Diagnostics of financial stability of agricultural enterprises of dairy cattle breeding of the Republic of Kazakhstan: Study of foreign crisis-forecasting models

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Abstract. Dairy farming, as one of the components of agriculture in Kazakhstan, plays a crucial role for the effective development of the industry and the country, which makes its constant study relevant. Thus, the purpose of this study was to examine different models for predicting the performance of dairy farming enterprises and their financial stability. The methods that were applied within the study were analysis, forecasting, and abstraction. Within the framework of this study, the authors considered various

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models of ensuring financial stability for the enterprises of this sphere in the Republic of Kazakhstan. Furthermore, the state of the dairy industry in Kazakhstan was assessed, emphasising its significant potential to contribute to the agricultural sector. Some difficulties that arise within the framework of the development of this sphere in the country were described, such as dependence on imports of certain types of products and insufficient production of certain types of goods of the industry. Shortcomings also exist in terms of milk quality and its export, specifically to China. The study also proposed crisis prediction models. One of them was a model based on the logit regression approach, which included seven coefficients that helped to identify organisations experiencing financial difficulties, assess the boundary values of financial stability, rank organisations, and accurately predict the risk of financial crisis. It was shown that its use can allow for increased efficiency in the functioning of agriculture. The study brought new knowledge for the research of the agricultural sphere of the Republic of Kazakhstan. The findings provide a better understanding of the foreign features of forecast model construction and allow enterprises and government representatives to improve the construction of such models

INTRODUCTION

Agriculture as a whole serve not only as an industry for the production of raw materials and goods, but also as an important part of the life of the country. The level of agricultural production directly affects the food security of the country. Thus, identifying problems at an early stage can lead to prompt implementation of measures to prevent potential future bankruptcies. Given the reasons described above, it is relevant to revise the recommendations that enhance the management of financial security of agricultural enterprises, ensuring their sustainability and growth in an unstable environment. The deepening of this topic will make it possible to assess the financial condition of the subjects of agrarian-industrial complex and improve the accounting, analytical, and financial tools used in managing the development of agricultural enterprises. In modern conditions, many enterprises cannot assess their stability in the face of various crises that may arise (Gutsul *et al.*, 2023). This creates additional risks for companies that, in the event of certain situations that cannot be foreseen, they will not be able to resist difficulties or will suffer significant losses. Improving the methodology of crisis models will considerably reduce the risk of such an outcome. The importance of the study is also in identifying promising areas for improving the methods of measuring the financial stability of domestic agricultural enterprises based on foreign practices in diagnosing financial crises. This will help in forecasting and making informed management decisions to improve the financial health of agricultural organisations.

The general study of the current state of Kazakhstan's economy has been worked on by quite a considerable number of scientists. Thus, M. Sadyrova *et al.* (2021) investigated innovation processes in Kazakhstan. Researchers have noted that there is a clear trend within the country towards an increasing role for the latest technologies (both in terms of production and as part of a more global policy of the state in long-term development). Although scholars have

described certain steps that have already been taken and should be implemented in the country in the future in this area, but they are not enough to build a full-fledged policy. A. Figus and D. Shaikin (2019) investigated the features of socio-economic development of the country. Scholars have written that Kazakhstan is making considerable strides towards becoming a major global player by emphasising enlightened reforms and technological advance. They analysed government plans for the future development of the country but did not themselves propose any improvements or alternatives for them. Zh. Aigazin (2021) in turn assessed the economic trends in the state in the aftermath of the COVID-19 crisis, forming predictions on how the situation may evolve in the future. A.T. Aimen *et al.* (2022) studied the state of dairy products in Kazakhstan. They emphasised that certain problems do exist within the industry (lack of competition, lack of productive capacity, low involvement of scientific production), and proposed methods of solutions for them. Y. Akhmedyarov *et al.* (2023) noted the opportunities for the development of sustainable dairy production in the country. They considered the environmental and economic factors affecting the possibilities of sustainable development mechanism in the country. They also looked at technologies that states could use for these purposes, although they paid little attention to public policy issues.

Thus, the purpose of this study was to assess the current state of development of the dairy sector in Kazakhstan and to draw conclusions about what models can be used to forecast future trends in the industry. This will allow for a more precise definition of public policy in this sector.

MATERIALS AND METHODS

During the study, statistical data related to the assessment of the current state of agriculture and the dairy sector in Kazakhstan was also analysed. For this purpose, data on the distribution of agricultural enterprises

of Kazakhstan by financial results, distribution of agrarian formations by their number and volumes of milk production were used. The source of data for all three of these indicators was the Bureau of National Statistics of Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (2023). All calculations and plots were performed in Microsoft Excel.

The main approach during the study was systematic. It allowed an assessment of the factors affecting Kazakhstan's dairy sector within a single system where they interact with each other. This made the generated evaluation model more accurate and qualitative. Several main scientific methods were utilised within the study. Based on data analysis, the specific features of formation of crisis-models of agricultural enterprises both in Kazakhstan and in other countries were evaluated. The historical method helped to draw conclusions about current trends in the development of the industry based on known information about how it has evolved in the past. Forecasting made it possible to assess future scenarios of its development, based on the same known past and present data. The comparison method was used to evaluate different methods of crisis modelling to assess their strong and weak characteristics. Furthermore, statistical methods of research were applied, specifically, statistical modelling to describe the models of crisis forecasts based on the data of the Republic of Kazakhstan. Data characterising the development of agriculture and, namely, the dairy sector, were subjected to statistical processing to form conclusions. The study employed the tabular method, which made it possible to present the information analysed during the study in a compact way. The same applies to the graphical method because the study used figures to show individual statistics within the research.

Nevertheless, this study, like any other, has certain limitations. Thus, only a few crisis-forecasting models were analysed within the framework of the study, which may partially distort the final conclusions. Furthermore, there has been no comparative analysis of both the state of the dairy industry between individual countries and the effectiveness of certain models under different economic conditions. The study also does not assess the environmental part of the impact of the activities of such enterprises in the country, which may be especially relevant given the spread of the concept of sustainable development in the world. The study is also based solely on the analysis of statistical information and the evaluation of theoretical data, but for more accurate results, a survey of stakeholders, such as the authorities or dairy producers, may also be effective. All this indicates the importance of conducting additional research in this area.

RESULTS

To begin with, it is worth assessing the development of the dairy industry in Kazakhstan as a whole. The dairy industry has considerable potential for the development of the entire agricultural sector, contributing almost KZT 500 billion annually to the agricultural economy. Although there are around 800 dairy farms in the country, the average scale is small, with an average of 150 head per farm, while larger farms of more than 1000 head are rare. Despite the sector's potential for steady cash flow and the scarcity of the domestic market, entrepreneurs are discouraged by some of the complexities, including the need for considerable one-time investments, irrigation requirements, and difficulty in recruiting skilled staff. The need for a consistent long-term strategy is crucial as businesses are hesitant due to changes in government support rules, leading to a lack of confidence in creating long-term projects. This points to the need to create strong links between public authorities and enterprises to improve development opportunities for the industry.

Kazakhstan has a shortage of quality milk faced by dairy producers, resulting in dependence on imported milk powder. This shortage could lead to lower production turnover and potential company closures. The decline in milk supply over the past five years has outpaced producer growth, creating challenges for processors. Compensation of raw milk shortages with imported milk powder makes producers dependent on external prices, which affects their competitiveness (Raimbekov *et al.*, 2018). The region's Department of Agriculture emphasised the tightening of requirements for the quality of raw materials from 2025, stressing the importance of animal feed supply and condition. To address the shortage problem, it is worth increasing dairy production in the country by investing in dairy farming projects, which can also be influenced by the government through both direct injections of funds and by offering incentives for such enterprises by reducing their taxes or credit rates (Amirbekova *et al.*, 2022).

In general, one can identify several major issues in the dairy sector of Kazakhstan related to its production and imports. There are approximately 908 dairy enterprises in Kazakhstan, and they generally have problems meeting microbiological requirements for raw milk and problems with testing of milk quality parameters, which affects exports to China. Adjustments to the requirements for dairy products made from milk other than cow's milk are also proposed. Thus, it is relevant to review conformity assessments and consider cancelling some declaration schemes based on rules adopted in 2013 (Kazakhstan has a big…, 2023).

In State program for the development of the agro-industrial complex of the Republic of Kazakhstan for 2017-2021 (2017), SWOT analysis revealed that one of the weaknesses of the agricultural sector is low productivity and limited profitability of agricultural producers. Consequently, Kazakhstan has expressed significant concerns about the sustainability of agricultural production. Financial instability of agricultural business

is manifested in the main financial and economic indicators of the agricultural sector of the Republic of Kazakhstan. Thus, over the period from 2010 to 2021, the share of agricultural enterprises reporting negative financial results has been steadily fluctuating at the level of at least 21% of all enterprises in the agricultural sector, as presented on Figure 1.

As can be seen from Figure 1, the highest percentage of unprofitable results was observed among agricultural enterprises in 2013 – 48.3% and in 2015 – 39%. At the end of 2023, the share of unprofitable enterprises decreased to 21.8% (compared to 45% in 2010). Data on the location of agricultural units across the country are presented in Figure 2.
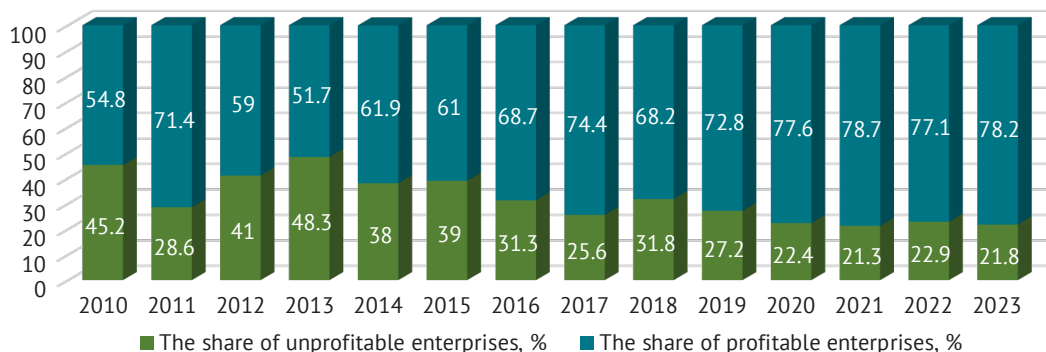

Figure 1. *Distribution of agricultural enterprises in Kazakhstan by financial results for 2010-2023*
Source: *compiled by the authors of this study based on data from Bureau of National Statistics of Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (2023)*

Figure 2. *Distribution of agricultural formations in Kazakhstan by their number for 2010-2023*
Source: *compiled by the authors of this study based on data from Bureau of National Statistics of Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (2023)*
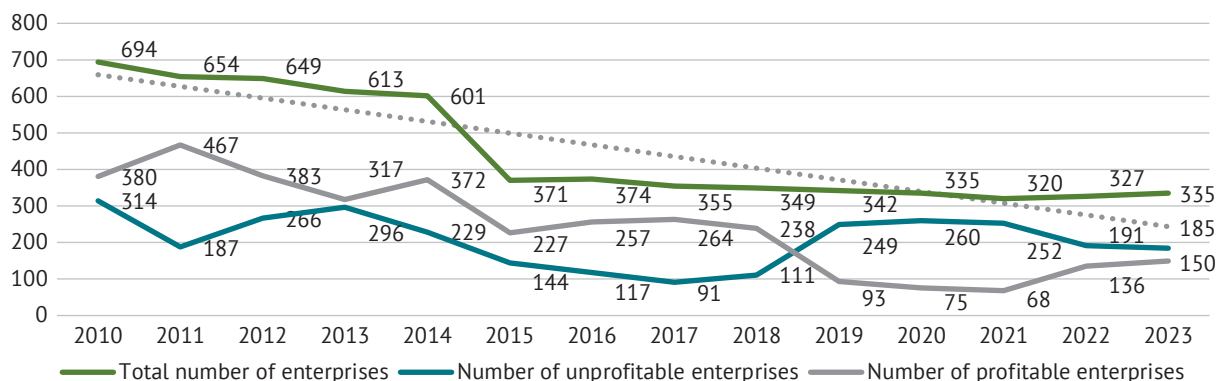
Much of the decline presented in Figure 1 can be explained by the data from Figure 2. Thus, there was almost 52% decrease in the number of agricultural enterprises between 2010 and 2023. Therewith, the most substantial reduction in the number of enterprises occurred against the background of general financial instability in the country in 2015: 38% of agricultural entities declared their insolvency. Consequently, in the face of intense competition and global market integration, the evolution of the agricultural sector highlights

the growing importance of strategic management for agricultural organisations. A critical objective of strategic management includes the development of practical methodologies that can identify, assess, and analyse the prevailing threats to the financial stability of agricultural enterprises (Vaintrub *et al.*, 2021). Although statistics on dairy farming in Kazakhstan are rather limited, they can still be found in free sources. Thus, the volume of milk production of all types in the country is presented in Figure 3.
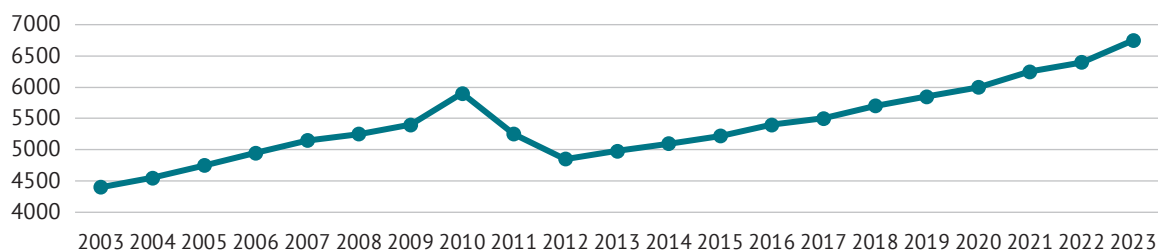
Figure 3. *Milk production volumes in Kazakhstan in 2003-2023, thousand tonnes*
Source: *compiled by the authors of this study based on data from Bureau of National Statistics of Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (2023)*

As Figure 3 shows, the volume of production of these products in the country as a whole is increasing over the selected period, which indicates the development of this sphere in general. This is coupled with the information discussed above regarding the development of the dairy sector in Kazakhstan as a whole. Nevertheless, this does not cancel the difficulties that exist in terms of import substitution of certain types of milk, specifically, milk powder. This indicates the need for further increase in production in this sector and increased attention to it by public authorities.

Within the framework of this study, the ability to assess the financial health of agricultural enterprises played a significant role, for which many approaches, methods, and techniques, indicative and computational measures were generally created. Nevertheless, the main focus in the development of the methodology of financial stability assessment is the creation of a factor model. They make it easier to identify signs of financial distress in agricultural organisations and allow the identification of the concrete category of financial strength that an organisation maintains. Such factor models should be built on certain indicators that describe the financial stability, economic potential, and recent performance of the enterprise. The resulting value of the functions should reflect the degree of financial stability within the organisation. Some of these are presented in Table 1.

Table 1. *Comparative characteristics of crisis forecasting models*

Sources of the crisis forecast model			
$Z=0.717X_1+0.847X_2+3.107X_3+0.42X_4+0.995X_5$		$Z=1.03X_1+3.07X_2+0.66X_3+0.4X_4$	
X_1	The ratio of net working capital to total assets	The ratio of working capital to total assets	
X_2	The ratio of retained earnings and reserve capital to total assets	The ratio of profit before taxes and interest to total amount	
X_3	The ratio of profit before tax and interest to total assets	The ratio of profit before tax to the amount of short-term liabilities	
X_4	The ratio of equity to the value of total debt	The ratio of revenue (net) to total assets	
X_5	The ratio of revenue (net) to total assets	-	
	Z-score value	Threat of bankruptcy	Z-score value	Threat of bankruptcy
	less than 1.23	high	less than 0.86	high
	1.23–2.9	uncertainty	over 0.86	absent
	over 2.9	low		
Sources of the crisis forecast model			
$Z=0.063X_1+0.092X_2+3.057X_3+0.001X_4$		$Z=0.53X_1+0.13X_2+0.18X_3+0.16X_4$	
X_1	The ratio of working capital to total assets	The ratio of profit from sales to the amount of short-term liabilities	
X_2	The ratio of profit from sales to total assets	The ratio of working capital to the amount of liabilities	
X_3	The ratio of retained earnings to total assets	The ratio of short-term liabilities to total assets	
X_4	The ratio of equity to debt	The ratio of revenue to total assets	
	Z-score value	Threat of bankruptcy	Z-score value	Threat of bankruptcy
	Less than 0.037	High	Less than 0.2	High
	Over 0.037	Absent	Over 0.3	Absent

Source: *compiled by the authors of this study based on E.I. Altman et al. (2017), G.L.V. Springate (1978), K.O. Appiah (2011), R.J. Taffler (1982)*

At the initial stage of building the identification model, a set of indicators relating to both production and financial activities is established. To assess the characteristics of agricultural production in different sectors, this set should include indicators related to financial stability and economic efficiency. Moreover, these indicators need to be normalised for geographical differences, as agricultural organisations can vary substantially in size, production intensity, and resource availability. Therefore, the indicators selected for analysis should be relative. Hence, there is a need for a diagnostic model of financial stability that can consider not only the impact of numerous factors, but also the unique aspects of agricultural production. Furthermore, these models should be regularly updated using the latest statistical data and should be adapted to the evolving economic situation in the industry, the region, as well as to changes in financial regulations, accounting practices, and reporting standards. When building crisis prediction models, it is crucial to choose appropriate modelling tools, such as mathematical methods, to create an understanding of the subject under study, in this case the risk of financial crisis. The purpose is to make this simulation model as close to real data as possible. It is key that the model is interpretable in terms of its content and user-friendly in its application (Feil *et al.*, 2020).

Learning from the experience of developing multivariate crisis forecasting models, as observed by W. Zhu *et al.* (2022), along with understanding the financial features of agricultural enterprises in Kazakhstan, it is possible to calculate an integrated indicator to assess financial stability based on the previously established crisis forecasting model. Meanwhile, the indicators selected for analysis, reflecting the financial condition of organisations, provide insight into financial stability from various perspectives, including both the sustainability of financial conditions and development potential. Consequently, the crisis forecasting model includes the most significant indicators characterising the structure of the balance sheet of the enterprise and its economic activity. The crisis prediction model can be described as follows (1):

$$Z = 27 - 5X_1 + 15.96X_2 - 15X_3 - 1.16X_4 - 63.68X_5 - 0.39X_6 + 47.44X_7, \qquad (1)$$

where Z – value of the crisis forecasting model; X_1 – current liquidity ratio; X_2 – financial leverage ratio; X_3 –

turnover ratio of current assets; X_4 – working capital ratio; X_5 – ratio of financial liabilities to assets; X_6 – return on equity; X_7 – turnover ratio of total assets.

This model suggests that if the tested function F(Z) gives a value equal to or less than zero, there is no probability of financial crisis. Conversely, if the value of the function F(Z) for the tested enterprise is equal to or greater than one, the probability of a financial crisis increases. The logit regression model is universal because it relies on annual cluster and discriminant analysis. This approach mitigates fluctuations in the production and financial performance of enterprises, including timing differences. Such adaptability is particularly important in agriculture, where natural and climatic conditions substantially affect the sustainability of agricultural enterprises (Läpple and Thorne, 2019).

The proposed logit model offers several advantages for agricultural producers in Kazakhstan. It consists of calculating seven coefficients that can be easily substituted into functional equations. Thanks to this approach, it becomes possible to identify agricultural organisations experiencing financial difficulties and assess the "boundary" values of financial sustainability ratios, indicating the transition from one level of financial sustainability to another. The model ranks agricultural organisations according to their proximity to the point of financial distress, providing an accurate prediction of the risk of financial distress. This emphasises its practical relevance in assessing and managing financial stability.

To assess the financial stability of an enterprise, it is recommended to attribute it to a certain class of risk by the nature of its financial and economic activities, considering both their quantitative and qualitative attributes. Similarly, four clusters of enterprises were identified according to the type of their financial stability, and the overall indicator was presented in the form of a range of values: thus, the groups with a low level of crisis risk have a value below -51, with an average risk – from -50 to -11, with a risk greater than average – from -10 to 0, with a high level of risk – above 0. The present study is based on the use of factor model to diagnose the presence of signs of financial crisis in agricultural organisations. Table 2 shows the grouping of enterprises by type of financial stability, as well as the average values for each group.

Table 2. Logit model value (Z) according to the type of financial sustainability of agricultural organisations

Year	Group of enterprises according to the level of crisis risk	Number of objects in a group	The average value of group indicators							
			Z	X_1	X_2	X_3	X_4	X_5	X_6	X_7
2022	Low risk level	3	-77.11	20.52	0.07	1.02	0.95	0.05	16.41	0.49
2023		3	-95.73	24.98	0.04	0.95	0.96	0.04	10.87	0.48
Absolute change (+,-)		0	-18.63	4.46	-0.03	-0.07	0.01	-0.01	-5.54	-0.01
Average for 2 years		x	-86.42	22.75	0.05	0.99	0.95	0.04	13.64	0.48

Year	Group of enterprises according to the level of crisis risk	Number of objects in a group	The average value of group indicators							
			Z	X_1	X_2	X_3	X_4	X_5	X_6	X_7
2022	Moderate risk level	4	-16.12	5.75	0.41	1.14	0.81	0.28	13.47	0.42
2023		3	-14.68	6.61	0.27	1.07	0.85	0.21	10.51	0.44
Absolute change (+,-)		-1	1.44	0.87	-0.14	-0.07	0.04	-0.06	-2.95	0.02
Average for 2 years		x	-15.4	6.18	0.34	1.1	0.83	0.24	11.99	0.43
2022	Above average risk level	3	-3.41	4.18	0.26	1.39	0.75	0.2	10.94	0.53
2023		2	-3.58	3.5	0.83	1.18	0.81	0.36	8.43	0.36
Absolute change (+,-)		+1	-0.17	-0.68	0.57	-0.21	0.06	0.16	-2.51	-0.17
Average for 2 years		x	-3.5	3.84	0.54	1.29	0.78	0.28	9.69	0.45
2022	High risk level	1	2.79	1.53	0.82	1.62	0.34	0.45	6.13	0.55
2023		3	6.03	2.54	0.42	1.25	0.57	0.27	5.91	0.48
Absolute change (+,-)		+2	3.24	1.01	-0.4	-0.37	0.23	-0.18	-0.22	-0.07
Average for 2 years		x	4.41	2.04	0.62	1.44	0.45	0.36	6.02	0.52

Source: *compiled by the authors of this study*

According to the crisis prediction model for 2022-2023 (as presented in Table 2), 8 farms (representing 72.7%) do not face an immediate threat of financial crisis in 2022, as indicated by logit regression values below zero. Of these, six farms maintained a satisfactory level of financial sustainability, three farms exhibited a less than adequate level of sustainability, and two farms were approaching this critical state.

DISCUSSION

Based on the information analysed above, it is possible to offer certain recommendations related to the long-term development of the dairy sector. Thus, establishing strong and consistent links between government agencies and dairy enterprises to build trust and increase development opportunities is still important. It is also important to provide financial support to dairy farm projects, including direct injection of funds, tax reductions, and favourable loan rates. Small and medium-sized enterprises in the industry should also be given attention, and support programmes should be considered to help them overcome the obstacles they face when operating in the market. It is also important to disseminate among enterprises in the sector the new possibilities of building models for assessing the financial stability of companies, using factor models such as logit regression. It is important to update them frequently and adapt them to changing economic conditions, industry changes, and financial regulations. It is also important to develop a methodology for identifying, assessing and analysing threats to the financial stability of agricultural enterprises. It is also important to introduce crisis prediction models, using appropriate mathematical techniques to simulate real financial conditions. The application of these recommendations can considerably increase the efficiency of the industry in the long term.

C. Foroni *et al.* (2022) evaluated some methods to improve current forecasts of gross domestic product (GDP) growth during the COVID-19 crisis and recovery period using mixed MIDAS and UMIDAS models with monthly indicators. These techniques include combining forecasts from different specifications or models, extending the model by moving average, using similarity approaches for estimation, and applying certain overlap corrections to bring the forecasts back on track. The researchers suggest that careful thought about the external indicators used to build the model is critical to improve the reliability of forecasts during significant economic shocks, after which additional indicators, econometric models and real-time data can be explored to improve forecasts. One can indeed agree with this, given that the choice of external factors influencing the model will considerably change the data it will produce and what decisions will be made based on it (Anarbayev *et al.*, 2023). It even determines the choice of the model as a whole. Thus, it is really worthwhile to devote more attention to the evaluation of the factors analysed within the models.

A comparable study was also conducted by L. Barbaglia *et al.* (2023). They discussed the challenges of economic forecasting during the COVID-19 pandemic, considering the uncertainty and the need for accurate data for policy makers. The results of the paper emphasised the importance of prompt provision of big data in predicting the rapidly changing economic landscape. Scholars have written that it is important to use multiple models and modify them as the reality of the world economy changes. This also suggests the role of progressively updating the relevance of data and information during research. This was also mentioned earlier in the present paper: while the application of individual models in the dairy sector in Kazakhstan can indeed help to increase the efficiency of the industry, it is important to continuously monitor the changes taking place in the context of the role of the influencing factors on the industry as well as their quantification.

C.L. Beber *et al.* (2021) investigated certain topical features of milk market development in the EU countries. Researchers described that milk production is

expected to shift from unification countries to developing nations. Conducting their study within Germany, the researchers described that to maintain or increase their global market share, German dairy companies would have to process milk outside the country. However, international competitiveness is under pressure due to growing domestic demand and high production costs, while the value of commodity exports is relatively low. Developing countries face serious environmental challenges and addressing them is critical to their access to modern supply chains and developed markets (Oleksandrenko & Levis, 2023). This may indicate that in the future one should expect production capacities to move to Kazakhstan as well, and thus a comparative increase in the country's role in the international dairy production arena.

H. Nozari *et al.* (2021) studied the possibilities of applying green marketing in the dairy industry. Researchers have described the role of using selected emerging technologies in this area, such as the Internet of Things, as well as evaluated its potential application in marketing activities. Furthermore, the scientists noted that the use of such technologies, among other things, will help to achieve considerably better performance in the field of dairy farming, including the reduction of harm from its side to the environment. In the present study methods of support for the dairy sector were also mentioned, but they consisted of somewhat different principles than those proposed by scientists (and primarily on the application of the latest forecasting models, strengthening trust between the state and enterprises). However, the development of technology can also have a positive impact on the industry, for which the state should also make efforts, specifically through financial support (Tulush *et al.*, 2023).

R.S. Mor *et al.* (2021) were concerned with modelling distribution efficiency in the dairy industry. Within the framework of the study, the researchers selected 22 elements of distribution practices for factor analysis for statistical analysis and model building. Hypothesis testing showed that all the factors analysed have a positive effect on distribution efficiency in the dairy industry. Thus, an effective information system improves coordination. Effective marketing of products in rural areas and flexible logistics systems are also considered essential factors in achieving marketing objectives (Moldabekova *et al.*, 2022). All these factors mentioned by the researchers in their study should also be considered by entrepreneurs in Kazakhstan when forming long-term development strategies.

G. Gebreyohanes *et al.* (2021) investigated dairy development trends in Ethiopia. Researchers have noted that this area has significant growth potential, but concerted efforts by both government and the private sector are needed to overcome the challenges. Although continuous efforts are being made to create value chains in the dairy sector, they are fragmented and have certain challenges. Private sector investment also plays a massive role in development. The researchers, on the other hand, recommend building a sustainable resource system, strengthening regulatory institutions, establishing dairy clusters, expanding extension services, investing in breed improvement research, implementing breeding policies, adopting a value chain approach, stimulating the private sector, encouraging milk consumption, and strengthening the market. In general, the present study has also proposed recommendations related to the development of the dairy sector. They consisted mainly in the introduction of improved methodologies for analysing crisis-forecasting strategies in enterprises. Nevertheless, the recommendations proposed in the analysed source are also of sufficient quality to be used to support the industry.

Thus, analyses of the dairy industry in Kazakhstan show that the sector has significant potential to contribute to the agricultural economy, and although there are some difficulties, these can be resolved if certain components of government policy are applied. Furthermore, the companies themselves can also influence this if they properly build a long-term development strategy. Nevertheless, it is also important how the state and enterprises will interact and whether they will be able to reach an understanding. Only if the actions of both parties prove to be pro-industry should significant improvements be expected.

CONCLUSIONS

The findings of this study emphasise the importance of considering the indicators of financial stability along with the indicators of economic efficiency in diagnosing financial crises in agricultural enterprises. These include such indicators as animal productivity, calf yield per 100 head, milk yield per 1 cash unit, fixed assets maintenance costs, feed consumption, labour costs per 1 centner of milk per head, profitability of milk production. Moreover, the results of the correlation assessment revealed strong relationships between most of these indicators, indicating their interrelated and interdependent nature. Additionally, models were developed to establish the relationship between the risk of financial crisis and the key factor indicators to address this issue. Using a set of concrete indicators, this analysis not only identifies the factors leading to a decline in the financial sustainability of agricultural enterprises, but also provides a tool for forecasting and creating a science-based information base that can serve as a guide for managing the activities of agricultural enterprises.

Using logit regression models offers several advantages over discriminant models. They are more versatile, easy to apply, and can be used to identify agricultural enterprises facing financial crisis. Moreover, the results of these models can help determine "threshold" values of financial strength ratios. These models also

allow ranking agricultural enterprises according to their proximity to the brink of financial crisis, which proves their practical usefulness. Relevant for follow-up research is the assessment of crisis models for business sectors other than dairy in Kazakhstan and other countries. Furthermore, it is important to provide a broader list of public policy recommendations that could have a positive impact on agriculture in the country, as well as the formation of more advice to businesses to conduct such activities in the country.

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CONFLICT OF INTEREST

None.

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Діагностика фінансової стабільності сільськогосподарських підприємств молочного тваринництва Республіки Казахстан: дослідження зарубіжних кризово-прогнозних моделей

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Анотація. Молочне тваринництво, як одна зі складових сільського господарства в Казахстані, відіграє дуже важливу роль для ефективного розвитку галузі та країни, що робить актуальним її постійне вивчення. Таким чином, метою цього дослідження стало розглянути різні моделі для прогнозування діяльності підприємств молочного тваринництва, їхньої фінансової стабільності. Методами, що застосовувалися в рамках дослідження, були аналіз, прогнозування та абстрагування. У рамках даної роботи було розглянуто різні моделі забезпечення фінансової стабільності для підприємств даної сфери в Республіці Казахстан. Крім того, було оцінено стан молочної промисловості в Казахстані, підкреслюючи її значний потенціал для внеску в сільськогосподарський сектор. Було описано деякі труднощі, які виникають у рамках розвитку цієї сфери в країні, такі як залежність від імпорту окремих видів продукції та недостатність виробництва окремих видів товарів галузі. Недоліки існують і в розрізі якості молока та його експорту, зокрема – до Китаю. У рамках роботи було також запропоновано моделі прогнозування криз. Однією з них були модель, заснована на підході логіт-регресії, що містила сім коефіцієнтів, які дають змогу ідентифікувати організації, що відчувають фінансові труднощі, оцінювати граничні значення фінансової стійкості, ранжувати організації та точно прогнозувати ризик фінансової кризи. Було показано, що її використання може дозволити збільшити ефективність функціонування сільського господарства. Робота приносить нові знання для вивчення сільськогосподарської сфери Республіки Казахстан. Вона дає змогу краще зрозуміти зарубіжні особливості побудови прогнозних моделей і поліпшити їхню побудову з боку підприємств і державних представників

Ключові слова: фінанси; макроекономіка; торгівля; інвестиції; економетричний аналіз