

**A.T. Zhanseitov<sup>1\*</sup>, G.K. Saparova<sup>2</sup>, A.B. Myrzhykbayeva<sup>3</sup>**

<sup>1,2</sup>Turan-Astana University, Kazakhstan

<sup>3</sup>Buketov Karaganda University, Kazakhstan

<sup>1</sup>azamat.zhanseitov@icloud.com, <sup>2</sup>saparova\_g.k@mail.ru, <sup>3</sup>ainurm2000@mail.ru

ORCID ID: <sup>1</sup><https://orcid.org/0000-0001-9495-0530>, <sup>2</sup><https://orcid.org/0000-0003-3414-1787>,

<sup>3</sup><https://orcid.org/0000-0002-7183-7911>

<sup>1</sup>Scopus Author ID: 57201319204, <sup>2</sup>Scopus Author ID: 57199285790, <sup>3</sup>Scopus Author ID: 57919972300

## **Influence of infrastructure institutions on the dynamics of agricultural production development in Kazakhstan**

### **Abstract**

*Object:* to assess the impact of infrastructural institutions on the development of rural production, as well as to investigate the present results in agricultural production and its prospects.

*Methods:* the system-functional approach was used as a general method, as well as general scientific methods: abstract-logical, dialectical; methods of statistical analysis. Results and conclusions.

*Findings:* technology, infrastructure, and market strategies all play a role in fostering agricultural growth for the benefit of the broader population at all developmental phases. Insufficient infrastructure stands out as a significant barrier to the effective advancement of the agro-industrial sector. Investing public funds into infrastructure holds significance in establishing favorable conditions for financial markets to operate effectively in rural regions. Enhancing rural infrastructure also incentivizes commercial entities to extend favorable loan terms to farmers, as the associated risks diminish. Furthermore, a pivotal determinant of international competitiveness lies in the presence of sufficient and efficient national infrastructure.

*Conclusions:* enhancing national infrastructure can bolster international competitiveness through several avenues, including boosting price competitiveness, enhancing non-price competitiveness, and attracting foreign direct investment (FDI).

**Keywords:** agriculture, agro-industrial complex, economy, infrastructure, Kazakhstan, competitiveness.

### **Introduction**

Agriculture represents the most intricate facet of the economy due to its reliance on the activities of living organisms and its direct dependence on environmental factors and other variables beyond human influence, such as temperature, light, air movement, and water availability. Thus, agriculture includes a very complex chain of “man-nature-technology”.

The relevance of this topic lies in the key role of agricultural development in ensuring general economic progress, and rural infrastructure serves as an important catalyst for achieving or accelerating this development. Advances in agriculture offer significant prospects for poverty reduction at the national level, mainly through direct increases in agricultural income and employment, as well as indirect effects on broader economic growth and food pricing. Numerous studies have highlighted the positive link between agricultural development and poverty reduction (Byerlee, et al., 2005). Empirical research consistently represents that more than half population tends to benefit a lot from the economic growth that occurs in the agricultural sector than from the growth that occurs in industry or the service sector.

Despite the great potential of agricultural for promotion general economic development, a mixture of market failures and an unfavorable political environment in many developing countries has led to the failure of agriculture-focused strategies. Furthermore, the low interest to liberalize agricultural trade or decrease domestic agricultural subsidies in Organization for Economic Cooperation and Development (OECD) countries contributes to low prices in worldwide agricultural market. This, in turn, reduces the profitability of Agriculture for developing countries and hammers both private and public investment in the sector.

Great power of agriculture could leverage inclusive economic development, however, market failures and an unfavorable political environment in many developing countries ruined agriculture-focused strategies. Moreover, unwillingness to develop agricultural trade or agricultural subsidies in Organization for Economic Cooperation and Development (OECD) countries leads to low prices world market. Consequently, this situa-

\* Corresponding author's e-mail: [azamat.zhanseitov@icloud.com](mailto:azamat.zhanseitov@icloud.com)

tion hits both private and public investment in the sector of agriculture for developing. It is essential that developing countries create conditions for international trade as well as local market.

However, even with existence of political constrains, agriculture remains one of the key elements which promote economic growth. Dawson (2005) has underlined the institutional development. This supports growth by improving conditions from government and other institutions related to agriculture field. The governments and other development agents ought to enhance institutional development and rural infrastructure to lower transaction costs.

Building upon this foundation, the aim of this research is to evaluate the influence of infrastructural institutions on the advancement of rural production. Additionally, it seeks to analyze the present condition of agricultural production and its future prospects.

### ***Literature Review***

To comprehensively gauge the current status of the agro-industrial sector in the country, it's essential to delve into the historical backdrop of rural production formation in Kazakhstan. The agricultural landscape in Kazakhstan has evolved significantly, transitioning from semi-nomadic livestock husbandry and extensive farming to a large-scale, highly mechanized sector of the economy, progressing along the path of industrialization and intensification.

During the Soviet era, socialist restructuring of agriculture in the republic, as well as across the nation, followed three primary trajectories: the establishment of state farms (sovkhozes), the formation of Machine Tractor Stations (MTS), and the collectivization of individual peasant holdings. The progression of agriculture can be delineated into several distinct phases: pre-war, land reclamation, the development of virgin lands, technological advancements, and the post-Soviet era.

Since 1990, nearly 80 % of livestock and approximately 19 million hectares of crops have been lost by 2000. Following a period of substantial development in the oil and gas sector, the government shifted its focus towards diversifying the economy, with particular emphasis on the agricultural sector. This necessitated significant long-term investments in infrastructure, water management, veterinary and sanitary services, education and research, as well as risk management (Kaliyeva et al., 2020).

Concurrently, reforms were implemented in the veterinary domain, introducing stricter penalties for violations of sanitary regulations and offering support to farmers, including the provision of animal identification tags and veterinary transport documents at no cost. The new legislation also includes provisions for reimbursing the expenses to maintain sanitary reasons and enhancing control over phytosanitary products to align them with the sanitary standards.

In the early 90s, reforms began in agriculture with the entire economy of the country- the transition from planned administrative work to a market economy (Khandker, 2005). To achieve this goal, structural reforms of agricultural production were carried out by creating new forms of business organization and changing ownership forms. Agricultural land has been redistributed and privatized.

The agricultural sector, which had historically received substantial subsidies from the Central Union budget during the Soviet era, faced particularly trying times (Bizikova et al., 2020). Collective farm and state farm leaders were ill-prepared to navigate the new market conditions. Agricultural enterprises swiftly accrued debts, while the number of cultivated crops dwindled, yields declined, and most livestock were sold at meager prices. Consequently, the standard of living in rural areas steadily declined, leading tens of thousands of Kazakhs, unable to sustain themselves, to migrate from villages to cities.

In the initial "flagship plan" of the nation-the Strategy for the Development of Kazakhstan until 2030 the president outlined gradual steps to be taken over the next two years:

- Decrease the cost of credit, with a primary focus on farmers and genuine private farms.
- Offer micro-loans to at least 150,000 of the most economically vulnerable rural residents, enabling them to procure livestock, tools, and engage in permissible activities, thereby sustaining their livelihoods, fostering business continuity, and enhancing their entrepreneurial skills.
- Attract both domestic and foreign direct investments.
- Aid farmers in effectively marketing their produce.
- Address issues pertaining to water supply and irrigation.
- Ensure prioritized funding for rural issues across all ministries and foundations.

Over the ensuing decade, as the economic landscape improved, Kazakhstan delineated key directions for agricultural development. These included ensuring the nation's food security, bolstering labor productivi-

ty, enhancing the competitiveness of products in both foreign and domestic markets, and maximizing the export potential of the agricultural sector.

Throughout this period of independence, a total of nine policy documents were formulated, serving as the foundation for implementing state policies within the agro-industrial complex (Khitakhunov, 2021). These measures not only sustained the achievements of Soviet-era Kazakhstan but also surpassed them in certain domains.

At present time many alterations made by the state in terms of agriculture legislations as the introduction of the Concept of Development of the Agro-Industrial Complex of the Republic of Kazakhstan for 2021–2030 (Adilet, 2023). This document outlines new directions for agriculture, including the emphasis on substituting imported products and fostering the export of high-value-added products. The process of rationalizing production subsidies persists, with greater transparency in accessing rural credit. The ongoing transformation of KazAgro is underway and slated for completion. The compulsory crop insurance system has transitioned into a voluntary insurance system, aimed at nurturing crop insurance markets within the country. Under this new framework, subsidies will cover insurance premiums instead of direct government compensation. Moreover, investment assistance has been optimized to focus on upgrading agricultural machinery and equipment, modernizing existing agricultural enterprises, substituting imported products, and unlocking export potential.

### **Methods**

In this study, the overall methodological basis is the functional and methodological approach. This method is based on such principles as dynamism, interaction of system elements, completeness, integrity and hierarchy. Within this indicative area, solutions are explored using economic and statistical approaches, classification analysis, visual graphical data. Additionally, general scientific tools, which were used in the research process. Mainly modern software to process statistical data was used, increasing the efficiency and accuracy of analysis.

### **Results**

From 1960, agriculture considered as a trigger for overall economic growth (FAO, 2023). Since then, agriculture field has evolved because of implementation of policies, attracting investment and introducing new technology. In turn, there were an increase regarding land and labor output. Low price for food increased consumption which affected to growth of industry. Entire chain of processing management was improved by being additional multiplier effect. This situation supported booming in demand for goods and services in other sectors.

Several experimental studies conducted by the OECD in 2022 showed that the multiplier effect of agricultural growth usually exceeds 2. However, the magnitude of this multiplier varies depending on geographical and temporal factors, identifying different patterns involvement. Mellor (1976) pointed that the multiplier has huge impact on economy when there is growth in production of small farms in rural areas of Asian countries. This enhances rural marketing by providing dynamics in the economy.

Many processes are needed to achieve rapid growth in food production and comprehensive rural economic development. Technology, infrastructure and market-based measures play a key role in stimulating agricultural growth for the benefit of the general population at all stages of development. At Stage 1, such basic measures as infrastructure development are crucial for creating favorable conditions for the introduction of intensive grain production technologies. However, at the initial stage, the development of such technologies may be difficult due to the limited access of farmers to seasonal financing and markets. The transformation of agriculture can be accelerated by government intervention in Stage 2, which will facilitate farmers' access to seasonal financing, resources and markets for low-risk and low-cost products. These agricultural activities have a positive impact on non-agricultural activities through networking, further reducing transaction costs. Then, at Stage 3, governments can phase out these measures and allow the private sector to take responsibility, reallocating efforts to create favorable conditions for the development of rural non-agricultural economies (Byerlee et al., 2005).

According to a technical data document prepared for the World Food Summit, infrastructure services such as roads, electricity, and telecommunications are inadequate across all regions, including rural areas, despite their critical role in stimulating agricultural investment and growth (Dawson, 2005). The document emphasizes that improving the communications infrastructure is fundamental because it reduces transportation costs, increases competition, reduces trade barriers and, therefore, can directly increase agricultural revenues and private investment opportunities (Pretty, 2003).

These conclusions find reinforcement in numerous infrastructure studies conducted in developing countries (Kaliyeva, 2020). These studies underscore the necessity of infrastructure investments to enhance farmers' access to markets for resources and products, catalyze the growth of rural non-agricultural economies, invigorate rural towns. Accumulation of factors including physical infrastructure, agricultural research and technology, institutions, civil society organizations, farmer behavior, and agricultural production and productivity provides immense impact, but it is important to consider them individually.

Insufficient infrastructure stands out as a significant obstacle to the effective utilization of agricultural research and technology, as it constrains farmers' options in terms of crop selection and agricultural production levels. However, when rural infrastructure offers a conducive environment, the economic returns from research and technology tend to be high.

Based on data from 44 developing countries across three regions (Africa, Asia and Latin America), Thirtle, Lane, et al. (2003) demonstrates the high returns on investments in agricultural research and technology. In addition, Fan, Zhang and Zhang (2002) and Fan, Zhang and Rao (2004) discovered that government spending on agricultural research and technology significantly boosted agricultural production. Several econometric studies have evaluated the impact of infrastructure investments (or inventories) on agricultural yields and productivity, with most indicating a positive and significant impact (Khandaker et al., 2006).

The main challenge in these studies lies in controlling the inverse causal relationship between agricultural growth and infrastructure investment to achieve a reliable assessment of the causal impact of infrastructure on agricultural growth. A commonly used method of addressing this problem is the use of techniques such as static effect models, which involve comparing the differences between two time points (Chhibber, 1988). However, while this approach helps mitigate reverse causation, it may overlook long-term relationships in the data, potentially underestimating the impact of infrastructure by focusing solely on short-term effects.

Fan and Zhang (2002) presented some promising results of econometric analysis related to this issue. They solve the problem of inverse causality using the generalized method of moments (GMM) in a dynamic structure. In fact, the findings of Van, Hazel and Revolutions (2000) suggest that public investment in rural roads has a noticeable positive effect on the growth of agricultural productivity in India. Moreover, investments in road construction make a significant contribution not only to the growth of agriculture, but also to the expansion of the non-agricultural sector and the national economy as a whole (Fan et al., 2000).

Fan and Zhang Kang (2005) noted that investments in high-quality roads in China generate almost 50 % more revenue in GDP than investments in low-quality roads. Thus, market integration in both time and space requires reliable infrastructure and effective market institutions. Weak integration of regional markets can lead to sharp fluctuations in local prices in response to local conditions conducive to economic growth, improvement of production methods or the introduction of modern technologies, which leads to surpluses and rapid price increases in some regions and causes shortages and price hikes in others.

In addition, the response of smallholder farmers to supply is influenced by infrastructure and market conditions. Schipper (1988) found that a 1 % increase in production costs leads to an increase in supply by about 0.3–0.5 % in areas with insufficient infrastructure, compared to 0.7–0.9 % in areas with developed infrastructure. The willingness of farmers to implement productivity-enhancing technologies largely depends on the state of infrastructure and market conditions.

### *Discussions*

During the years of independence, Kazakhstan successfully navigated the challenges stemming from the economic disruptions following the collapse of the Soviet Union and achieved positive momentum in agricultural development. Many farmers have developed their business process to be more productive with limited resources. In 2022, the gross output of agricultural, forestry, and fisheries products and services in the republic totaled 9.521 billion tenge, marking a 9.1 % increase compared to the previous year (Fig. 1).

Agriculture output emerges as the main contributor within this sector (Fig. 2), introducing agriculture complex as a driver of economy. This is essential for both external and internal economies, namely, ensuring the country's food security.

The largest share in the total gross output of agricultural products (services) in 2022 was occupied by North Kazakhstan (12.4 %), Akmola (11.5 %), Turkestan (11.1 %) and Kostanay (10.8 %) regions (Fig.3).

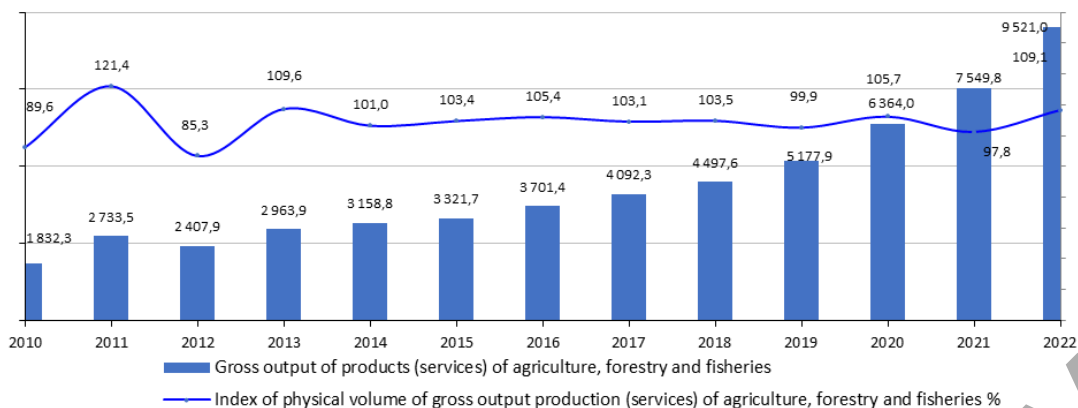


Figure 1. Dynamics of gross output of agriculture, forestry and fisheries

Note – compiled by the authors based on (Bureau of National statistics of Agency for Strategic planning and reforms of the Republic of Kazakhstan, 2024)

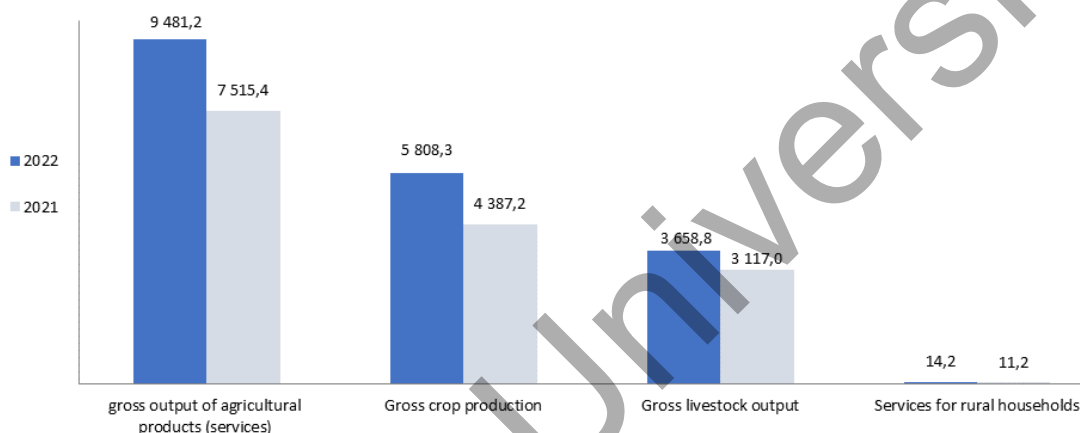


Figure 2. Gross output of agricultural products (services)

Note – compiled by the authors based on (Bureau of National statistics of Agency for Strategic planning and reforms of the Republic of Kazakhstan, 2024)

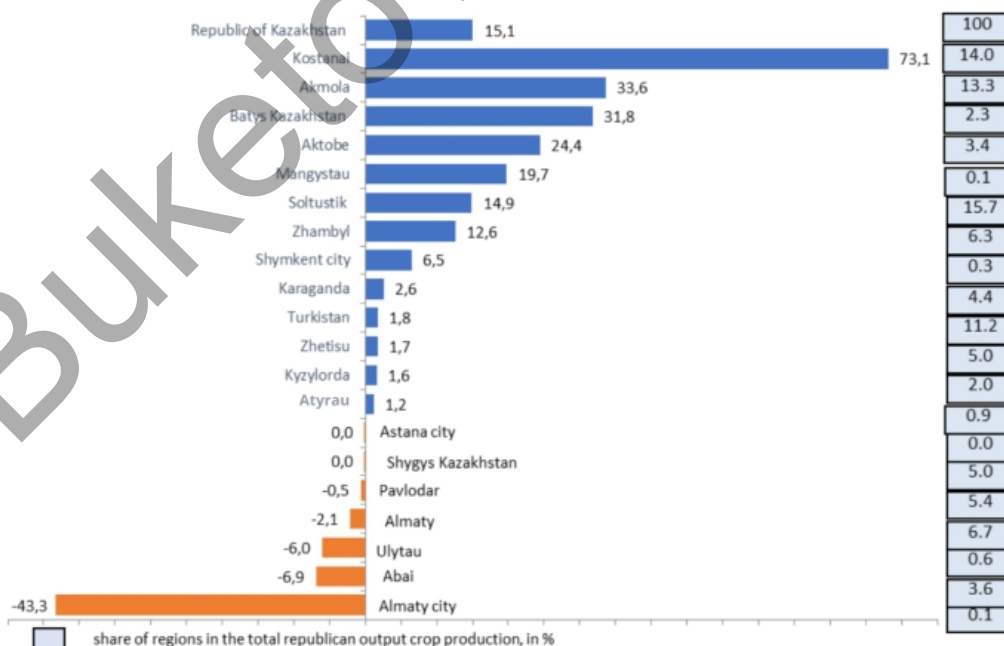


Figure 3. Gross crop production Indices

Note – compiled by the authors based on (Bureau of National statistics of Agency for Strategic planning and reforms of the Republic of Kazakhstan, 2024)

The growth of crop production in the reporting period (by 15.1 % compared to the previous year) is associated with an increase in the production of cereals and legumes by 38.2 %, oilseeds — by 24.6 %. In agricultural enterprises, there was an increase in crop production by 35.1 %, in individual entrepreneurs and 4 20 8 peasant or farm enterprises — by 11.8 %, in households a decrease of 3.1 %. Gross livestock production increased by 0.8 %, due to an increase in production volumes by types of economic activity of “dairy cattle” by 1.6 %, “horses and other equine animals” — by 3.2 %, “birds” — by 3.7 %. “Breeding of other cattle and buffaloes” decreased by 1.6 %. In agricultural enterprises, gross livestock production decreased by 1.7 %, in individual entrepreneurs and peasant or farm enterprises increased by 4.5 % and in households — by 0.4 % (Bureau of National statistics of Agency for Strategic planning and reforms of the Republic of Kazakhstan, 2024).

However, despite the positive dynamics, the potential of Kazakhstan's agro-industrial sector is still not fully realized, largely due to infrastructure. In particular, Kazakhstan's export power is limited by logistics problems. The landlocked country is experiencing a shortage of storage infrastructure, as well as railways and wagons. Aktau's only grain port on the Caspian Sea (closed sea) has too low a capacity (about 600,000 tons per year) and is easily overloaded.

The meat and dairy sector also faces these logistical challenges, as the lack of modern cold storage facilities and vehicles prevents sales outside the local market. Despite the fact that Kazakhstan currently produces 6.4 million tons of milk, this is more in terms of domestic demand, the import of butter and cheeses from the EU and Russia continues due to the poor quality of domestic milk and difficulties with collection (90 % of milk is produced on family farms).

The dairy industry in Kazakhstan faces many challenges, but most of them are directly related to the long distances that need to be overcome for milk processing and high fragmentation of milk supplies. There are not enough milk collection centers in the country to meet the needs of a large number of milk producers or satisfy the milk producers' demand for milk, and the path from farms to dairy processing plants can stretch for hundreds of kilometers, including to the North. This leads to high transportation costs and the risk of damage.

Another problem with the infrastructure of agriculture today is the most water-consuming sector. Agriculture uses about two-thirds of the withdrawn water for irrigation, and from 11 to 15 % of this water is lost during transportation, mainly due to the deterioration of irrigation infrastructure and the low cost of water (Khitakhonov, 2021). The efficiency of water use in agriculture should be improved by promoting the use of sustainable irrigation methods, expanding agricultural knowledge dissemination services and introducing reimbursable irrigation tariffs.

In addition, numerous studies show that the state of national infrastructure is a key factor determining the level of private capital flows. Efficient transport, reliable energy supply, access to clean water and modern communication systems are necessary to attract foreign investment. Therefore, additional investments in rural infrastructure are needed to increase the accessibility of infrastructure in rural areas.

### **Conclusions**

Investments in rural infrastructure and maintenance of existing infrastructure in Kazakhstan must be the priority. Along with investments in technology infrastructure, the state strategy should include efforts to create and implement new small agriculture businesses, expand national rural markets for resources, products and capital, develop appropriate technologies for small farmers. In the future, technologies with artificial intelligence and digital currencies will be very effective to drive economy.

The economic return to society from investments in rural infrastructure has more likelihood to be crucial. Given that these investments are mostly state-owned, most of the financing should come from the public sector, including the government, international development institutions, development banks and bilateral aid agencies.

Where possible, public-private partnerships should be explored, although their viability depends on the sector. Therefore, their use should be evaluated on a case-by-case basis. Partnerships tend to be more feasible in sectors such as telecommunications, energy and high-quality road construction, compared to sectors such as water supply and sanitation.

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А.Т. Жансейтов<sup>1</sup>, Г.К. Сапарова<sup>2</sup>, А.Б. Мыржыкбаева<sup>3</sup>

<sup>1,2</sup> «Тұран-Астана» университеті, Астана, Қазақстан;

<sup>3</sup> Академик Е.А. Бөкетов атындағы Қарағанды университеті, Қарағанды, Қазақстан

<sup>1</sup>azamat.zhanseitov@icloud.com, <sup>2</sup>saparova\_g.k@mail.ru, <sup>3</sup>ainurm2000@mail.ru

<sup>1</sup><https://orcid.org/0000-0001-9495-0530>, <sup>2</sup><https://orcid.org/0000-0003-3414-1787>,

<sup>3</sup><https://orcid.org/0000-0002-7183-7911>

<sup>1</sup>Scopus Author ID: 57201319204, <sup>2</sup>Scopus Author ID: 57199285790, <sup>3</sup>Scopus Author ID: 57919972300

### Инфрақұрылымдық институттардың Қазақстандағы ауыл шаруашылығы өндірісінің даму динамикасына әсері

#### Аңдатпа:

**Мақсаты:** Инфрақұрылымдық институттардың ауыл шаруашылығы өндірісін дамытуға әсерін бағалау, сондай-ақ ауыл шаруашылығы өндірісінің ағымдағы жай-күйін және оның перспективаларын талдау.

**Әдісі:** Жалпы әдіс ретінде жүйелік-функционалдық тәсіл, сонымен қатар жалпы ғылыми әдістер қолданылды, атап айтсақ: дерексіз-логикалық, диалектикалық, статистикалық талдау әдістері.

*Қорытынды:* Технологиялар, инфрақұрылым және нарықтық шаралар дамудың әрбір кезеңінде халыққа кеңірек пайда әкелу үшін ауыл шаруашылығының өсуін қолдайды. Инфрақұрылымның жеткіліксіздігі агроөнеркәсіптік секторды табысты дамыту жолындағы негізгі кедергілердің бірі. Ауылдық жерлерде қаржы нарықтарының тиімді жұмыс істеуіне жағдай жасау үшін инфрақұрылымға мемлекеттік инвестициялардың маңызы зор. Ауылдық инфрақұрылымды жақсарту коммерциялық агенттерді фермерлерге жеңілдетілген несиелер ұсынуға ынталандырады, өйткені тәуекелдер төмен. Сонымен қатар, халықаралық бәсекеге қабілеттілікті анықтайтын негізгі факторлардың бірі — барабар және тиімді ұлттық инфрақұрылымның болуы.

*Тұжырымдама:* Ұлттық инфрақұрылымды жақсарту кем дегенде үш арна бойынша халықаралық бәсекеге қабілеттілікті арттыруға ықпал етуі мүмкін. Олар: бағалық бәсекеге қабілеттілікті арттыру, бағалық емес бәсекеге қабілеттілікті жақсарту және тікелей шетелдік инвестицияларды (ТШИ) тарту.

**Кілт сөздер:** ауыл шаруашылығы, агроөнеркәсіптік кешен, экономика, инфрақұрылым, Қазақстан, бәсекеге қабілеттілік.

**А.Т. Жансейтов<sup>1\*</sup>, Г.К. Сапарова<sup>2</sup>, А.Б. Мыржықбаева<sup>3</sup>**

<sup>1,2</sup>Университет Туран-Астана, Астана, Қазақстан;

<sup>3</sup>Карагандинский университет имени академика Е.А. Букетова, Караганда, Қазақстан

<sup>1</sup>azamat.zhanseitov@icloud.com, <sup>2</sup>saparova\_g.k@mail.ru, <sup>3</sup>ainurm2000@mail.ru

<sup>1</sup><https://orcid.org/0000-0001-9495-0530>, <sup>2</sup><https://orcid.org/0000-0003-3414-1787>,

<sup>3</sup><https://orcid.org/0000-0002-7183-7911>

<sup>1</sup>Scopus Author ID: 57201319204, <sup>2</sup>Scopus Author ID: 57199285790, <sup>3</sup>Scopus Author ID: 57919972300

### **Влияние инфраструктурных институтов на динамику развития сельскохозяйственного производства в Казахстане**

#### **Аннотация:**

*Цель:* Оценка влияния инфраструктурных институтов на развитие сельского производства, а также анализ текущего состояния сельскохозяйственного производства и его перспективы.

*Методы:* В качестве общего метода был использован системно-функциональный подход, а также общенаучные методы: абстрактно-логический, диалектический, методы статистического анализа.

*Результаты:* Технологии, инфраструктура и рыночные меры способствуют росту сельского хозяйства в интересах широких слоев населения на каждом этапе развития. Неадекватная инфраструктура является одним из ключевых препятствий на пути успешного развития агропромышленного сектора. Государственные инвестиции в инфраструктуру важны для создания условий для эффективного функционирования финансовых рынков в сельской местности. Улучшение сельской инфраструктуры также побуждает коммерческих агентов предлагать фермерам льготные кредиты, поскольку риски ниже. Более того, одним из ключевых факторов, определяющих международную конкурентоспособность, является наличие адекватной и эффективной национальной инфраструктуры.

*Выводы:* Улучшение национальной инфраструктуры может способствовать повышению международной конкурентоспособности как минимум по трем каналам: повышение ценовой конкурентоспособности, улучшение неценовой конкурентоспособности и привлечение прямых иностранных инвестиций.

**Ключевые слова:** сельское хозяйство, агропромышленный комплекс, экономика, инфраструктура, Казахстан, конкурентоспособность.