

IRSTI 06.71.07; 68.75.29

UDC 338.43:339.564

Research Article

<https://www.jprra-kazniapk.kz><https://doi.org/10.46666/2026-3.2708-9991.08>

EXPORT CAPABILITIES OF GRAIN PROCESSING ENTERPRISES OF THE REPUBLIC OF KAZAKHSTAN: ASSESSMENT METHODOLOGY

ҚАЗАҚСТАН РЕСПУБЛИКАСЫНЫҢ АСТЫҚТЫ ҚАЙТА ӨНДЕУ КӘСІПОРЫНДАРЫНЫҢ ЭКСПОРТТЫҚ МҮМКІНДІКТЕРІ: БАҒАЛАУ ӘДІСТЕМЕСІ

ЭКСПОРТНЫЕ ВОЗМОЖНОСТИ ЗЕРНОПЕРЕРАБАТЫВАЮЩИХ ПРЕДПРИЯТИЙ РЕСПУБЛИКИ КАЗАХСТАН: МЕТОДИКА ОЦЕНКИ

G. JOLDASBAYEVA¹*Dr.E.Sc., Professor***L. YESSAKHMETOVA^{1*}***Ph.D***N. GRITSENKO²***C.E.Sc.*¹ *Almaty Technological University, Almaty, Kazakhstan*² *Kazakh Research Institute of Water Management, Taraz, Kazakhstan***corresponding author: yesakhmetova.l@mail.ru***Г.К. ДЖОЛДАСБАЕВА¹***э.ф.д, профессор***Л.М. ЕСАХМЕТОВА^{1*}***Ph.D***Н.В. ГРИЦЕНКО²***Э.Ф.К.*¹ *Алматы технологиялық университеті, Алматы, Қазақстан*² *Қазақ су шаруашылығы ғылыми-зерттеу институты, Тараз, Қазақстан***автордың электрондық поштасы: yesakhmetova.l@mail.ru***Г.К. ДЖОЛДАСБАЕВА¹***д.э.н., профессор***Л.М. ЕСАХМЕТОВА^{1*}***Ph.D***Н.В. ГРИЦЕНКО²***К.Э.Н*¹ *Алматинский технологический университет, Алматы, Казахстан*² *Казахский научно-исследовательский институт водного хозяйства, Тараз, Казахстан***электронная почта автора: yesakhmetova.l@mail.ru*

Abstract. The development of exports of grain processing products is one of the priority directions for increasing the competitiveness of the agro-industrial complex of Kazakhstan. Despite a sufficient raw material base and stable demand in foreign markets, the export mechanisms of grain processing enterprises are not fully utilized. One of the reasons is the lack of a unified methodological approach that allows for a comprehensive study of the export potential of economic entities, taking into account internal resources and conditions for carrying out export activities. **Objective** – to develop a methodology for assessing the foreign economic capabilities of grain industrial processing complexes based on an integral indicator. The methodological framework of the study consisted of system, comparative, and economic-statistical analysis for studying foreign trade reserves; standardization, expert assessment – when comparing and determining the significance of parameters; integral characterization – to establish the level of transboundary dynamics of international trade. Data from the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, the Ministry of Agriculture of the Republic of Kazakhstan, the State Revenue Committee of the Ministry of Finance of the Republic of Kazakhstan, the international Trade Map database, and financial statements of grain processing entities were used in forming the criteria system. **Results** – a comprehensive diagnostic mechanism for interstate strategic reserves of the republic's grain processing companies was formed, including

metrics for production, financial, market, and human capital, as well as the competitiveness of grain products. *Conclusions* – testing of the methodology confirmed its practical value, contributed to identifying constraining factors, and facilitated its application in analytical developments and managerial decision-making aimed at increasing the efficiency of the grain processing industry.

Аңдатпа. Астықты қайта өңдеу өнімдерінің экспортын дамыту Қазақстанның агроөнеркәсіптік кешенінің бәсекеге қабілеттілігін арттырудың басым бағыттарының бірі болып табылады. Жеткілікті шикізат базасы мен сыртқы нарықтардағы тұрақты сұранысқа қарамастан, астықты қайта өңдеу кәсіпорындарының экспорттық механизмдері толық көлемде тартылмаған. Себептердің бірі – ішкі ресурстарды және экспорттық қызметті жүзеге асыру жағдайларын ескере отырып, шаруашылық жүргізуші субъектілердің экспорттық әлеуетін кешенді зерттеуге мүмкіндік беретін бірыңғай әдіснамалық тәсілдің болмауы. *Мақсаты* – интегралдық көрсеткіш негізінде дәнді дақылдарды өнеркәсіптік өңдеу бойынша өндірістік кешендердің сыртқы экономикалық мүмкіндіктерін бағалау әдістемесін әзірлеу. Әдістері – сыртқы сауда резервтерін зерттеу үшін жүйелік, салыстырмалы және экономикалық-статистикалық талдау; параметрлердің маңыздылығын салыстыру және анықтау кезінде – нормалау, бағалау сараптамасы; халықаралық сауданың трансшекаралық динамикасы деңгейін белгілеу үшін – интегралдық сипаттама зерттеудің әдістемелік негізін құрады. Өлшемшарттар жүйесін қалыптастыру кезінде Қазақстан Республикасы Стратегиялық жоспарлау және реформалар агенттігі Ұлттық статистика бюросының, Қазақстан Республикасы Ауыл шаруашылығы министрлігінің, Қазақстан Республикасы Қаржы министрлігі Мемлекеттік кірістер комитетінің, Trade Map халықаралық деректер базасының деректері, сондай-ақ астықты қайта өңдеу құрылымдарының қаржылық есептілігі пайдаланылды. *Нәтижелері* – өндірістік, қаржылық, нарықтық және кадрлық капитал, сондай-ақ астық өнімдерінің бәсекеге қабілеттілігі метрикаларын қамтитын республиканың астықты қайта өңдеу компанияларының мемлекетаралық стратегиялық қорларын диагностикалаудың кешенді механизмі қалыптастырылды. *Қорытынды* – әдістемені апробациялау оның практикалық құндылығын дәлелдеді, бөгеуші факторларды анықтауға, оны талдамалық әзірлемелер жүргізу және астықты қайта өңдеу индустриясының тиімділігін арттыруға бағытталған басқарушылық шешімдер қабылдау кезінде іске асыруға ықпал етті.

Аннотация. Развитие экспорта продукции переработки зерна является одним из приоритетных направлений повышения конкурентоспособности агропромышленного комплекса Казахстана. Несмотря на достаточную сырьевую базу и устойчивый спрос на внешних рынках, экспортные механизмы зерноперерабатывающих предприятий задействованы не в полной мере. Одной из причин является отсутствие единого методологического подхода, позволяющего комплексно исследовать экспортный потенциал субъектов хозяйствования с учетом внутренних ресурсов и условий осуществления экспортной деятельности. *Цель* – разработать методику оценки внешне-экономических возможностей производственных комплексов по промышленной обработке зерновых на основе интегрального показателя. Методическую основу исследования составили системный, сравнительный и экономико-статистический анализ для изучения внешнеторговых резервов; нормирование, оценочная экспертиза – при сопоставлении и определении значимости параметров; интегральная характеристика – для установления уровня трансграничной динамики международной торговли. При формировании системы критериев использовались данные Бюро национальной статистики Агентства по стратегическому планированию и реформам Республики Казахстан, Министерства сельского хозяйства Республики Казахстан, Комитета государственных доходов Министерства финансов Республики Казахстан, международной базы данных Trade Map, а также финансовая отчетность зерноперерабатывающих структур. *Результаты* – сформирован комплексный механизм диагностики межгосударственных стратегических запасов зерноперерабатывающих компаний республики, включающий метрики производственного, финансового, рыночного и кадрового капитала, а также конкурентоспособности зернопродуктов. *Выводы* – апробация методики подтвердила ее практическую ценность, способствовала выявлению сдерживающих факторов, реализации ее при проведении аналитических разработок и принятии управленческих решений, направленных на увеличение эффективности зерноперерабатывающей индустрии.

Keywords: agro-industrial complex, grain processing enterprises, assessment methodology, product export, export potential, interstate trade turnover, efficiency, competitiveness.

Түйінді сөздер: агроөнеркәсіптік кешен, астықты қайта өңдеу кәсіпорындары, бағалау
..... 93

әдістемесі, өнім экспорты, экспорттық әлеует, мемлекетаралық тауар айналымы, тиімділік, бәсекеге қабілеттілік.

Ключевые слова: агропромышленный комплекс, зерноперерабатывающие предприятия, методика оценки, экспорт продукции, экспортный потенциал, межгосударственный товарооборот, эффективность, конкурентоспособность.

Received: 20.07.2026. Approved after Peer-reviewed: 12.09.2026. Accepted: 19.09.2026.

Introduction

Grain processing represents a pivotal sector within Kazakhstan's agro-industrial complex. Advances in the grain processing sector contribute to supplying the domestic market with processed grain products and expanding non-resource exports. Kazakhstan is among the largest producers of grain. However, raw materials still account for the largest share of exports. Export capabilities are determined not only by production volumes but also by crop yields, the quality of production resources, investment levels, technological equipment, and cost efficiency. Processed products have higher added value and generate greater economic benefits both for enterprises and the country's economy as a whole. The development of exports of processed grain products contributes to a more complete realization of the country's raw material potential, the expansion of supply geography, and an increase in the output of high value-added products [1].

Modern conditions of foreign trade place new demands on the export activities of grain-processing enterprises. Growing competition, changes in logistics routes and transportation costs, price fluctuations, and higher requirements for product quality and safety increase the risks associated with entering foreign markets and maintaining market positions. Under these conditions, the availability of raw materials and production capacities alone cannot ensure sustainable export development. The export potential of an enterprise increasingly depends on the technological level of production, financial stability, product quality, efficient use of resources, logistics, marketing opportunities, and the ability to respond to changes in the external environment.

At the same time, enterprises within the same industry show different export performance even when their production conditions are comparable. Some enterprises steadily increase their export volumes and expand the geography of supplies, while others have only a limited presence in foreign markets or gradually lose their export positions. This indicates that the assessment of export potential should not be limited to individual export indicators. It should take into account the set

of factors that determine the export potential of an enterprise.

Existing methodological approaches do not always take into account, in an integrated manner, the relationship between production, financial, labor, technological, marketing, logistics, and external factors. This creates a need to develop a comprehensive approach to assessing the export potential of grain-processing enterprises. In this regard, the development of a system of indicators becomes particularly important. Such a system should make it possible to objectively assess the export opportunities of enterprises, identify reserves for their further development, and determine ways to strengthen their competitiveness in foreign markets.

Literature review

According to a number of researchers, firms' export performance is closely associated with the level of digitalisation and export readiness. The effects of these factors can be assessed using structural equation modelling [2].

From a resource-based perspective, the production potential of food industry enterprises depends on how effectively they use their production, labour and investment resources. These resources largely determine their capacity for sustainable development and further expansion of production [3].

Considerable attention in the international literature has been devoted to firms' readiness to engage in export activities. Export readiness is commonly viewed in terms of financial, trade and marketing capabilities and their contribution to export performance [4].

A broader approach considers export development as the outcome of several interconnected factors, including institutional support, export readiness, innovation activity, export strategy and export performance. Structural equation modelling is used to examine the relationships between these factors and the extent of their influence [5].

Another perspective treats export potential as a combination of internal and external components. Its assessment is based on a set of interrelated indicators reflecting a firm's production, logistics, financial, market, pricing and regulatory readiness [6].

Within a comprehensive approach, the assessment of enterprise export potential is based on a combination of quantitative and qualitative methods, including the analysis of financial indicators, the evaluation of export activities, and the assessment of an enterprise's export maturity [7].

More recent methodological approaches also employ multidimensional measures of export potential. One example is the Export Potential Index (EPIT), which provides a quantitative assessment of a firm's export capacity based on resources, dynamism, knowledge, innovation and sustainability [8].

For the agricultural sector, particular attention has been paid to index-based measures of export readiness. Such methods combine a set of indicators with statistical assessment to determine how prepared agricultural enterprises are to enter and operate in foreign markets [9].

Overall, the literature shows that there is no single methodological framework for assessing enterprise export potential. The diversity of existing methods and indicators therefore supports the development of an integrated coefficient that incorporates both internal and external factors. Such a measure would make it possible not only to assess the current level of export potential but also to identify opportunities for its further development.

Materials and methods

The methodological framework of the study is based on systemic and logical approaches, supplemented by the methods of analysis, synthesis, comparison, and generalization. The research also employs economic and statistical tools, indicator normalization, expert assessment, and economic and mathematical modeling. The integrated application of these approaches made it possible to examine export potential not as a set of isolated characteristics, but as an integrated system of closely interrelated factors determining an enterprise's capacity to conduct export activities effectively.

The theoretical foundation of the study was developed through a critical analysis of the works of Kazakhstani and international scholars. A rigorous comparison and systematic organization of the existing scientific approaches made it possible to move beyond their generalization, substantiate the proposed system of indicators, and clearly define the structure of the integral assessment.

Practical testing of the methodology was conducted using data from 30 leading grain processing enterprises in Kazakhstan. The information base of the study consisted of data

from the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, the Ministry of Agriculture of the Republic of Kazakhstan, the State Revenue Committee of the Ministry of Finance of the Republic of Kazakhstan, the Trade Map international database, as well as the financial statements of the studied enterprises.

Results

The assessment of export potential is aimed at identifying the strengths and weaknesses of an enterprise, as well as determining reserves for increasing the efficiency and competitiveness of export activities. A high export share does not always reflect the actual level of export potential, since its realization is influenced by the competitive environment, demand characteristics, and dependence on specific foreign markets. Therefore, the assessment must take into account both the internal capabilities of the enterprise and the market conditions under which export activities are carried out.

To assess the export potential, it is proposed to use a system of group indicators characterizing the production potential of the enterprise, the financial potential of the enterprise, market potential, the personnel potential of the enterprise, and product competitiveness. The necessity of such an approach is driven by the fact that, despite the significant export reserve of Kazakhstan's grain industry, its realization is limited by crop yield instability, insufficient development of warehouse and transport infrastructure, high shipping costs, and the predominance of raw material exports. A comprehensive assessment allows for the determination of the actual capabilities of enterprises and the identification of reserves for increasing the efficiency of export activities.

Production potential is determined by the efficiency of utilization of the enterprise's production resources, including raw materials and technological equipment. Under modern conditions of the grain processing industry's development, increasing the efficiency of production resource utilization is considered one of the key approaches to increasing the production volumes of high value-added products and strengthening the export capabilities of enterprises. According to research results, the implementation of innovations contributes to increasing the performance efficiency of grain processing enterprises and to a more rational utilization of production resources [10]. Production potential is evaluated through five indicators: the quality of raw materials, flour yield from processed grain, production capacity utili-

zation, the serviceability of technological equipment, and fixed-asset productivity. These indicators are subsequently aggregated into the group indicator of production potential (PP), which is calculated as follows:

$$PP = \sum_i^n ci * A_i^o = 0.2878 * P_1^o + 0.1020 * P_2^o + 0.2395 * P_3^o + 0.3092 * P_4^o + 0.0615 * P_5^o, \quad (1)$$

where A_i^o — is the relative value of the individual i -th indicator;

ci — is the weight coefficient of the individual i -th indicator;

P_1^o — is the relative indicator of the share of high-quality raw materials;

P_2^o — is the relative indicator of flour yield;

P_3^o — is the relative indicator of production capacity utilization;

P_4^o — is the relative indicator of equipment fitness;

P_5^o — is the relative indicator of return on assets.

The weight coefficients for each individual indicator of production potential are equal to 0.278, 0.1020, 0.2395, 0.3092, and 0.0615, respectively.

Product competitiveness is one of the key factors in realizing the export potential of an enterprise. Its level is determined by the conformity of the products to the requirements of foreign markets in terms of price, quality, and assortment. Price competitiveness is determined by the ratio of the actual price of the product to the maximum market price. Product quality is assessed by the degree of compliance with GOST (State Standard) and TS (Technical Specifications) requirements using a point system. The assortment is characterized by the number of produced types and grades of flour.

The group indicator of product competitiveness (C):

$$PC = \sum_i^n ci A_i^o = 0.3536 * C_p^o + 0.1980 C_a^o + 0.4484 C_q^o, \quad (2)$$

where C_p^o — relative indicator of flour price;

C_a^o — relative indicator of flour assortment;

C_q^o — relative indicator of flour quality.

0.3536, 0.1980 and 0.4484 represent the respective weights assigned to the three indicators included in the product competitiveness block.

The financial potential of the enterprise reflects its financial stability, solvency, and the effi-

ciency of resource utilization. For its assessment, it is proposed to use the current ratio, the turnover ratio of working capital, the return on sales, and the financial leverage indicator.

The group indicator of financial potential (FP) of the enterprise:

$$FP = \sum_i^n ci * Ai = 0.3265 * FP_1^o + 0.2201 * FP_2^o + 0.0972 * FP_3^o + 0.0848 * FP_4^o + 0.2713 * FP_5^o, \quad (3)$$

where FP_1^o — is the relative indicator of the enterprise's liquidity;

FP_2^o — is the relative indicator of working capital turnover;

FP_3^o — is the relative indicator of return on sales;

FP_4^o — is the relative indicator of return on assets;

FP_5^o — is the relative indicator of financial leverage.

The values 0.3265, 0.2201, 0.0972, 0.0848 and 0.2713 were assigned as weights to the five indicators used to assess financial potential.

The market potential of an enterprise is understood as the aggregate of capabilities for product sales in foreign markets, taking into account market conditions, infrastructural conditions, and the characteristics of importing countries [11]. For its assessment, it is proposed to use indicators of market share, product sales dynamics, and brand awareness.

The market potential of the enterprise (MP):

$$MP = \sum_i^n ci * A_i^o = 0.4224 * MP_1^o + 0.2442 * MP_2^o + 0.3333 * MP_3^o, \quad (4)$$

where MP_1^o — relative indicator of the market share occupied by the enterprise;

MP_2^o — relative indicator of product sales dynamics;

MP_3^o — relative indicator of brand awareness.

The values 0.4224, 0.2442 and 0.3333 were assigned as weights to the three indicators used to evaluate marketing effectiveness.

The efficiency of labor resource utilization is considered an important component of the enterprise's personnel potential. To capture the personnel dimension of the enterprise's potential, the assessment considers five aspects: labor productivity, working conditions, staff

qualifications, employee turnover, and job satisfaction. These measures are then brought together in the group indicator of personnel potential (PeP), which is calculated as follows:

$$\text{PeP} = \sum_{i=1}^n c_i * A_i^0 = 0.2550 * \text{PeP}_1^0 + 0.1365 * \text{PeP}_2^0 + 0.3124 * \text{PeP}_3^0 + 0.0621 * \text{PeP}_4^0 + 0.2340 * \text{PeP}_5^0, \quad (5)$$

where PeP_1^0 — relative indicator of labor productivity;

PeP_2^0 — relative indicator of working conditions;

PeP_3^0 — relative indicator of personnel qualification;

PeP_4^0 — relative indicator of personnel stability;

PeP_5^0 — relative indicator of personnel satisfaction with the company.

The indicators were assigned coefficients of 0.2550, 0.1365, 0.3124, 0.0621 and 0.234.

Each block reflects the efficiency with which the enterprise uses a particular category of resources. Combining the results for all blocks produces an integrated export potential indicator and provides an overall assessment of how effectively the enterprise uses its resource base in export activities.

The export potential of the enterprise (EP) is defined as:

$$\text{EP} = 0.2763\text{PP} + 0.0688\text{C} + 0.2547\text{FP} + 0.232\text{MP} + 0.1682 \text{PeP}, \quad (6)$$

where 0.2763, 0.0688, 0.2547, 0.2320, 0.1685 — weight coefficients of the i-th group indicator.

The developed methodology is intended for the quantitative assessment of the export potential of grain processing enterprises and their comparative analysis. The necessity of an integrated approach stems from the fact that export competitiveness

is determined not only by production and supply volumes but also by the enterprises' ability to produce high value-added products, ensuring the economic efficiency of export activities. The methodology is based on the principles of comprehensiveness, reliability, and comparability of indicators. Within the framework of the study, the quantitative assessment of export potential is carried out by calculating an integral indicator based on a system of individual indicators, taking into account their weight coefficients.

After the general structure of the methodology is formed, the composition of individual indicators that make up the respective groups of export potential is determined. The indicators used must be capable of quantitative or qualitative assessment and must relate to the same calculation period.

After the composition of the indicators is determined, their weight coefficients are calculated, reflecting the contribution of each indicator to the formation of group indicators and the integral assessment of export potential. This approach corresponds to a ranking methodology based on selecting evaluated parameters, determining criteria, and forming an aggregated indicator.

For subsequent aggregation, the indicators are converted into relative values through normalization:

$$A_{oi} = \frac{A_i}{A_{\max}}, \quad (7)$$

where A_{oi} — is the relative value of the indicator; A_i — is the actual value of the indicator; $A_{\max}$ — is the base (maximum) value of the indicator.

In the study, the weights were determined based on the results of a survey of 10 experts who ranked the indicators by their degree of importance. The obtained assessments were processed using a probabilistic-statistical method (table 1).

Table 1 — Coefficients of normalized relative importance of the enterprise's export potential indicators

Group	Indicator Name	Designation	Weight k
1	Indicators of production potential		
	Share of high-quality raw materials	P1	0.2878
	Flour extraction rate	P2	0.1020
	Production capacity utilization rate	P3	0.2395
	Equipment soundness ratio	P4	0.3092
	Return on assets	P5	0.0615
2	Indicators of the enterprise's financial potential		

	Current ratio	FP1	0.3265
	Working capital turnover ratio	FP2	0.2201
	Return on sales	FP3	0.0972
	Return on assets	FP4	0.0848
	Financial leverage	FP5	0.2713
3	Indicators of market potential		
	Market share	MP1	0.4224
	Sales dynamics	MP2	0.2442
	Brand awareness	MP3	0.3333
4	Indicators of personnel potential		
	Output per worker	PeP ₁	0.2550
	Personnel working conditions	PeP ₂	0.1365
	Personnel qualification level	PeP ₃	0.3124
	Personnel stability level	PeP ₄	0.0621
	Personnel satisfaction with the company	PeP ₅	0.2340
5	Indicators of product competitiveness		
	Flour price	Cp	0.3536
	Flour assortment	Ca	0.1980
	Flour quality	Cq	0.4484
6	Key indicators of the enterprise's export potential		
	Production potential	PP	0.2763
	Financial potential of the enterprise	FP	0.2547
	Market potential	MP	0.2320
	Personnel potential	PeP	0.1682
	Product (flour) competitiveness	C	0.0688
Note: compiled by the authors based on the literature source [12]			

The integral indicator of export potential is determined by the additive aggregation method:

$$EP = \sum_{i=1}^n k_i E_i, \quad (8)$$

where — is the weight coefficient of the i-th indicator; — is the value of the corresponding group indicator.

The obtained values are interpreted using the export potential evaluation scale, and a rating of the investigated enterprises is formed. Based on the results of the integral assessment, a rating of grain processing enterprises in Kazakhstan was formed (table 2).

Table 2 — Rating of leading grain processing enterprises by the level of export potential based on 2025 data

Rank	Scale for evaluating export potential	Comprehensive indicator of export potential	Enterprise Name
1	2	3	4
1	High level 0.81-1.0	0.9	«AsiaAgroFood» JSC
2		0.89	«Company Salamat» LLP
3		0.89	«Zhelayevsky Kombinat Khleboproduktov» JSC
4		0.88	«JFOOD Kazakhstan» LLP

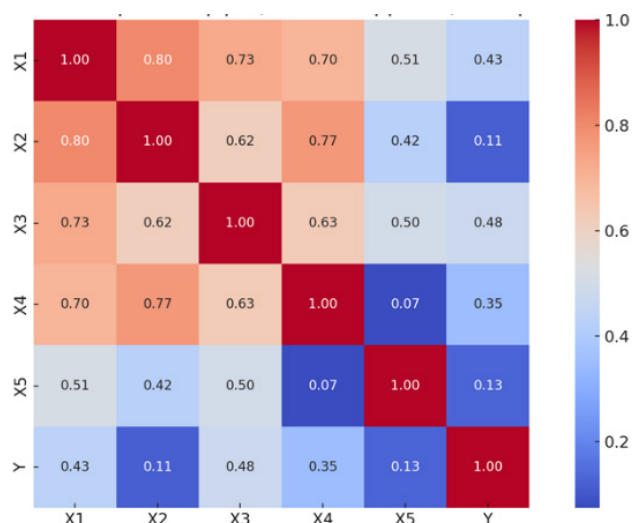
5		0.87	«Sevesilzerno» LLP	
6		0.86	«Novo-Aldzhinsky Melkombinat» LLP	
7		0.85	«Kostanaisky Melkombinat» JSC	
8		0.82	«Vostochno-Kazakhstansky Mukomolno-Kombikormovy Kombinat» JSC	
9		0.82	«Karagandinsky Melkombinat» LLP	
10		Above average level 0.71—0.80	0.79	«Asaliya» LLP
11			0.75	«Irchenko Elevator» LLP
12			0.75	«Kazmuka» LLP
13			0.75	«Atameken-dos» LLP
14	0.74		«Ust-Kamenogorsky Mukomolny Kombinat» LLP	
15	0.73		«Kazovur» LLP	
16	0.71		«Beles-Agro» LLP	
Note: compiled by the authors based on the literature source [13]				

The assessment results placed nine enterprises in the high export potential category, with index values ranging from 0.81 to 1.00. Seven other enterprises recorded above-average values within the interval of 0.71 to 0.80. A comparison based on enterprise size showed that large enterprises had a higher level of export potential than medium-sized enterprises. Table 2 presents the enterprises included in the groups with high and above-average levels of export potential.

To further develop the methodology, economic-mathematical modeling was conducted based on data from 30 leading grain processing enterprises in Kazakhstan. Correlation and regression analysis allowed for evaluating the impact of the main factors on export volume, identifying relationships, and generating forecasting scenarios. The calculations were performed in Python.

To identify the relationships between internal factors and export volume, a correlation analysis was conducted using Pearson's correlation coefficient. The resulting correlation matrix is presented in the form of a heatmap, allowing for a visual assessment of the strength and direction of the links between the studied indicators [14].

Based on the results of the correlation analysis, it was established that the closest relationship with export volume was found in market potential (X_3 , $r = 0.48$) and production potential (X_1 , $r = 0.43$). The relationship with personnel potential is weak (X_4 , $r = 0.35$), while the connection with financial potential and product competitiveness is minimal (X_2 , $r = 0.11$; X_5 , $r = 0.13$). A high correlation was established between X_1 and X_2 ($r = 0.80$), X_2 and X_4 ($r = 0.77$), and X_1 and X_3 ($r = 0.73$), whereas the relationship between X_4 and X_5 is virtually non-existent ($r = 0.07$) (figure 1).



Note: developed by the author based on the literature source [15]

Figure 1 — Heatmap of the correlation matrix of export potential factors for grain processing enterprises in Kazakhstan

Increasing the export volume of grain processing products is one of the priority tasks for the industry's development, which necessitates the use of modern methods for assessing and forecasting export potential. The application of quantitative models allows for taking into account the impact of production and market factors and using the identified dependencies to forecast the dynamics of agricultural exports [16, 17]. Production potential (X1) and market potential (X3) were selected as the explanatory variables, since these specific factors demonstrated a statistically significant positive relationship with export volume. The correlation coefficients were 0.43 and 0.48, respectively, with p-values falling below the accepted significance level of 0.05.

The model has the following general form:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_3 + \varepsilon, \quad (9)$$

where Y represents the predicted export volume of processed grain products, in the model, X_1 represents the enterprise's production potential, whereas X_3 reflects its market potential. The terms β_0 , β_1 , and β_2 denote the model parameters, while ε represents the random error term.

Discussion

The findings underscore the need for a comprehensive approach to assessing the export potential of grain-processing enterprises. The proposed methodology integrates production, financial, market, and human resource potential, along with product competitiveness, thereby enabling a multidimensional assessment of the factors shaping an enterprise's export capacity.

The integral assessment of 30 grain-processing enterprises in Kazakhstan revealed considerable variation in their export potential: nine enterprises were classified as having a high level of export potential, while seven demonstrated an above-average level. Higher scores were predominantly observed among large enterprises with a well-developed production base and strong market positions. This suggests that the availability of raw materials alone is insufficient to ensure the effective realization of export potential.

The correlation analysis revealed the strongest relationships between export volume and market potential ($r = 0.48$) and production potential ($r = 0.43$). These findings are consistent with previous studies highlighting the significant role of production and market factors in shaping agricultural export dynamics [15,16], [17]. By contrast, financial potential ($r = 0.11$) and product competitiveness ($r = 0.13$) showed relatively weak

relationships with export volume, suggesting that their effects on export performance may be largely indirect.

Thus, the proposed approach makes it possible not only to assess the overall export potential of grain-processing enterprises but also to identify the factors constraining its realization. The findings can provide an analytical basis for determining priorities for production development, strengthening market positions, and designing enterprise-level export strategies.

Conclusions

1. The study proposes a comprehensive method for evaluating the export potential of Kazakhstan's grain processing enterprises. The assessment is built around an integral indicator that incorporates production, financial, market, and personnel potential, together with product competitiveness.

2. The application of this methodology to data from 30 enterprises made it possible to determine the level of their export potential, execute a comparative analysis, and highlight the top-performing enterprises.

3. The correlation analysis showed that production and market potential had the closest relationship with export volume. The regression results supported this pattern, indicating that these two variables had the greatest relative importance among the factors included in the model.

4. The constructed regression model provides a framework for forecasting export volumes under baseline, optimistic, and pessimistic scenarios, making it a viable tool for assessing potential fluctuations in the export activities of these enterprises.

5. The practical value of the proposed methodology lies in its ability to provide a systematic assessment of the export potential of grain processing enterprises. Its application helps reveal priority areas for further development and provides an analytical basis for management decisions aimed at strengthening export activities.

6. The practical value of this study lies in the direct applicability of the developed methodology for evaluating enterprise export potential and selecting targeted pathways for its improvement.

Author's contribution: Joldasbayeva Gulnar: contributed to the conceptualization and methodology, coordinated and supervised the project, provided resources, validated the results, and reviewed and edited the manuscript; Yessakhmetova Lyailya: curated and collected the data, conducted quantitative and qualitative analyses, contributed to the methodology and

software, prepared the visual materials and original draft, and reviewed and edited the manuscript; Gritsenko Natalia: collected and analyzed the statistical data, provided resources, validated the results, supervised the research, and reviewed and edited the manuscript.

Conflict of interests: the authors declare that they have no conflicts of interest.

References

- [1] Джолдасбаева Г.К. Экспорт продукции зерноперерабатывающих предприятий / Г.К. Джолдасбаева, Л.М. Есахметова // Проблемы агрорыннка. – 2020. – N.2.- С. 126–133.
- [2] Goldooz, A. Assessing the impact of digitalisation on the export performance of Iranian SMEs: the mediating role of export readiness / A. Goldooz, A. Zakery // International Journal of Globalisation and Small Business. – 2024. – Vol. 14.- No. 1. – P. 86–106. [https://doi.org/ 10.1504/IJGSB.2024.138681](https://doi.org/10.1504/IJGSB.2024.138681)
- [3] Riabenko, V. Peculiarities of formation of production potential of food industry enterprises / V. Riabenko, O. Balan, Y. Polishko // Ukrainian Journal of Applied Economics and Technology. – 2024. – № 4. – P. 17–23. [https://doi.org/ 10.36887/2415-8453-2024-4-2](https://doi.org/10.36887/2415-8453-2024-4-2)
- [4] Gerschewski, S. Ready to export? The role of export readiness for superior export performance of small and medium-sized enterprises / S. Gerschewski, J. Scott-Kennel, E. Rose // The World Economy. – 2020. – Vol. 43.- No. 5. – P. 1253–1276. [https://doi.org/ 10.1111/twec.12928](https://doi.org/10.1111/twec.12928)
- [5] Singh, V.K. Green export strategies and SMEs export performance: mediating roles of innovation, readiness, and activities / V.K. Singh, A. Keshari, D. Singh, P.C. Singh, A. Gautam // Journal of Innovation and Entrepreneurship. – 2024. – Vol. 13.- Issue 1. – P. 1–33. [https://doi.org/ 10.1186/s13731-024-00451-y](https://doi.org/10.1186/s13731-024-00451-y)
- [6] Batyuk, R. Peculiarities of the economic assessment of the development of the export potential of agricultural enterprises // Scientific Messenger of Lviv National University of Veterinary Medicine and Biotechnologies. Series: Economical Sciences. – 2022. – Vol. 24.-N 99. – P. 25–30. [https://doi.org/ 10.32718/nvlvete9905](https://doi.org/10.32718/nvlvete9905)
- [7] Рузанов, Д. С. Комплексная оценка экспортного потенциала предприятий / Д. С. Рузанов, П. А. Шелупанова, А. Г. Сабанов // Вестник Тюменского государственного университета. Социально-экономические и правовые исследования. – 2025. – Т. 11. – № 4 (44). – С. 173–194. [https://doi.org/ 10.21684/2411-7897-2025-11-4-173-194](https://doi.org/10.21684/2411-7897-2025-11-4-173-194)
- [8] Kırkın, M. Export Potential Index for Textile Industry (EPIT) model proposal with structural equation modelling and application / M. Kırkın, A. Aktepe, B.Toklu // Kybernetes. – 2024. – Vol. 54.- No. 10. – P. 5996–6025. [https://doi.org/ 10.1108/K-11-2023-2485](https://doi.org/10.1108/K-11-2023-2485)

- [9] Rodrigo, A.R.A. Munasinghe N.N., Rasanjalee P.H.N. Assessing Export Readiness of the SMEs in Agriculture Sector in Sri Lanka / A.Rodrigo, K.Silva // Sri Lankan Journal of Business Economics. – 2026. – Vol. 15.- No. 1. –Article 9146. [https://doi.org/ 10.31357/sljbe.v15.9146](https://doi.org/10.31357/sljbe.v15.9146)
- [10] Yesakhmetova, L. Assessing the efficiency of the effect of innovations on the development of grain processing enterprises / L.Yesakhmetova, G. Dzholdasbaeva, A. Saurukova, M. Sauranova, A. Alibekova // Eastern-European Journal of Enterprise Technologies. – 2024. – Vol. 4.-Issue 13. – P. 64–74. [https://doi.org/ 10.15587/1729-4061.2024.308299](https://doi.org/10.15587/1729-4061.2024.308299)
- [11] Khmeleva, G.A. The Assessment of the Potential of Russian Grain Trade in Asian and African Countries: A Gravity Model Approach / G. Khmeleva, A. Shcherbak, E. Kuzubov, A. Tikhomirov // Sustainability. - 2025. - Vol. 17. - No. 2. - Article 413. <https://doi.org/10.3390/su17020413>
- [12] Галкина, Е.В. Ранжирование вариантов управленческих решений / Е. Галкина // Международный научно-исследовательский журнал. - 2020. - № 10(100). - Ч. 1. - С. 134-137. <https://doi.org/10.23670/IRJ.2020.100.10.025>
- [13] Бюро национальной статистики Агентства по стратегическому планированию и реформам Республики Казахстан. Статистические материалы [Электронный ресурс].-2025.-URL: <https://www.stat.gov.kz> (дата обращения: 12.06.2026).
- [14] Graffelman, J. Improved Approximation and Visualization of the Correlation Matrix / J. Graffelman, J. de Leeuw // The American Statistician. - 2023. - Vol. 77. - No. 4. - P. 432-442. <https://doi.org/10.1080/00031305.2023.2186952>
- [15] Gron, O. Assessment of the Enterprise Export Potential / O. Gron, O. Sikalenko // Galician Economic Journal. – 2021. – Vol. 73.- No. 6. – P. 115–122. https://doi.org/10.33108/galicianvisnyk_tntu2021.06.115
- [16] Devyatkin, D. Methods for Mid-Term Forecasting of Crop Export and Production / D. Devyatkin, Y. Otmakhova // Applied Sciences. - 2021. - Vol. 11. - No. 22. - Article 10973. [https://doi.org/ 10.3390/app112210973](https://doi.org/10.3390/app112210973)
- [17] Popescu, L. Study on the Evolution and Forecast of Agricultural Raw Material Exports in Central and Eastern European Emerging Economies / L. Popescu, M. Găman, L.-S. Mihai, M. Mihai, C. Drăgan // Agriculture. - 2025. - Vol. 15. - No. 17. - Article 1811. [https://doi.org/ 10.3390/agriculture15171811](https://doi.org/10.3390/agriculture15171811)

References

- [1] Dzholdasbaeva, G.K. & Yesakhmetova, L.M. (2020). Eksport produkci zernopererabatyvajushih predpriyatij [Export of products of grain processing enterprises]. *Problemy agrorynka - Problems of Agri-Market*, 2, 126–133 [in Russian].
- [2] Goldooz, A. & Zakery, A. (2024). Assessing the impact of digitalisation on the export performance of Iranian SMEs: the mediating role of export readiness. *International Journal of Globalisation and Small*

Business, 14 (1), 86–106. <https://doi.org/10.1504/IJGSB.2024.138681> [in English].

[3] Riabenko, V., Balan, O. & Polishko, Y. (2024). Peculiarities of formation of production potential of food industry enterprises. *Ukrainian Journal of Applied Economics and Technology*, 4, 17–23. <https://doi.org/10.36887/2415-8453-2024-4-2> [in English].

[4] Gerschewski, S., Scott-Kennel, J. & Rose, E. (2020). Ready to export? The role of export readiness for superior export performance of small and medium-sized enterprises. *The World Economy*, 43 (5), 1253–1276. <https://doi.org/10.1111/twec.12928> [in English].

[5] Singh, V.K., Keshari, A., Singh, D., Singh, P.C. & Gautam, A. (2024). Green export strategies and SMEs export performance: mediating roles of innovation, readiness, and activities. *Journal of Innovation and Entrepreneurship*, 13 (1), 45. <https://doi.org/10.1186/s13731-024-00451-y> [in English].

[6] Batyuk, R. (2022). Peculiarities of the economic assessment of the development of the export potential of agricultural enterprises. *Scientific Messenger of Lviv National University of Veterinary Medicine and Biotechnologies. Series: Economical Sciences*, 24 (99), 25–30. <https://doi.org/10.32718/nvlvete9905> [in English].

[7] Ruzanov, D.S., Shelupanova, P.A. & Sabanov, A.G. (2025). Kompleksnaya ocenka jeksportnogo potenciala predpriyatij [Comprehensive assessment of the export potential of enterprises]. *Vestnik Tyumenskogo gosudarstvennogo universiteta. Social'no-jekonomicheskie i pravovye issledovaniya - Tyumen State University Herald. Social, Economic, and Law Research*, 11 (4), 173–194. <https://doi.org/10.21684/2411-7897-2025-11-4-173-194> [in Russian].

[8] Kırkın, M., Aktepe, A. & Toklu, B. (2024). Export Potential Index for Textile Industry (EPIT) model proposal with structural equation modelling and application. *Kybernetes*, 54 (10), 5996–6025. <https://doi.org/10.1108/K-11-2023-2485> [in English].

[9] Rodrigo, A.R.A., Munasinghe, N.N., Rasanjalee, P.H.N. & Silva, K. (2026). Assessing Export Readiness of the SMEs in Agriculture Sector in Sri Lanka. *Sri Lankan Journal of Business Economics*, 15 (1), Article 9146. <https://doi.org/10.31357/sljb.e.v15.9146> [in English].

[10] Yesakhmetova, L., Dzholdasbaeva, G., Saurukova, A., Sauranova, M. & Alibekova, A. (2024). Assessing the efficiency of the effect of innovations on the development of grain processing enterprises. *Eastern-European Journal of Enterprise Technologies*, 4 (13), 64–74. <https://doi.org/10.15587/1729-4061.2024.308299> [in English].

[11] Khmeleva, G., Shcherbak, A., Kuzubov, E. & Tikhomirov, A. (2025). The Assessment of the Potential of Russian Grain Trade in Asian and African Countries: A Gravity Model Approach. *Sustainability*, 17 (2), 413. <https://doi.org/10.3390/su17020413> [in English].

[12] Galkina, E.V. (2020). Ranzhirovanie variantov upravlencheskih reshenij [Ranking options for management decisions]. *Mezhdunarodnyj nauchno-issledovatel'skij zhurnal - International Research Journal*, 10 (100), Part 1, 134–137. <https://doi.org/10.23670/IRJ.2020.100.10.025> [in Russian].

[13] Bjuro nacional'noj statistiki Agentstva po strategicheskemu planirovaniju i reformam Respubliki Kazakhstan [Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan] (2025). Statischeskie materialy [Statistical materials]. Available at: <https://www.stat.gov.kz> (date of access: 12.06.2026) [in Russian].

[14] Graffelman, J. & de Leeuw, J. (2023). Improved Approximation and Visualization of the Correlation Matrix. *The American Statistician*, 77 (4), 432–442. <https://doi.org/10.1080/00031305.2023.2186952> [in English].

[15] Gron, O. & Sikalenko, O. (2021). Assessment of the Enterprise Export Potential. *Galician Economic Journal*, 73 (6), 115–122. https://doi.org/10.33108/galicianvisnyk_tntu2021.06.115 [in English].

[16] Devyatkin, D. & Otmakhova, Y. (2021). Methods for Mid-Term Forecasting of Crop Export and Production. *Applied Sciences*, 11 (22), Article 10973. <https://doi.org/10.3390/app112210973> [in English].

[17] Popescu, L., Găman, M., Mihai, L.-S., Mihai, M. & Drăgan, C. (2025). Study on the Evolution and Forecast of Agricultural Raw Material Exports in Central and Eastern European Emerging Economies. *Agriculture*, 15 (17), Article 1811. <https://doi.org/10.3390/agriculture15171811> [in English].

Information about authors:

Joldasbayeva Gulnar — The main author; Doctor of Economic Sciences, Professor; Professor of the Department of Economics and Management; Almaty Technological University; 050012 Tole bi str., 100, Almaty, Kazakhstan; e-mail: gulnara_00@mail.ru; <https://orcid.org/0000-0002-5757-3083>

Yessakhmetova Lyailya; Ph.D; Assistant Professor of the Department of Economics and Management; Almaty Technological University; 050012 Tole bi str., 100, Almaty, Kazakhstan; e-mail: yesakhmetova.l@mail.ru; <https://orcid.org/0000-0003-3364-3021>

Gritsenko Natalya; Candidate of Economic Sciences; Leading Researcher of the Department of Irrigation Technique and Technology; Kazakh Research Institute of Water Management; 080003 K. Koigeldy str., 12, Taraz, Kazakhstan; e-mail: Gritsenko.natalya.74@mail.ru; <https://orcid.org/0000-0003-1461-4559>

Авторлар туралы ақпарат

Джолдасбаева Гульнар Каримовна — негізгі автор; экономика ғылымдарының докторы, профессор; «Экономика және менеджмент» кафедрасының профессоры; Алматы технологиялық университеті.

050012 Төле би көш., 100, Алматы қ., Қазақстан; e-mail: gulnara_00@mail.ru; <https://orcid.org/0000-0002-5757-3083>

Есахметова Ляйля Муратбековна; Ph.D; «Экономика және менеджмент» кафедрасының ассистент-профессоры; Алматы технологиялық университеті; 050012 Төле би көш., 100, Алматы қ., Қазақстан; e-mail: yesakhmetova.l@mail.ru; <https://orcid.org/0000-0003-3364-3021>

Гриценко Наталья Владимировна; экономика ғылымдарының кандидаты; «Суару техникасы және технологиясы» кафедрасының жетекші ғылыми қызметкері; Қазақ су шаруашылығы ғылыми-зерттеу институты; 080003 Қ. Қойгелді көш., 12, Тараз қ., Қазақстан; e-mail: Gritsenko.natalya.74@mail.ru; <https://orcid.org/0000-0003-1461-4559>

Информация об авторах:

Джолдасбаева Гульнар Каримовна — **основной автор**; доктор экономических наук, профессор; профессор кафедры «Экономика и менеджмент»; Алматинский технологический университет; 050012 ул. Толе би, 100, г. Алматы, Казахстан; e-mail: gulnara_00@mail.ru; <https://orcid.org/0000-0002-5757-3083>

Есахметова Ляйля Муратбековна; Ph.D; ассистент-профессор кафедры «Экономика и менеджмент»; Алматинский технологический университет; 050012 ул. Толе би, 100, г. Алматы, Казахстан; e-mail: yesakhmetova.l@mail.ru; <https://orcid.org/0000-0003-3364-3021>

Гриценко Наталья Владимировна; кандидат экономических наук; ведущий научный сотрудник отдела «Техника и технология полива»; Казахский научно-исследовательский институт водного хозяйства; 080003 ул. К. Койгельды, 12, г. Тараз, Казахстан; e-mail: Gritsenko.natalya.74@mail.ru; <https://orcid.org/0000-0003-1461-4559>