DOI 10.52260/2304-7216.2026.1(62).5
UDC 338.43:338.439.5(574)
SRSTI 06.61.45

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ECONOMIC FACTORS SHAPING FOOD SECURITY IN THE NORTHERN REGIONS OF KAZAKHSTAN

The article examines the regional aspects of food security in the northern regions of Kazakhstan in the context of the dynamics of agricultural production and labor productivity. The methods of comparative and dynamic analysis, calculation of relative growth rates, and elements of structural comparison based on official data from the Bureau of National Statistics of the Republic of Kazakhstan were used as a methodological base.

The indices of the physical volume of gross agricultural output for 2017-2024 have been analyzed, pronounced interannual volatility of production has been revealed, and differences in short- and long-term development dynamics have been identified. It is shown that the medium-term growth rates did not ensure a stable trajectory of expanded reproduction, which indicated the structural vulnerability of the agricultural sector.

The dynamics of labor productivity in agriculture in the northern regions are analyzed and compared with indicators for the economy as a whole. A significant relative increase in the efficiency of the use of labor resources was revealed while maintaining the gap in absolute values compared with the average economic level. The relationship between the instability of the physical volume of production and the growth of labor productivity as a factor of compensation of production fluctuations is determined.

Based on the analysis, the directions of increasing the sustainability of agricultural production, increasing labor productivity and improving institutional regulatory mechanisms are substantiated. The importance of an integrated approach to the formation of food security in the regions of Kazakhstan in conditions of climatic and economic instability is shown.

Keywords: *food security, agriculture, labor productivity, physical volume indices, regional development, sustainability of agricultural production, northern regions of Kazakhstan, state agrarian policy.*

Кілт сөздер: *азық-түлік қауіпсіздігі, ауыл шаруашылығы, еңбек өнімділігі, нақты көлем индекстері, өңірлік даму, аграрлық өндірістің тұрақтылығы, Қазақстанның солтүстік өңірлері, мемлекеттік аграрлық саясат.*

Ключевые слова: *продовольственная безопасность, сельское хозяйство, производительность труда, индексы физического объёма, региональное развитие, устойчивость аграрного производства, северные регионы Казахстана, государственная аграрная политика.*

Introduction. Food security in the context of climatic instability and structural transformation of the economy is of strategic importance for the regional development of Kazakhstan. The northern regions, which form the basis of the country's grain production, determine the stability of the domestic food market and the export potential of the agricultural sector. At the same time, the dynamics of agricultural production is characterized by a pronounced dependence on natural and climatic conditions, technological equipment and the institutional environment.

The current configuration of factors actualizes the scientific question: to what extent do the sustainability of agricultural output and the efficiency of the use of labor resources affect the formation of food security in the regions. Modern research in the field of agricultural economics and sustainable development emphasizes the need for a comprehensive assessment of production dynamics and factors of

intensive growth. However, the regional aspect of food sustainability in the context of the northern agricultural belt of Kazakhstan remains insufficiently systematized. Of particular interest is the comparison of interannual fluctuations in output and trends in labor productivity as an indicator of the internal efficiency of the sector.

The purpose of the study is to identify patterns of agricultural development in the northern regions of Kazakhstan based on an analysis of the dynamics of physical output and labor productivity, as well as to substantiate the directions of increasing the sustainability of the agricultural system in the context of food security. To achieve this goal, the following tasks have been solved: the dynamics of gross output indices has been analyzed; the transformation of labor productivity in the regional context has been assessed; structural imbalances have been identified and areas for improving economic and institutional regulatory mechanisms have been identified.

The information base of the study consisted **of** official data from the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan. The paper uses methods of comparative and dynamic analysis, calculation of relative growth and increase rates, and elements of structural comparison. Statistical data processing was performed using standard time series analysis procedures to ensure reproducibility of the results. The methodological basis of the research is based on the provisions of the theory of sustainable development and regional economics, presented in the works of domestic and foreign authors. Framing the problem in this context allows us to move from a fragmentary assessment of agricultural indicators to the formation of a systematic view of the food sustainability of the regions of Kazakhstan.

Literature review. In recent years, the issue of food security has been considered in close relationship with the factors of sustainable economic growth, climate transformation and technological renewal of agricultural production. International research highlights the dependence of food sustainability on structural changes in energy and environmental policy. Thus, the work [1] substantiates the relationship between "green" economic growth, the development of renewable energy and the parameters of food security in Central Asian countries, which shows the influence of macroeconomic factors on agricultural sustainability. A separate area of research is related to the impact of climate change on crop yields and food risks.

The article [3] demonstrates that fluctuations in climatic indicators have a statistically significant impact on grain production in Kazakhstan, increasing the instability of regional output. The obtained conclusions actualize the need to analyze the interannual dynamics of production in the context of individual regions. In domestic publications, the emphasis is shifted towards institutional and regional aspects. In [2], the dynamics of the agricultural sector in Kazakhstan was studied and the role of the industry in ensuring national food sustainability was substantiated. The authors [4] reveal the territorial disparities in food availability, pointing to the differences in socio-economic conditions in the regions.

The strategic directions for strengthening food security are summarized in the study [5], which emphasizes the importance of state coordination and systemic modernization of the industry. In recent years, there has been increased attention to digital and predictive tools for agricultural production management. The paper [7] demonstrates the possibilities of using machine learning algorithms to predict grain yields based on climate and satellite indicators, which expands the tools for assessing agricultural sustainability.

Despite a significant amount of research, a number of unresolved issues remain. Most of the work focuses either on macroeconomic factors of food security or on climate impacts, while the relationship between the dynamics of physical output and labor productivity in the regional context remains insufficiently disclosed. Contradictions are evident in assessing the sustainability of agricultural growth: some authors record positive modernization trends, while others emphasize the continued vulnerability of the sector. The need for further analysis is due to the need for a comprehensive assessment of production dynamics and the effectiveness of the use of labor resources as complementary factors of food security. The choice of the research topic is aimed at filling this gap and forming a holistic view of the sustainability of the northern agricultural regions of Kazakhstan.

The main part. The analysis of food sustainability in the northern regions of Kazakhstan requires consideration not only of the resource base and institutional solutions, but above all of the dynamics of real production. The gross output volume indices reflect the agricultural sector's response to climatic, technological, and managerial factors. The northern macroregion, which forms a significant share of the country's grain balance, is characterized by a pronounced amplitude of fluctuations - it sets the rhythm for

the entire food supply system. The data in Table 1 show that in 2017-2024, the dynamics in the Republic of Kazakhstan differed sharply from the baseline level.

Table – 1

Dynamics of indices of the physical volume of gross agricultural output in the northern regions of Kazakhstan, % compared to the previous year

Region	Years								The average for the period	
	2017	2018	2019	2020	2021	2022	2023	2024	2021-2024	2017-2024
Republic of Kazakhstan	104.7	104.1	93.7	107.8	91.8	124.7	85.1	138.3	110.0	106.3
Akmola	95.6	106.8	93.8	110.5	87.5	128.0	70.7	158.5	111.2	106.4
Kostanay	104.2	97.4	65.6	128.3	79.2	172.9	83.8	121.4	114.4	106.6
Pavlodar	119.3	123.4	104.4	105.6	125.6	103.8	95.7	134.6	114.9	114.1
North Kazakhstan	110.8	96.7	94.6	95.7	85.7	129.5	83.0	159.8	114.5	107.0

** compiled by the authors based on source [8]*

An analysis of the data in Table 1 shows that after moderate growth in 2017-2018, there is a decline in 2019 (93.7%), followed by a recovery momentum in 2020 and a decline again in 2021. The peak is in 2022 - 124.7%, but in 2023 the index drops to 85.1%. The final year of the period is characterized by a sharp rise - 138.3%. Such a trajectory indicates not a steady expansion, but a cyclical model of development, dependent on external and climatic conditions.

An even more contrasting picture is observed in the northern regions. Akmola region shows fluctuations from 70.7% to 158.5%. Kostanay region - from 65.6% to 172.9%. Pavlodar and North Kazakhstan regions are characterized by similar volatility, with some years recording an excess of 150%. Such values indicate a high sensitivity of the production structure to grain yields, technological shifts, and logistical constraints. The medium-term range of 2021-2024 looks more optimistic. In all regions, the average index exceeds 110%, reflecting the phase of recovery and intensification of production. However, the long-term indicator for 2017-2024 shows moderate dynamics - 106-114%, depending on the region. The gap between the short-term acceleration and the long-term trajectory indicates the absence of a stable trend of expanded reproduction. The accumulated result does not correspond to the amplitude of the annual jumps. In research practice, such parameters are considered as a sign of the structural vulnerability of the agricultural sector.

The production cycle in the northern regions has a pronounced extensive character: harvest years compensate for periods of decline, but do not form a smooth growth trend. Food security in such dynamics depends not so much on the average annual index as on the stability of interannual transitions. Sharp dips in 2019, 2021, and 2023 put a strain on stocks, price dynamics, and budget support. Spatial heterogeneity is also noted. Pavlodar region demonstrates relatively smooth dynamics in comparison with Kostanay, where the amplitude reaches maximum values. The North Kazakhstan region is characterized by sharp growth in 2024 - 159.8%, reflecting a recovery effect after the recession of the previous year. Such fluctuations form the asynchrony of the regional supply.

In general, the analysis of physical volume indices confirms: the northern agricultural belt has significant production potential, but the dynamics of development is unstable. The average figures for the period create the illusion of stability, while the internal structure shows pronounced cyclicity. For the food security system, it is not absolute growth that is of key importance, but a reduction in volatility and the formation of a predictable production trajectory. Further analysis should be linked to the assessment of labor productivity as a factor determining the economic efficiency of the agricultural sector and its ability to compensate for production fluctuations. Table 2 reveals the structural aspect of agricultural development - the efficiency of using labor resources. Unlike volume indices, which reflect fluctuations in output, labor productivity makes it possible to assess qualitative changes in the organization of production and technological equipment of the industry.

Table – 2

Dynamics and changes in labor productivity in agriculture, million tenge per 1 employee

Region	Years								Change	
	2017	2018	2019	2020	2021	2022	2023	2024	+/-	%
In the economy as a whole	5.52	6.17	6.87	7.11	8.42	10.08	11.35	12.89	7.37	133.5
Akmola	1.66	1.92	2.32	3.19	3.70	6.04	4.46	6.83	5.17	311.5
Kostanay	1.45	1.78	1.89	2.57	2.59	2.49	4.09	5.55	4.10	282.8
Pavlodar	1.49	1.76	1.93	2.51	2.98	3.78	3.60	4.79	3.30	221.4
North Kazakhstan	2.62	2.78	3.55	4.58	5.00	7.05	6.19	8.96	6.35	242.0

** compiled by the authors based on source [8]*

In the economy as a whole, in 2017-2024, productivity increased from 5.52 to 12.89 million tenge per 1 employee. The absolute increase amounted to 7.37 million tenge, relative - 133.5%. There is a progressive increase in efficiency, especially pronounced after 2021, a period coinciding with the active modernization of production processes and the acceleration of digital solutions. The growth trajectory is steady, without sharp dips, which contrasts with the dynamics of physical volume in agriculture. The situation differs in the agricultural sector of the northern regions. Akmola region shows an increase from 1.66 to 6.83 million tenge per 1 employee, an increase of 311.5%. Kostanay region - from 1.45 to 5.55 million tenge, an increase of 282.8%. Pavlodar region - from 1.49 to 4.79 million tenge, an increase of 221.4%. The North Kazakhstan region records a similar trend, reaching 8.96 million tenge by 2024.

The scale of the relative increase significantly exceeds the economic average. Such rates are explained by the low starting base of 2017 and the effect of technological renewal - the concentration of capital, optimization of employment, and expansion of mechanization. Productivity growth is accompanied by periods of unstable output, which indicates a redistribution of factors of production: an increase in output per employee occurs not only due to technological progress, but also due to a reduction in the number of employees. Despite the high dynamics, the absolute values of agricultural productivity remain almost twice lower than the average economic level.

The gap persists over the entire time interval, reflecting the structural specifics of agriculture - seasonality, dependence on natural conditions, and lower added value per unit of labor. However, the accelerated growth in recent years indicates a transition to a more intensive model. From a practical point of view, there is an important pattern: with volatile dynamics of physical volume, it is productivity that demonstrates a steady upward trend. This indicates the formation of an internal efficiency potential capable of smoothing out production fluctuations. In the context of food security, increasing labor productivity is of systemic importance as a factor in reducing costs, strengthening competitiveness and stabilizing the regional agricultural complex. Figure 1 shows a structured system of measures aimed at ensuring food security in the regions of Kazakhstan, taking into account the imbalances in the dynamics of production and labor productivity identified during the analysis. The proposed model is based on three interrelated areas that form the economic, technological and institutional contours of the sustainability of the agricultural sector.

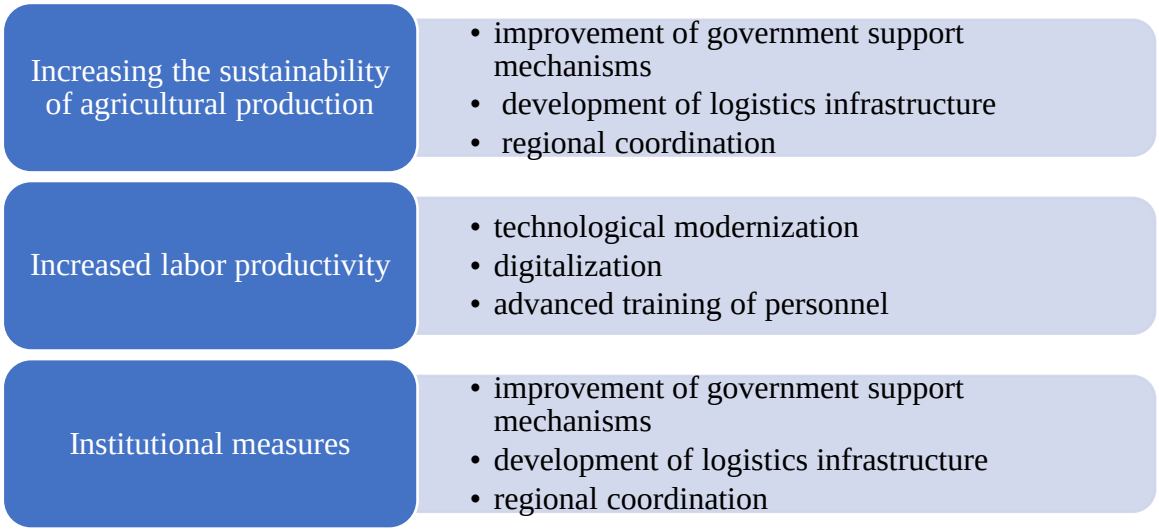

Figure – 1. **Recommendations for ensuring food security in the regions of Kazakhstan***

** compiled by the authors*

The first block, increasing the sustainability of agricultural production, is focused on reducing output volatility, identified by analyzing volume indices. Agricultural risk insurance is considered as a tool to mitigate climate and price instability. The formation of stabilization funds makes it possible to compensate for interannual fluctuations in yields and support the domestic market during periods of recession. The diversification of the crop structure reduces dependence on mono-oriented grain production and strengthens the adaptability of the regional agricultural complex.

The second direction, labor productivity growth, is directly related to the results of Table 2. A significant increase in the indicator in the northern regions indicates the potential for intensive development. Technological modernization provides increased returns on capital and labor. Digitalization of the agro-industrial complex is a factor in optimizing production processes, monitoring acreage, and resource management. Professional development forms the basis for consolidating the achieved results and further increasing efficiency.

The third block combines institutional measures that determine the environment of the agricultural sector. The improvement of state support mechanisms involves a transition from compensatory instruments to stimulating development models. The development of logistics infrastructure strengthens regional connectivity and reduces losses during transportation and storage of products. Regional coordination enhances agricultural policy coherence and minimizes spatial disparities.

The presented recommendation system is comprehensive. Economic sustainability without technological renewal is limited in effect, technological progress without institutional support loses its scale, and institutional solutions without increasing production efficiency do not provide long-term results. The coordinated development of all three areas forms the basis for stabilizing agricultural output, strengthening competitiveness and increasing the level of food security in the regions of Kazakhstan.

Conclusion. The analysis of the dynamics of the indices of physical volume and labor productivity in agriculture in the northern regions of Kazakhstan revealed a key feature of agricultural development - a combination of high interannual volatility of production with a steady increase in labor efficiency. The medium-term acceleration of output does not form a stable long-term trajectory, which indicates the structural vulnerability of the industry. At the same time, the increase in labor productivity indicates that there is an internal potential for intensive development and modernization of the agricultural sector.

The scientific novelty of the study lies in a comprehensive assessment of the relationship between production dynamics and labor efficiency in the context of regional food security. The results obtained confirm that the sustainability of the agricultural system is determined not only by the volume of output, but also by the ability to reduce volatility and increase the return on resources. The formulated recommendations - economic, technological and institutional - are aimed at forming a balanced development model focused on long-term stability.

The practical application of the results is possible in the development of regional agricultural support programs, the adjustment of state support mechanisms and the formation of strategies for the sustainable development of agriculture. The prospects for further research are related to an in-depth analysis of the

impact of digitalization, climatic factors and investment activity on the parameters of production sustainability and competitiveness of agricultural regions of Kazakhstan.

This research has been funded by the Science Committee of the Ministry of Science and Higher Education of the Republic of Kazakhstan (Grant No. AP23484373 "Modern challenges of state policy: integrating green economy into solving the food security issue in the regions of Kazakhstan").

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ҚАЗАҚСТАННЫҢ СОЛТҮСТІК ӨҢІРЛЕРІНІҢ АЗЫҚ-ТҮЛІК ҚАУІПСІЗДІГІН ҚАЛЫПТАСТЫРУДЫҢ ЭКОНОМИКАЛЫҚ ФАКТОРЛАРЫ

Аңдатпа

Мақалада ауыл шаруашылығы өндірісінің серпіні мен еңбек өнімділігі тұрғысынан Қазақстанның солтүстік облыстарының азық-түлік қауіпсіздігінің өңірлік аспектілері қарастырылған. Әдіснамалық база ретінде салыстырмалы және динамикалық талдау әдістері, өсімнің салыстырмалы көрсеткіштерін есептеу, Қазақстан Республикасы Ұлттық статистика бюросының ресми деректері негізінде құрылымдық салыстыру элементтері пайдаланылды.

2017-2024 жылдардағы ауыл шаруашылығының жалпы өнімінің нақты көлемінің индекстері талданды, өндірістің айқын жыларалық құбылмалылығы анықталды және қысқа мерзімді және ұзақ мерзімді даму динамикасының айырмашылықтары анықталды. Орташа мерзімді өсу қарқыны кеңейтілген өндірістің тұрақты траекториясын қамтамасыз етпегені көрсетілген, бұл аграрлық сектордың құрылымдық осалдығын көрсетті. Солтүстік өңірлердің ауыл шаруашылығындағы еңбек өнімділігінің динамикасы талданды және жалпы экономика бойынша көрсеткіштермен салыстырылды.

Орташа экономикалық деңгеймен салыстырғанда абсолютті мәндердегі алшақтықты сақтай отырып, Еңбек ресурстарын пайдалану тиімділігінің айтарлықтай салыстырмалы өсуі анықталды. Өндірістің нақты көлемінің тұрақсыздығы мен еңбек өнімділігінің өсуі арасындағы байланыс өндірістік ауытқуларды өтеу факторы ретінде анықталды.

Жүргізілген талдау негізінде аграрлық өндірістің тұрақтылығын арттыру, еңбек өнімділігін арттыру және реттеудің институционалдық тетіктерін жетілдіру бағыттары негізделген. Климаттық және экономикалық тұрақсыздық жағдайында Қазақстан өңірлерінің азық-түлік қауіпсіздігін қалыптастыруға кешенді тәсілдің маңыздылығы көрсетілген.

Кабдуллина Г.К., Кабдолла А., Аубакирова Ж.Б., Карсембаева А.С.

ЭКОНОМИЧЕСКИЕ ФАКТОРЫ ФОРМИРОВАНИЯ ПРОДОВОЛЬСТВЕННОЙ БЕЗОПАСНОСТИ СЕВЕРНЫХ РЕГИОНОВ КАЗАХСТАНА

Аннотация

В статье рассмотрены региональные аспекты продовольственной безопасности северных областей Казахстана в контексте динамики сельскохозяйственного производства и производительности труда. В качестве методологической базы использованы методы сравнительного и динамического анализа, расчёт относительных показателей прироста, элементы структурного сопоставления на основе официальных данных Бюро национальной статистики Республики Казахстан.

Проанализированы индексы физического объёма валовой продукции сельского хозяйства за 2017–2024 гг., выявлена выраженная межгодовая волатильность производства и определены различия краткосрочной и долгосрочной динамики развития. Показано, что среднесрочные темпы роста не обеспечили устойчивой траектории расширенного воспроизводства, что свидетельствовало о структурной уязвимости аграрного сектора.

Проанализирована динамика производительности труда в сельском хозяйстве северных регионов и сопоставлена с показателями по экономике в целом. Выявлен существенный относительный рост эффективности использования трудовых ресурсов при сохранении разрыва в абсолютных значениях по сравнению со средне-экономическим уровнем. Определена взаимосвязь между нестабильностью физического

объёма производства и ростом производительности труда как фактором компенсации производственных колебаний.

На основе проведённого анализа обоснованы направления повышения устойчивости аграрного производства, роста производительности труда и совершенствования институциональных механизмов регулирования. Показана значимость комплексного подхода к формированию продовольственной безопасности регионов Казахстана в условиях климатической и экономической нестабильности.