from a new production facility that uses new technology); - F2 (a new product supplied from an existing production facility that uses new technology and has a new structure on the existing market); - F3 (a new product in the developed market supplied from a new production facility with a different structure that uses new technology); - F4 (a new product in a new market supplied from the existing production facility with the existing structure that uses new technology); - F5 (a new product in a new market supplied from the existing production facility with a different structure that uses existing technology); - F6 (a new product in a new market supplied from a new production facility with the existing structure that uses existing technology); - FD (further development) – FD1 (a new product in a new market); - FD2 (a new product with a different structure); - FD3 (a new product supplied from a new production facility); - FD4 (a new product that uses new technology); - FD5 (marketing of existing products in new markets collaboratively with the integration); - S (support) – S1 (new product development); - S2 (a new market development); - S3 (backward vertical integration); - S4 (forward vertical integration); - S5 (horizontal integration); - G (growth) – G1 (main product development strategy); - RE (retrenchment) – RE1 (reduction strategy).
Type of membership function	*gaussmf* (Gaussian) – for input parameters; *trimf* (triangular) – for output parameters
Number of terms	3
Fuzzy knowledge base	Expert survey data
Knowledge base rules	Mamdani type rules
Defuzzification method	Centre of gravity method

Source: created by the author.

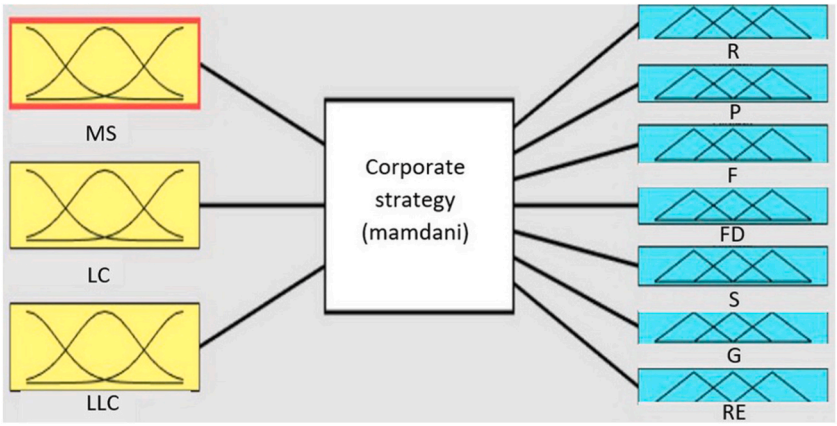

Fig. 1. FIS editor graphical user interface example.
Source: created by the author.

3. Results

According to this study, the global crisis triggered by the COVID-19 pandemic resulted in a sharp contraction of markets, disruption of supply chains, restrictions on citizens' freedom of movement, and quarantine policy. Furthermore, compared to the effects of the previous crisis in 2014–2015, the country's economic growth was slower. As illustrated in Fig. 2, the agricultural sector's physical GDP index decreased (−8.3 %) to 97.6 % in 2021, down from 105.9 % to 99.9 % in 2019. In the current market environment, there are 563 new agricultural enterprises, compared to 1626 in 2020 and 1278 in 2019. The vast majority were agricultural enterprises engaged in mixed agriculture [18,19].

Due to the COVID-19 implications, economic growth has been steadily slowing, reducing the population's effective demand. Agricultural businesses have begun to compete for market share in today's market conditions, thereby strengthening the competitiveness of Kazakhstan's agricultural enterprises. According to the analysis [16], JSC Aitas KZ, JSC Alel' Agro, JSC Atameken-Agro, JSC KazAgroFinance, and Kazrost Engineering Ltd. are currently in charge of Kazakhstan's main agricultural operations.

In the new reality, the primary goal of corporate strategic management is the effective use of local resources. It is also crucial to search for a safe zone to establish growth avenues and production planning. As of 2021, Table 5 summarises the corporate strategic management of Kazakhstan's agricultural enterprises Zhumashev et al. [26] and SFERA [17].

The global economic crisis, which occurred during the COVID-19 pandemic, has led to a situation of uncertainty, as shown in Table 5. It creates risks if all corporate strategies of agricultural enterprises employ the same risk response strategy: the acceptance of the current circumstances. Afterwards, the enterprises use strategies to respond to negative risks.

- reducing secondary expenses;
- focusing on high-demand goods;
- revising long business processes;
- shifting the management system to an online mode.

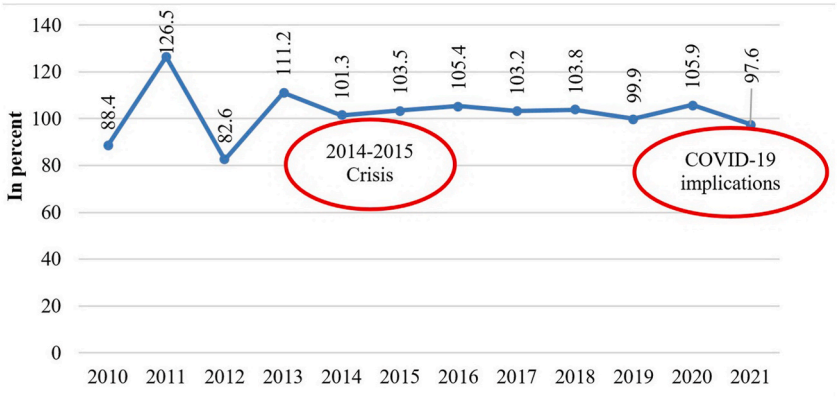

Fig. 2. Physical GDP Index, 2010-2021.
Source: created by the authors according to the data of the Statistics of National Accounts [18,19].

Table 5
Corporate strategic management audit in light of COVID-19 crisis imperatives.

Name and composition of the company	Adaptation of corporate strategies to COVID-19 crisis imperatives (quarantine and social distancing policy)	The main business objectives of enterprises	Net profit
JSC Atameken-Agro 3 enterprises JSC Alel' Agro 10 enterprises JSC KazAgroFinance 1 shareholder Kazrost Engineering Ltd JSC Aitas KZ 15 enterprises	Corporate strategies: - organizational stability; - rational use of production opportunities; - unlocking the growth potential by diversifying and seeking innovative production methods; - development of capital-intensive investment projects; - automation of business processes using technologies; - centralised monitoring; - development of the company's product line; - introduction of digital technology; - the legality and ethics principle; - environmentally safe production. ↓. Responding to the COVID-19 crisis: a general strategy for responding to risks – accepting the situation. ↓. Measures taken to maintain the sustainability of the enterprise: - strategy of budget solutions for the implementation of capital-intensive investment projects; - remote work; - optimisation of the procurement structure (concentration on the procurement of key goods and materials); - focus on local alternative suppliers and micro-supply chains; - narrowing of the product line	Increasing production capacity through crop production, seed production, and animal husbandry meat and poultry production development of technical equipment in the agricultural sector of the country high productivity of farming machinery production, processing, and distribution of poultry meat and chicken products	15.2 billion tenge 10.2 billion tenge 9.6 billion tenge 4.3 billion tenge 1.37 billion tenge

Source: created by the authors based on data from the official websites of agricultural enterprises, Zhumashev et al. [26] and SFERA [17].

The COVID-19 pandemic has forced enterprises to alter their business strategies and focus on.

- investing in their main business goals and the highest growth points;
- mass sales channels in the domestic market;
- digital technology.

This study used economic forecasting to verify the accuracy of risk assessments made in response to the COVID-19 pandemic and associated with the adopted corporate long-term development strategies. To reflect the activity of independent business entities at the meso level, the study used a statistically accessible indicator – the number of operation agricultural enterprises. With the Excel tool and the trend line function, the study analyzed possible strategic real-world implications and forecasted changes. This analysis serves as a conceptual framework for corporate strategies in the context of the COVID-19 pandemic (Fig. 3) [18,19,22].

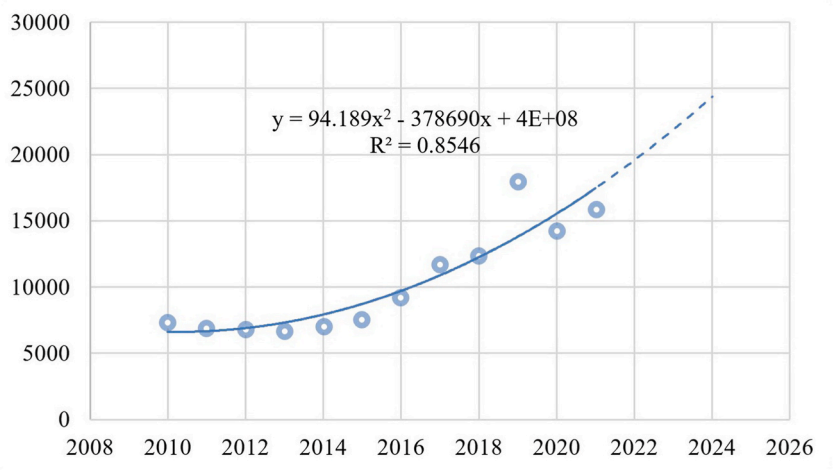

Fig. 3. Forecast of corporate strategies of agricultural enterprises in light of the COVID-19 pandemic spread for 2021-2024.
Source: created by the authors according to Kenshimon [22] and Statistics of National Accounts [18,19].

The analysis rests on historical dynamic indicators. These indicators clearly show that the corporate strategic management actions aimed at the long-term viability of agricultural enterprises are highly likely to expand businesses operating in the agricultural market soon. This result increases the likelihood of positive risks. The enterprises would more actively adopt response strategies to allow for a gradual return to normal business operations. Specifically, businesses tend to mature, receive more resources, and invest in projects. The results of the analysis are confirmed by the combined calculated coefficients of the equation, where $R^2 = 0.8546$, indicating that the polynomial relationship is reliable.

Factor analysis and a generalized criterion method determined the integral development level of the studied agricultural enterprises. Table 6 shows the values for the period from 2016 to 2020. In 2020, compared to 2019, during the COVID-19 crisis, there are unfavorable trends in integral development indicators at all the studied enterprises.

JSC Aitas KZ has shown positive trends from 2017 to 2019 and has the highest integral indicator values. In turn, there are negative trends in the values of the integral development indicator at JSC Alel' Agro [24], JSC Atameken-Agro [23], JSC KazAgroFinance [20], and Kazrost Engineering Ltd [21]. The analysis identified three distinct groups of enterprises, each with a high, medium, or low level of development. Therefore, the priority and promising lines of enterprise development within the context of selected corporate strategies include the following.

- support of acquired positions in the internal and external environment;
- the search for new contacts in all areas of activity;
- updating the resource base to ensure development;
- active information interaction with agents of the external environment to establish relationships with the enterprise;
- modernization of production and updating of products;
- implementation and adaptation of innovations;
- staff training.

Thus, the study identified the primary issues affecting the operation of agricultural enterprises. This finding reaffirms the fact that crises force most enterprises to utilize resources more prudently and implement cost-cutting measures to remain competitive in the market. In this regard, it is necessary to determine the main priority vectors for the development of an agricultural enterprise. The essential aspects are the following.

- a selected group of corporate strategies and the development strategy;
- forecasting market trends;
- enterprise-stated strategic objectives.

In this case, the defuzzification process applies to output variables corresponding to a given set of characteristics, as indicated by the rule viewing window. The procedure uses the FIS editor's rule database. Fig. 4 illustrates a fragment of a rule viewing window (for one of the studied agricultural enterprises).

Similarly, the defuzzification process can work for the rest of the enterprises. It visualized the dependence of output variables on input ones. The visualization presents a response surface for an enterprise's adaptation of corporate strategies during the COVID-19 crisis. Fig. 5 shows a graphical representation of the response surface for a corporate revolutionary strategy.

In the context of the COVID-19 crisis, the revolutionary approach to the corporate strategy demonstrated the enterprise's reliance on its level of development. Notably, this strategy was effective for a small number of enterprises. Fig. 6 illustrates the response surface for a corporate progressive strategy.

A progressive strategy used for agricultural business during the COVID-19 crisis demonstrates that a significant number of enterprises have development opportunities. Simultaneously, these enterprises exhibit a relatively low degree of adaptability. Therefore, this type of corporate strategy during crises is risky and limits agricultural enterprises' ability to adapt to changing operating conditions. Fig. 7 illustrates the response surface for the corporate formative strategy.

In comparison to the above-mentioned corporate strategy (progressive), agricultural enterprises exhibit the opposite effect. Agricultural enterprises that use this type of corporate strategy can achieve a high level of adaptability during the pandemic crisis. However, a significant number of agricultural enterprises may experience a slowdown in their growth. Fig. 8 illustrates the response surface for the corporate further development strategy.

Most agricultural enterprises can benefit from the further development strategy. It allows for developing uniformly and adapting to

Table 6
Agricultural enterprises' integral levels of development from 2016 to 2020.

Enterprise	2016	2017	2018	2019	2020
JSC Aitas KZ	0.327	0.151 (↓)	0.492 (↑)	0.516 (↑)	0.256 (↓)
JSC Alel Agro	0.208	0.118 (↓)	0.219 (↑)	0.334 (↑)	0.235 (↓)
JSC Atameken-Agro	0.315	0.234 (↓)	0.157 (↓)	0.186 (↑)	0.144 (↓)
JSC KazAgroFinance	0.428	0.304 (↓)	0.317 (↑)	0.285 (↓)	0.156 (↓)
Kazrost Engineering Ltd	0.282	0.143 (↓)	0.255 (↑)	0.349 (↑)	0.224 (↓)

Source: created by the author.

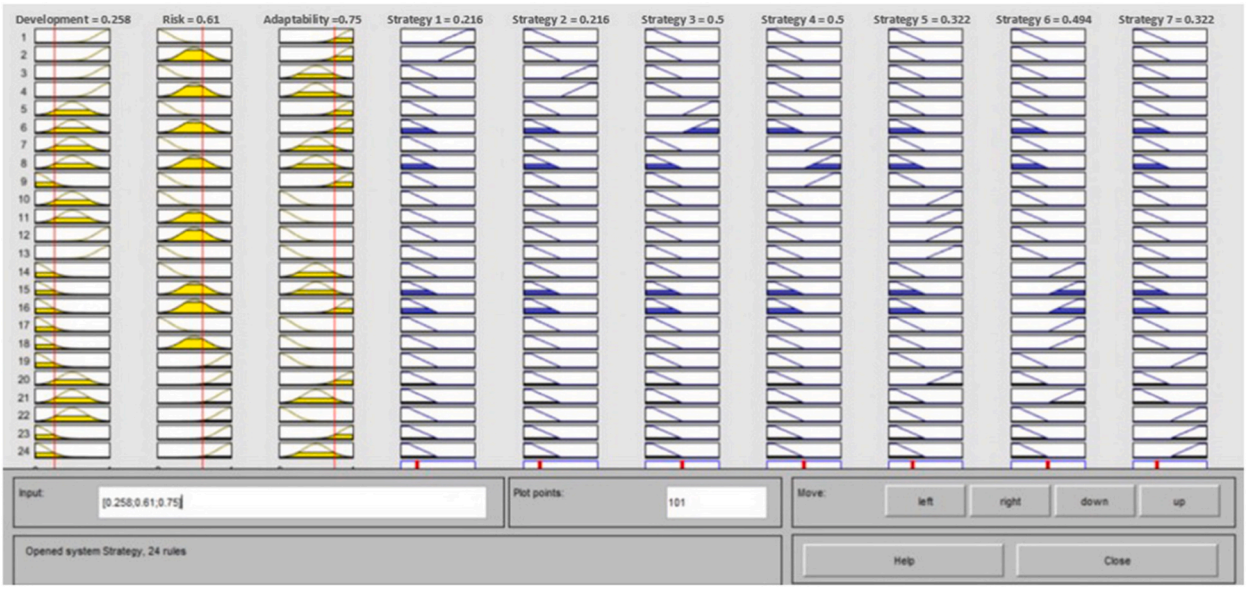

Fig. 4. Defuzzification process for JSC Aitas KZ|.
Source: created by the author.

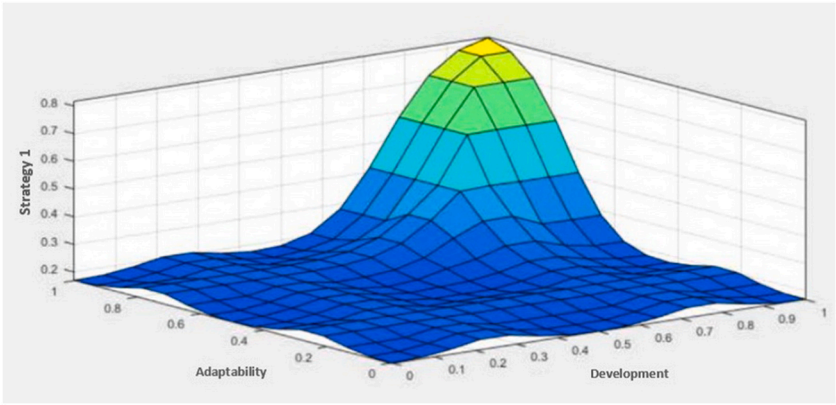

Fig. 5. Response surface for the corporate revolutionary strategy of the studied agricultural enterprises.
Source: created by the author.

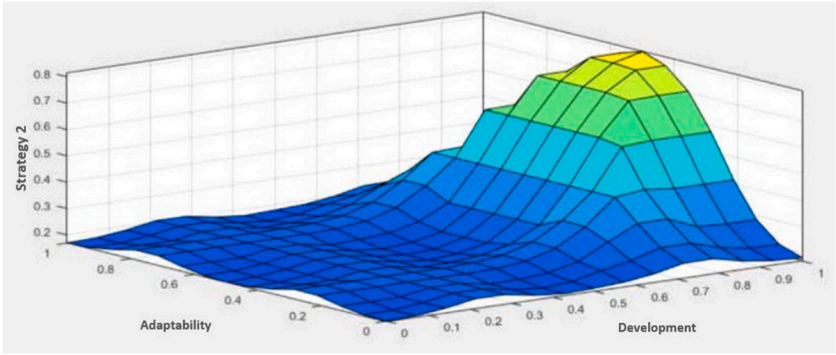

Fig. 6. Response surface for the corporate progressive strategy.
Source: created by the author.

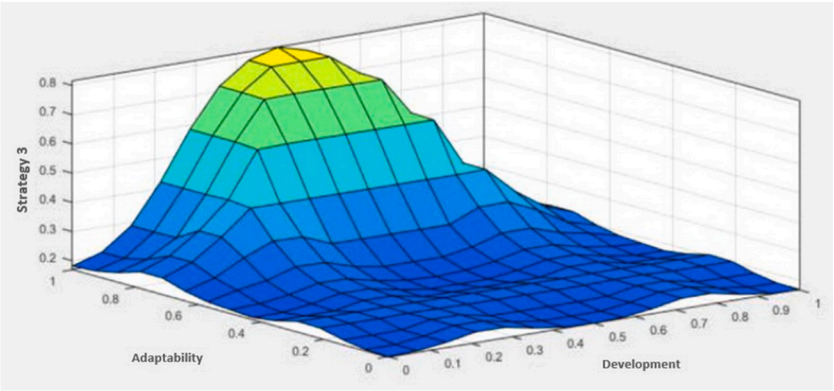

Fig. 7. Response surface for the corporate formative strategy.
Source: created by the author.

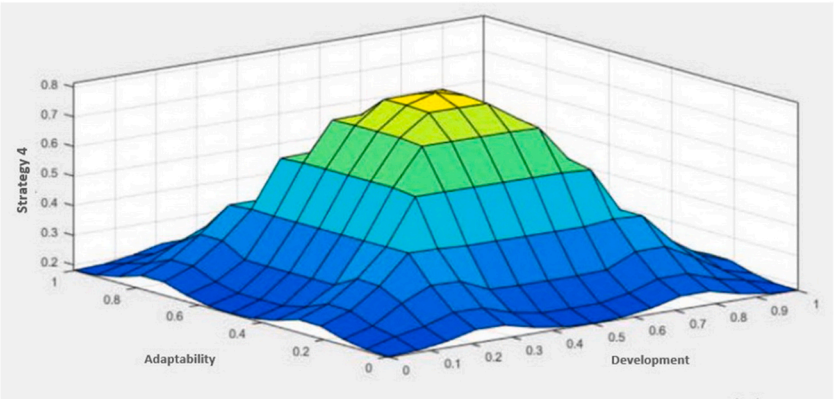

Fig. 8. Response surface for the corporate further development strategy.
Source: created by the author.

the COVID-19 crisis. Nevertheless, this strategy is insufficiently effective in the operation of businesses. Its efficiency is lower than in other strategies. Fig. 9 illustrates the response surface for the corporate strategy to support the enterprise's activities.

During the COVID-19 crisis, most agricultural enterprises' support strategies assumed a low level of adaptability. Meanwhile, this corporate strategy does not guarantee rapid growth. Agricultural enterprises employed a support strategy during the COVID-19 crisis to meet the bare minimum requirements of the business environment. Fig. 10 illustrates the response surface for the enterprise's corporate growth strategy.

Agricultural enterprises' growth strategy does not include opportunities for business development. To achieve high efficiency in the implementation, this strategy requires a high level of adaptation to the COVID-19 crisis. However, this feature is characteristic of only a small number of agricultural enterprises. Simultaneously, agricultural enterprise development remains below average. The reason is that enterprises that pursue this strategy place a premium on quantity over quality in business development. Fig. 11 illustrates the response surface for the corporate reduction strategy.

The corporate reduction strategy implemented by agricultural enterprises during the COVID-19 crisis demonstrated the inherent relationship between adaptability and business development levels. In other words, the application of this strategy may result in a variety of different outputs and corresponding outcomes. For most enterprises, the reduction strategy was ineffective during the COVID-19 crisis. On the other hand, it allowed enterprises to improve their adaptability and, in some cases, their development level. Thus, the adaptation of agricultural enterprises' corporate strategies toward reduction does not allow for high performance. Nevertheless, an enterprise that employs this strategy can survive the COVID-19 crisis.

4. Discussion

The analysis examined how corporate strategies adapt to the COVID-19 crisis imperatives, as well as the potential implications of their implementation in practice. The study of McGrath [27] identified six changes that impacted business operations during the COVID-19 pandemic era.

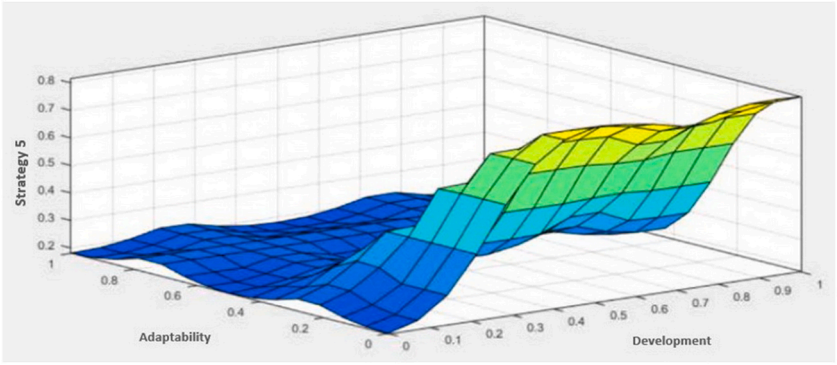

Fig. 9. Response surface for the corporate support strategy.
Source: created by the author.

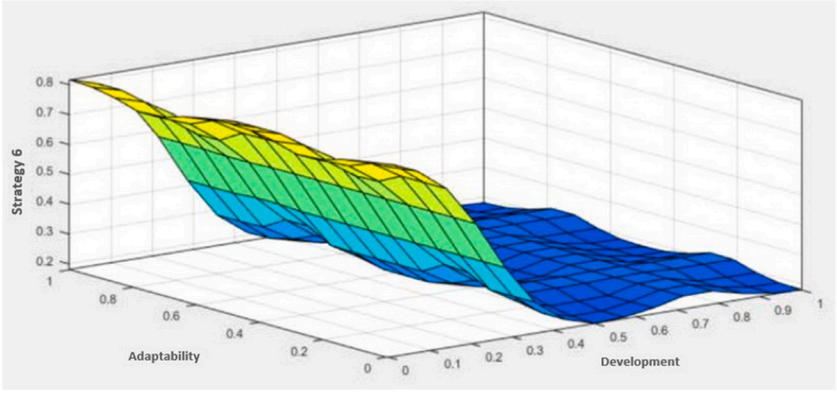

Fig. 10. Response surface for corporate growth strategy.
Source: created by the author.

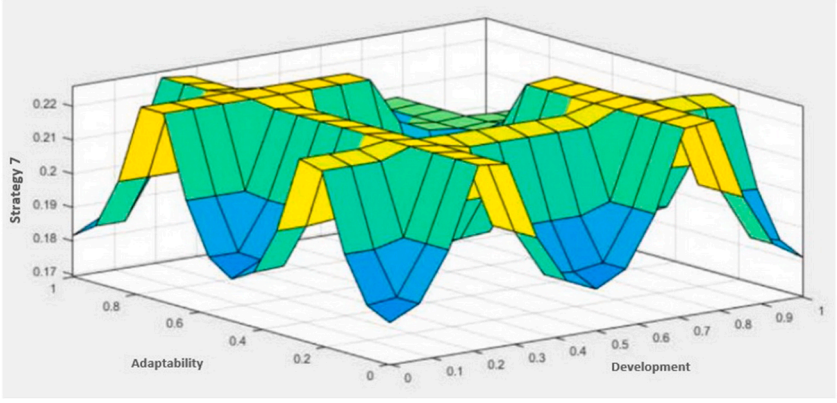

Fig. 11. Response surface for the corporate reduction strategy.
Source: created by the author.

- continuous transformations;
- business activity monitoring;
- data analysis;
- innovation application;
- redistribution of enterprise resources;
- adherence to safe operating conditions [20].

This study monitored the agricultural sector's production processes. The monitoring results indicated that the COVID-19 crisis had the following implications in 2021.

- a negative indicator of the economic growth pace;
- a decrease in consumer capacity;
- increased competition among agricultural enterprises in the agricultural market.

Concerning the COVID-19 pandemic's current state, it is reasonable to conclude that there is a high degree of uncertainty regarding business prospects. This uncertainty prevents agricultural enterprises from developing and planning in the current environment. According to Akuriba et al. [28], agricultural enterprises are a necessary component of the market economy and the foundation for inclusive economic growth. Their development depends on.

- concerted efforts at the national, regional, and continental levels;
- a robust policy framework governing the activities of agricultural businesses;
- identifying specific products for niche markets that offer the greatest potential for sustainable and inclusive growth [21].

The availability of basic infrastructure, such as roads, railways, and storage facilities, is critical to sustainability and inclusiveness as well. Other researchers [29] addressed the impact of the COVID-19 pandemic on supply and demand. The research focused on biophysical (crop yield; resource availability) and socioeconomic factors (access to labor, markets, and social services). Market access, marketing, and disruptions became significant constraints for agricultural businesses, according to the study. Food security and social support turned out to be the most important issues of sustainability and livelihood in this regard. As suggested by Priyadarshini and Abhilash [2], agricultural food systems implement innovative strategies, including healthy nutrition strategies, to increase resilience in the post-COVID-19 period. The purpose of this study was to examine the corporate strategies of five large agricultural enterprises in the Republic of Kazakhstan. The research focused on the primary business objectives and financial profit indicators associated with the COVID-19 pandemic as the primary challenge. The methodology was audit analysis. The study examined corporate governance concerning business entities. In particular, it analyzed the measures that businesses took to deal with the COVID-19 crisis imperatives. On this basis, an audit opinion showed how corporate strategies adapted to current conditions. The study found that the agricultural market's large agricultural enterprises have reconsidered their development strategies. Additionally, the enterprises sought to reduce secondary costs by concentrating on high-demand goods, establishing short supply chains, and implementing a flexible remote-control system. This conclusion is supported by the results of Bhalla et al. [30], Jie-hong et al. [31], and Mikhailova and Yushchuk [32]. According to the researchers, global digitalization became more rapid during the COVID-19 pandemic. Countries tried to establish a quarantine policy. This policy forced schools and entire sectors of the economy to close, while digital sectors, such as e-commerce, service, and remote business management gained prominence. The United Nations Country Team [33] confirms that digitalization has altered the business landscape through innovation. Additionally, it has the potential to strengthen agricultural business resilience to future outbreaks of new infectious diseases similar to the COVID-19 pandemic. Furthermore, the digitalization of economic activity has additional advantages in terms of environmental preservation and public health [30,31]. Business is therefore confronted with the need to create new opportunities that allow for the assessment of risks associated with changes. It is necessary to take the subsequent actions to adapt to the new norm [31–36]. The current study presents economic forecasting for the period 2021–2024 using a trend line model. This empirical evidence demonstrates that agribusiness entities' risk assessment under the influence of the COVID-19 pandemic is accurate. It refers to the implementation of corporate strategies to restore economic activity to pre-COVID-19 levels and identify optimal points of interaction for future long-term development. In general, the analysis indicates that the COVID-19 crisis has had a detrimental effect on agricultural economic activity. However, in the current situation, corporate strategies have changed to meet the COVID-19 crisis imperatives by accepting the situation, downsizing, and cutting costs. In the global context, it is crucial to measure the real-world success of corporate strategic management for 2021–2024, as empirically demonstrated in this study. As long as there are no new COVID-19 relapses, this objective is achieved.

5. Conclusions

The conclusions of this article confirm that the state's economy experienced the negative impact of the COVID-19 crisis, which led to negative growth rates. The agricultural business sector has faced significant difficulties due to reduced demand. In addition, the crisis has changed the direction of the agricultural economy, decreasing the number of registered agricultural enterprises.

The analyses of large agricultural enterprises in Kazakhstan indicate their ability to continue operating by accepting the situation and adapting business processes. Empirical analysis confirms that changes in corporate strategies occur in response to changes in the external environment. These changes also correlate with changes in the capabilities of enterprises.

The study proposed a methodology for determining corporate strategy through a two-level decision-making model based on fuzzy logic. This approach allows enterprises to choose the optimal development at low costs and in a short time in a crisis. This tool can be important for the agricultural sector, especially during a pandemic.

The study makes a significant contribution to the scientific community. Highlighting survival strategies and their impact on agricultural enterprises, the paper expands the understanding of corporate governance in an unstable environment. The research presents modern theoretical approaches to strategic management with digital technologies as a key element of adaptation.

At the practical level, the results of the study have great potential for improving the strategic management of agricultural

enterprises. Businesses can use this knowledge to develop effective strategies for adapting and increasing their resilience to crises. The introduction of digital technologies in strategic management can become a key element for the success and survival of agricultural enterprises in the face of uncertainty. In addition, the study provides practical recommendations for businesses to choose survival strategies, such as cluster development and digital transformation. These strategies can prove to be an important tool for overcoming economic difficulties. Governments can use the results to develop effective agricultural policies aimed at production and consumption. It is also important to further explore global changes in the business landscape to adapt strategies to new market realities.

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Availability of data and materials

Data will be available on request.

Additional information

No additional information is available for this paper.

CRediT authorship contribution statement

Symbat Abilda: Writing – original draft, Resources, Project administration, Funding acquisition, Data curation. **Assem Kaliyeva:** Writing – review & editing, Supervision, Methodology, Formal analysis, Conceptualization. **Guliya Ilyashova:** Writing – original draft, Visualization, Software, Methodology, Formal analysis. **Aimankul Yerezhepova:** Writing – review & editing, Software, Resources, Methodology, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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