FACTORS INFLUENCING THE INNOVATIVE DEVELOPMENT OF THE AGRO-INDUSTRIAL COMPLEX OF UKRAINE

Abstract. The article identifies factors of influence on the innovative development of the agro-industrial complex of Ukraine. The main purpose of this article is to study the factors influencing the innovative development of the agro-industrial complex of Ukraine, to determine the relationship. The article uses general scientific methods of analysis and synthesis, induction and deduction, ascent from the abstract to the concrete, as well as specific methods of analysis: grouping, comparison, systematization, and others. The novelty of the article is to highlight the factors that affect the development of the agro-industrial complex of Ukraine. The author substantiates that in the context of globalization of the global financial crisis, the recession and the impact of the recession on the national economy have sharply increased. The external conditions of many countries in connection with joining the integration processes began to have a powerful impact on the country's economy. Current conditions and future events as a consequence of anti-crisis measures corresponding to the system and organization in contrast to negative phenomena. Foreign risk and dangerous underestimation of problems in the current environment cannot be ignored. The results of the study show that there are negative factors that significantly affect the containment of innovative development, which make up four classification groups. There are external and
internal factors that affect innovation activity. The key external factors of positive impact on the innovation activity of agro-industrial enterprises are institutional changes in the scale of the economy, transformation at the enterprise level (changes in the form of ownership and regulation), and increased competition between competitors. Internal factors of positive impact include the openness of the enterprise, the mobilization of personnel and management potential, strategic flexibility of the enterprise, as well as a commendable attitude to innovation and personnel development in this direction. The article shows that the innovative development of the agro-industrial complex largely depends on state support and the creation of the introduction of innovative development technologies.

**Keywords**: factors, influence, innovative development, innovative development technologies, agro-industrial complex

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**ФАКТОРИ ВПЛИВУ НА ІННОВАЦІЙНИЙ РОЗВИТОК АГРОПРОМИСЛОВОГО КОМПЛЕКСУ УКРАЇНИ**

**Анотація.** В статті ідентифіковано фактори впливу на інноваційний розвиток АПК України. Основною метою даної статті є дослідження факторів впливу на інноваційний розвиток АПК України, визначення взаємозв'язку. У статті використані загальнонаукові методи аналізу і синтезу, індукції і дедукції, сходження від абстрактного до конкретного, а також специфічні методи аналізу: утруповання, порівняння, систематизація та інші. Новизна статті полягає виділенні факторів, що впливають на розвиток АПК України. Автором обґрунтовано, що в умовах глобалізації світової фінансової кризи рецесія та вплив рецесії на національну економіку різко посилилися. Зовнішні умови багатьох країн у зв'язку з приєднанням до інтеграційних процесів почали спрашувати потужний вплив на економіку країни. Сучасні умови та майбутні події як наслідок антикризових заходів,
відповідних системі та організації на противагу негативним явищам. Іноземний ризик і небезпечне недооцінювання проблем у нинішніх умовах не можна ігнорувати. Результати дослідження показують, що існують негативні фактори, що істотно впливають на стримування інноваційного розвитку, які складають чотири класифікаційні групи. Існують зовнішні і внутрішні чинники, що впливають на інноваційну активність. Ключовими зовнішніми чинниками позитивного впливу на інноваційну активність підприємств агропромислового комплексу є інституційні зміни в масштабах економіки, перетворення на рівні підприємства (зміни форми власності та регулювання), загострення конкуренції між конкурентами. До внутрішніх факторів позитивного впливу належать відкритість підприємства, мобілізація потенціалу персоналу та менеджменту, стратегічна гнучкість підприємства, а також похвальне ставлення до інновацій та розвитку персоналу в цьому напрямку. У статті показано, що інноваційний розвиток АПК значною мірою залежить від державної підтримки та створення впровадження інноваційні технології розвитку.

Ключові слова: фактори, вплив, інноваційний розвиток, інноваційні технології розвитку, агропромисловий комплекс.

**Introduction.** The dynamically developing competitive market of the global community requires a new approach to improving the competitiveness of the economic system in each individual country, and therefore, innovations are one of the main success factors, especially when it regards the agricultural sector. Today, the agro-industrial complex, in particular agriculture, requires more financial support and protection than other sectors of the economy, and the nature of this support and protection should be determined by the specific conditions of its functioning, the socio-economic importance of the agrarian sector itself, as well as a number of other objective factors.

The state plays an important role in increasing financing of the agricultural sector. Since one of its main functions today is to create an economic environment that would facilitate innovative development, it helps to apply appropriate economic methods of impact. These include government loans, pricing through a system of premiums, government contracts, tax breaks, and financial assistance. These methods are aimed at ensuring maximum protection of domestic producers and maintaining their competitiveness in domestic and foreign markets. The main objectives of the state financial support for the development of the agricultural sector are to ensure sufficient profitability and to facilitate the achievement of target profitability levels of agricultural enterprises of all forms of ownership. One of the positive aspects of the current sanation period is that foreign companies and
individuals have established innovative agricultural enterprises in Russia. Given that the imposition of retaliatory sanctions in the agricultural sector is a win-win situation, it may be advisable to impose a moratorium on all direct taxes and tax payments from agricultural producers. During the moratorium period, this will help to develop and test a system of taxation of agricultural companies that, on the one hand, would take into account the specifics of agricultural production to the maximum extent possible, and, on the other hand, would be a component of the national taxation system. There is a need for a clear emphasis on stimulating innovation activity and a radical rethinking of approaches to the development of innovation within agribusiness enterprises. It is advisable for innovation entities to create an effective innovation management system and actively implement the results of R&D, both internal and external. It is necessary to find new markets and pay more attention to improving the level of staff training. These measures can ensure the long-term progressive development of the agricultural sector. The complexity and multidimensionality of the problem of enhancing the innovative development of Ukraine's agro-industrial complex, as well as the factors influencing this development in the process of improving the efficiency of the agro-industrial complex, have determined the scientific and practical relevance of the topic of the article.

Therefore, the purpose of the article is to identify and rank the factors influencing the innovative development of the agro-industrial complex of Ukraine. The dynamically developing competitive market of the global community requires a new approach to improving the competitiveness of the economic system in each individual country, and therefore, innovations are one of the main success factors, especially when it regards the agricultural sector. Today, the agro-industrial complex, in particular agriculture, requires more financial support and protection than other sectors of the economy, and the nature of this support and protection should be determined by the specific conditions of its functioning, the socio-economic importance of the agrarian sector itself, as well as a number of other objective factors.

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**Materials and methods.** The main purpose of this article is to study the factors influencing the innovative development of the agro-industrial complex of Ukraine and to determine their interconnection by ranking them. The article uses the general scientific methods of analysis and synthesis, induction and deduction, ascent from the abstract to the concrete, as well as specific methods of analysis: grouping, comparison, systematization, and others.

**Results and discussion.** In 2021, Ukraine had better indicators of innovative products than innovative resources. In 2021, Ukraine ranked 58th in terms of
innovation resources, which is lower than last year but higher than in 2019. In terms of innovation outcomes, Ukraine ranks 37th. According to the Bloomberg Innovation Index 2021, Ukraine ranks 58th among the 60 most innovative economies in the world, ahead of Algeria and behind Tunisia. Over the year, Ukraine has become less innovative. In 2020, the country was ranked 56th, in 2019 - 53rd, and in 2018 - 46th.

For the ninth year in a row, Bloomberg has been collecting data from more than 200 global economies and evaluating them on a scale of 0-100 in seven categories, including the quality of higher education in a country, spending on research and development (R&D) centers, and the number of publicly traded technology companies per capita.

In the 2021 report, Ukraine scored 47.5 points, meaning that the country's achievements in these areas are insufficient. For the record, the United States has a score of 83.6. The challenging way of developing innovations in the agro-industrial complex contributes to the choice of different models of innovative development used in the agricultural sector. The total size of the Ukrainian agricultural market can be estimated using the following formula:

Total market size = (Total local production + Total imports) - (Total exports).

The dynamics of the total size of the Ukrainian agro-industrial complex market in 2018-2021 is presented in Table 1.

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<tr>
<th>Table 1 Dynamics of the total size of the Ukrainian agricultural market in 2018-2021</th>
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<td><strong>Data in thousands of US dollars</strong></td>
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<td><strong>2018</strong></td>
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<td>Total local production</td>
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<td>Imports from the USA</td>
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<td>Total market size</td>
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**Source:** [Summarized by the author on the basis of the website of the State Statistics Service of Ukraine, Ministry of Economy of Ukraine].

Agribusiness remains the most promising sector of Ukraine's economy. With 41.5 million hectares of agricultural land covering 70% of the country's territory and about 25% of the world's black soil reserves, agriculture is Ukraine's largest export industry.
The structure of Ukraine's agricultural land compared to the European Union in 2021 is shown in Figure 1.

![Figure 1. Structure of agricultural land in Ukraine compared to the EU countries in 2021](image)

Source: [Generalized by the author based on https://data.oecd.org/agrland/agricultural-land.htm]

Production is mainly distributed between two groups: agricultural enterprises and households. The former produces 55% of gross output from 45 thousand enterprises. The latter group consists of more than 4 million households that cultivate 1.23 hectares of land on average, producing almost 45% of gross agricultural output.

Ukraine's agriculture is dominated by crop production, which accounts for 73% of agricultural output. Ukraine harvests over 60 million tons of grains and pulses annually. The dynamics of average grain yields in Ukraine in 2018-2021 is shown in Figure 2.

![Figure 2. Dynamics of average grain yields in Ukraine in 2018-2021.](image)

The year 2021 was a record year for Ukraine. The main grain crops in Ukraine are corn, wheat, and barley.

The choice of direction and innovation policy at the regional level depends almost entirely on the current economic situation of the region, its traditional scientific and industrial potential, and the understanding of regional political leaders of the current requirements for innovation strategy. Innovation in the agro-industrial complex is the implementation of the results of economic practice in research and development in the form of new plant varieties, animal breeds and species, and poultry crosses, new or improved food products, materials and new technologies in agriculture, livestock and processing industries, new fertilizers and plant and animal protection products, new methods of prevention and treatment of animals and birds, new forms of organization and management of various sectors of the economy, new approaches to social services that increase production efficiency.

The innovation structures created during the planned economy do not meet the requirements of a developing market economy; the management of the innovation process is impersonal. Thus, the use of outdated technologies and energy-intensive equipment, as well as imperfect management methods, exacerbate the degradation of the agricultural sector. In this situation, the intensification of innovation activity should be seen as a promising way to develop the agricultural sector.

The current socio-economic situation in agriculture shows the use of outdated technologies, a variety of plants and cattle breeds, and imperfect methods and forms of production and management. Thus, in 2021, the structure of agriculture in Ukraine decreased by 2.3% compared to 2016 and amounted to approximately 2.8% of GDP[13].

In the period of difficult socio-economic development of the agro-industrial complex in Ukraine, there are negative factors that significantly affect the restraint of innovation development, which are conditionally divided into four classification groups:

1. Financial and economic: unprofitability of enterprises, low financial responsibility, low level of profitability, low level of fixed capital expenditures, long payback period of innovations.
2. Scientific and technological: poor material and technical base, technical and technological weakness, high percentage of manual operations.
3. Human resources: reduction of workers in agriculture, low level of qualification and education of workers, migration of the rural population.
4. Psychological: sluggishness in the perception of innovations, unwillingness to implement innovations. Innovative activity in agriculture is
carried out in various areas, which can be grouped into four: selective and genetic, production and technological, organizational, and managerial, economic and socio-ecological. Ukraine is currently undergoing a historic transformation that will be felt throughout the world. The globally significant progress in this context is the agricultural land reform. For centuries, Ukraine has been called the breadbasket of Europe. This name is quite accurate, given that Ukraine has about a quarter of the world's black soil.

However, in the thirty years of independence, Ukrainians have not been able to fully capitalize on this agricultural wealth. Instead, independent Ukraine became one of six countries in the world without an agricultural land market, joining North Korea and Venezuela. Fortunately, the situation is now changing, and Ukraine is preparing to take its rightful place as an agricultural superpower.

The untapped potential of Ukraine's agricultural sector is impressive. The country boasts approximately 42 million hectares of farmland. Currently, 32 million hectares are cultivated annually, which is more than Italy. Given the size and fertility of the country's agricultural land, as well as the potential for increasing yields and efficiency through continuous modernization, it is no exaggeration to say that Ukraine can feed the world. The Middle East is a particularly promising destination for Ukrainian agricultural exporters. This became evident during President Zelenskyy's visit to the United Arab Emirates in February 2021, where agricultural trade featured prominently in a number of memorandums and agreements signed worth about $3 billion. Looking to the future, Ukraine aims to ensure food security for the UAE, as well as a number of other countries in the region, including Saudi Arabia and Qatar.

Ukraine has also demonstrated great potential in some of the fastest growing market niches for agricultural products. Today, Ukraine is among the top three exporters of organic products to the EU.

At the same time, energy consumption in production is an important factor in the competitiveness of products. This means that the problem of energy efficiency in agriculture should include the consistent solution of three tasks: development and gradual implementation of managerial, economic, legal, and regulatory measures; introduction of energy-saving technologies with widespread use of secondary energy resources; change of computer technologies with a fundamental reduction of energy costs. There are two contradictory points of view on the issue of classifying agricultural enterprises as innovation active. According to the first point of view, an innovation-active enterprise is one that has few completed innovations over the past three years, i.e., new or significantly improved products or services introduced to the market, or new or significantly improved production processes put into practice. According to the second point of view,
agribusinesses that have incurred innovation expenditures in the annual reporting period are considered to be innovatively active, regardless of their size, stage of the innovation process, or level of completion.

Thus, innovation activity is measured at the enterprise level and is assessed by the following main characteristics: a) the presence of completed innovations; b) the degree of participation of the enterprise in the development of these innovations; c) the enterprise has special units that conduct research and development. Innovation activity is influenced by many factors that can be divided into global factors caused by macroeconomic phenomena and local factors arising at the enterprise level. Global factors include political processes taking place within the country and in the world: the level of competitiveness in the sales market, relations with government agencies, tax regulation [16].

Factors at the enterprise level include the level of production capacity, availability of financial sources, qualified personnel, effective management, and adaptation to changing market conditions. However, the impact of these factors is not unambiguous, since for those agricultural enterprises with significant wear and tear of equipment, these factors stimulate the use of innovations, while for other enterprises they can be a deterrent. At the same time, the role of managerial innovations is increasing, but at the same time, the management of many enterprises does not meet current trends.

The relationship between global and local factors can be realized in the short and long term. This is due to the following: the impact of macroeconomic indicators in the short term (regulatory aspects, taxation, exchange rates) is large compared to the impact of microeconomic objects. But the same factors in the long-term lead to disturbances in the macroeconomic structure that arise on the basis of the existing relations between labor and capital, between owners, managers and employees at the enterprise [19]. Thus, the reduction of state control over the institutional environment negatively affects the activities of agro-industrial enterprises that have obligations to buyers and suppliers, and also reduces the efficiency of the use of production potential. As a result, the level of innovation activity is falling. The institutional environment that does not meet the conditions of global competition creates a mismatch between this environment and the position of the enterprise. This is reflected in the imperfection of management systems (including the regulation of innovations) [17]. Ignoring the relationship between macro- and microeconomic factors in industrial policy is a good indicator of the degree of influence on the causes of stagnation of innovation activity. Innovation activity and factors can be divided into motivating and inhibiting groups (Figure 3).
There are external and internal factors that affect innovation activity. External factors mean the unstable state of the external environment; this is a key reflection of the factors of time, investment and innovation climate, and innovative competitive environment. The key external factors of positive influence on the innovation activity of agricultural enterprises are institutional changes at the scale of the economy, transformations at the enterprise level (changes in ownership and regulation), and intensification of competition between competitors in the market [20].

Internal positive factors include the openness of the enterprise, mobilization of staff and management potential, strategic flexibility of the enterprise, as well as a positive attitude towards innovation and staff development in this direction. Physical deterioration of equipment, energy-related costs, low capacity, and insufficient staff qualifications are considered internal factors of negative impact. An appropriate innovation climate provides positive dynamics in the implementation of innovations and increases the return on their commercialization. The company's personnel involved in the changes should assess their adequacy at their own level, as well as the expected effectiveness of their implementation [16].

In fact, the more innovative a product is, the higher the risk of its use. If the innovations introduced into production have a low degree of novelty, the surrounding enterprises perceive such innovations indifferently, since there is a certain psychological perception threshold, after which one can expect to see interest. If the product has a high degree of novelty, the interest will be higher. The level of positive perception of innovations by personnel can be determined by filling out questionnaires, psychological tests, and professional certification [14].
Figure 3. Factors influencing the innovation activity of the agro-industrial complex.

Source: [Developed by the authors].

A properly chosen form of incentives affects the results of an enterprise's innovation activity. There are three forms of stimulating the innovation activity of an enterprise:

1) providing state support for innovation activity;
2) organization of extra-budgetary financing;
3) motivation of participants in innovation activities.

The state may provide support for innovation activities of agricultural enterprises in direct and indirect forms. Direct state regulation uses two methods: administrative and departmental and program targeted.
The administrative-departmental method uses subsidized financing; the creation of special organizations within the executive branch; the promotion of the exchange of scientific and technical specialists between organizations such as universities, industrial enterprises, and government laboratories; and the application of incentives to individuals and enterprises that make a significant contribution to the development of science and technology. As part of the program-targeted form of state regulation of innovations, specific funding for the latter is provided through state targeted programs to support innovations.

Indirect regulation creates favorable conditions for innovation. This could include liberalization of tax and depreciation legislation; development and implementation of legislative norms; and creation of social infrastructure. The land owned by individuals and legal entities but not used for its intended purpose should be purchased by the State Land Fund and leased to agricultural producers on the most favorable terms. Meanwhile, agricultural organizations should be incentivized with subsidies that should depend on the condition of the land received: the worse the condition, the higher the subsidy rate and the lower the land tax.

The harvest insurance instrument should also work during the first years of land use. By placing orders to produce agricultural products on leased land, the state is able to intensify the process of rational placement of agricultural products, which is one of the key factors in increasing the competitiveness of producers in the country. The implementation of this algorithm will help increase the sown areas, which, in turn, will lead to an increase in crop production, improvement and increase of the feed base, and will also affect the positive performance of livestock. Ultimately, this will help improve the food and economic security of the state.

The economic security of the state in the context of the development of the agro-industrial complex is to ensure a system of production and economic relations between different spheres of the agro-industrial complex that allows to smooth out the consequences of the disproportion of agricultural prices for products, reduces accounts payable and receivable, helps to reduce unemployment in rural areas and develop the country's social infrastructure, attracts investors, and leads to the maximum use of innovative approaches in agriculture. To do this, it is necessary to overcome challenges in the agricultural sector.

Since budgetary resources are limited, the main source of financing for innovation activities of agricultural enterprises is extra-budgetary funds. Here, to stimulate innovation, enterprises use their own funds; extra-budgetary funds; funds received in the financial market; and funds received through redistribution. Most enterprises finance their investment activities on their own at the expense of profits from sales of products, financial transactions; depreciation charges; proceeds from
the sale of disposed property; stable liabilities; and targeted revenues. Commercial loans also play an important role in financing innovation activities.

To reduce the impact of negative factors on innovation activity, it is urgent to create a system for monitoring the efficiency of the use of innovation infrastructure facilities, implement pilot projects to develop mechanisms to support large-scale innovation programs of business entities, including support for cluster initiatives, and the widespread implementation of international standards.

**Conclusions.** The low innovation activity of small and medium-sized enterprises in the agro-industrial complex highlights measures to improve the mechanism of incentives for employees, to attract highly qualified specialists to the agricultural sector, where the level of staff turnover is several times higher than the threshold value.

Extended reproduction in agriculture takes place in the interaction of economic and natural biological processes. Therefore, in managing innovation activities, it is necessary to take into account the requirements of not only economic laws, but also the laws of nature: the equivalence of an essential and necessary combination of factors, the laws of minimum, optimum and maximum.

The effect of an irreplaceable factor of production is manifested in the fact that, for example, breeding cannot compensate for fertilizer varieties, cannot compensate for farming or breeding, and cannot replace feed. According to the law of minimum, productivity is constrained by factors that are minimal. For example, the level of productivity of livestock is determined by the substance whose greatest amount is contained in the diet in accordance with the law; the maximum excess of any one nutrient beyond the needs of the animal will not increase its productivity. The complex nature of innovation activity in agriculture puts forward specific requirements for the innovation mechanism (legal framework for innovative development, organization and management, innovative marketing, development of innovative structures).

The novelty of the study is the identification of the main factor that hinders the development of the agro-industrial complex - access to loans and working capital. Domestic loans are expensive, and the difficult business climate in Ukraine prevents local companies from attracting cheaper international funds. Therefore, competition among agricultural machinery suppliers in Ukraine is not only about quality, but also about the supplier's financial conditions. The main trend in the agricultural banking sector is the financing of operating capital for the purchase of plant protection products, seeds, fertilizers, and fuel. Bankers are more willing to lend to agricultural producers of grains, cereals, and oilseeds.

In late December 2018, after more than five years of suspension, the Export-Import Bank of the United States resumed its short- and medium-term programs in
Ukraine for both the private and public sectors. This action sent a strong signal to U.S. companies seeking to supply the Ukrainian market with U.S. agricultural equipment and services, as financing is a key factor for buyers considering equipment purchases.

The complexity of agricultural production and its peculiarities determine the originality of approaches and methods of managing the innovation process, combining different types of innovation activities, and strengthening the role of the state in stimulating innovation.

It should be noted that the complexity and peculiarities of agricultural production are characterized by high risks of innovation processes in the agricultural sector. The risk of financing scientific and production results, the risk of a temporary gap between costs and results, and the uncertainty of demand for innovative products do not interest private investors in investing in agricultural development.

The significance of the article for theory and practice is to identify the conditions and factors that impede the development of innovations in the agro-industrial complex, including the compression of domestic demand for food, reduction of state support for agriculture and state funding of scientific and technical programs, inadequate credit system, high interest rates, lack of innovative infrastructure and state innovation policy and strategy inadequate training of personnel of agro-industrial organizations in the field of innovation management.

The prospects for further research are to substantiate the strategy of innovative development of the agro-industrial complex of Ukraine, which will help to neutralize negative factors and support innovative development technologies in the agro-industrial complex.

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