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**REGRESSION MODELING OF LIVESTOCK PRODUCTION IN  
UKRAINE IN THE CONTEXT OF AN INSTITUTIONAL  
NETWORK ECONOMY**

**Problem statement and its connection with important scientific and practical tasks**

In the context of economic instability, military challenges, and deep structural transformations in Ukraine's economy, ensuring the sustainable development and competitiveness of the livestock sector has become a critically important scientific and practical task. Livestock production is increasingly influenced not only by traditional economic factors, but also by a complex institutional environment that includes social norms, economic mechanisms, political regulation, and managerial practices. Fragmentation of institutional support, high risks, limited access to financial resources, and insufficient coordination among market participants reduce the sector's resilience and adaptive capacity. This necessitates a comprehensive scientific assessment of how institutional environment factors shape livestock production outcomes and competitiveness, as well as the development of effective, network-based institutional frameworks capable of integrating human capital, financial resources, innovation, and state regulation. Addressing this problem is directly linked to key practical objectives, including the formulation of evidence-based agricultural policy, the design of targeted support mechanisms for livestock producers, and the creation of conditions for long-term, sustainable growth of the livestock sector under conditions of uncertainty and systemic shocks.



### **Analysis of recent studies and publications addressing the problem**

Research on the institutional determinants of economic performance and the transformation of economic systems under conditions of digitalization and network structures provides the theoretical foundation for the present article. Browning and Reiss (2002) explore the emergence of the new economy, highlighting the growing role of knowledge and information in shaping competitive advantages. Castells and Cardoso (2005) develop the concept of the network society, emphasizing the significance of network structures and information flows in modern economic organization. Li Wei and Abiad (2009) analyze the role of institutions and institutional change in economic performance, underscoring how formal and informal rules influence economic outcomes. Williamson's (2000) work in the New Institutional Economics tradition provides insight into multi-level institutional frameworks and the differential pace of change among formal and informal constraints. Toffler (1999) characterizes contemporary economic dynamics through the lens of "waves" of change, stressing the impact of information and communication technologies on production and interaction processes. These studies collectively inform the methodological approach and conceptual framework of the article.

### **Identification of previously unresolved aspects of the general problem**

Despite a substantial body of research devoted to the development of the livestock sector, a number of important aspects of the general problem remain insufficiently explored. In particular, existing studies predominantly focus on individual economic or production factors, while the integrated impact of social, economic, political, and managerial components of the institutional environment on livestock production outcomes is still poorly systematized. Insufficient attention has been paid to the interaction effects among these institutional factors and their functioning within a network-based organizational framework, especially under conditions of heightened uncertainty caused by military conflict and economic instability. Moreover, there is a lack of comprehensive econometric assessments that combine institutional analysis with multifactor regression modeling to identify the most influential determinants of livestock production and to evaluate their relative contributions. The role of human capital, institutional coordination, and network interactions among enterprises, state institutions, financial organizations, and local communities in ensuring the resilience and competitiveness of the livestock sector also remains underexplored. These unresolved issues define the scientific gap addressed in this article.

### **Formulation of the article's objectives**

The objective of this article is to assess the impact of social, economic, and political components of the institutional environment on livestock production in



Ukraine through correlation and multifactor regression analysis, to identify the most significant determinants of production dynamics, and to substantiate the feasibility of considering the livestock sector as a network-based institutional system capable of ensuring resilience and sustainable development under conditions of instability.

### **Presentation of the main material**

The assessment of the impact of the institutional environment on livestock numbers and animal production in Ukraine revealed a connection between social, economic, political, and managerial factors. Social institutions, including traditions, norms, and behavioral practices of producers, create a foundation for maintaining livestock numbers and ensuring production stability even in times of crisis. Political and managerial tools provide operational regulation, access to resources, state support, and technologies, facilitating the adaptation of farms to market fluctuations.

The institutional environment functions on multiple levels. As Williamson notes, the level of social embeddedness includes informal norms, traditions, and social structures that change very slowly and determine the long-term potential of production. Economic institutions, such as property rights, contractual frameworks, and governance structures, transform social potential into specific and measurable results, while managerial and political mechanisms ensure operational adaptation to crisis conditions (Williamson 2000)

Institutional changes usually occur gradually: formal rules can change quickly, while informal constraints – customs, traditions, and codes of conduct – change much more slowly, shaping the path and pace of historical transformations (Li Wei, Abiad Victor 2009)

To quantitatively assess the impact of the institutional environment on the competitiveness and production of animal husbandry products, a system of factor indicators has been developed, grouped into three key areas: social, economic, and political. This approach aligns with the concept of a multi-level institutional environment structure, where informal social norms create long-term constraints and incentives, economic institutions ensure the transformation of potential into production results, and political and managerial mechanisms determine the conditions for the industry's functioning in the short- and medium-term.

The system of indicators forms the basis for conducting a correlation-regression analysis of the impact of social, economic, and political components of the institutional environment on the dynamics of animal husbandry production in Ukraine. The comprehensive nature of the selected indicators allows for the consideration of the long-term influence of informal social institutions, the medium-term impact of economic mechanisms, and the short-term effects of political and managerial decisions (such as state support, regulatory changes,



digitalization of administrative services), which provides a more complete interpretation of the results and increases the predictive value of the research.

To form an econometric model of the impact of the institutional environment on the indicators of livestock development, an expanded list of factor indicators was initially developed. These indicators comprehensively reflect the social, economic, and political components of the institutional environment. The social dimension covers indicators that reflect the behavioral attitudes, values, and social practices of livestock producers. These indicators represent informal institutions that determine the stability of livestock reproduction, the level of social acceptability of production, and farmers' willingness to make long-term investments in the industry. Social factors form the basic motivational foundation for the development of the livestock sector and explain the inertia of changes in livestock structure.

The economic dimension of the institutional environment is represented by indicators that characterize the financial, investment, innovation, and production conditions of livestock enterprises. These indicators reflect the capacity of economic institutions to ensure the material base for expanded reproduction, increasing productivity, and the competitiveness of livestock enterprises at the regional level.

The political dimension covers indicators that reflect the role of the state and the quality of formal institutions in the functioning of the sector. Political indicators characterize the effectiveness of the regulatory environment, the level of reduction in transaction costs, and the availability of institutional support for enterprises of various scales, which is particularly relevant in the context of military and economic challenges.

The outcome variable for the regression analysis was chosen to be the gross output of animal husbandry products due to its direct physical and integrative nature, which allows for a quantitative assessment of the impact of the institutional environment on production processes. The production of milk, beef, pork, and eggs reflects the final result of the sector's functioning and enables measurement of how social norms, economic mechanisms, and political instruments affect productivity.

This choice ensures an objective assessment of the effectiveness of the institutional environment, as animal husbandry production reflects the actual production outcome without distortions from external market fluctuations or secondary factors. The indicator of gross output in animal husbandry integrates all levels of institutional influence, allowing the modeling of the industry's long-term potential, its resilience, and its adaptation to crises, including wartime shocks and economic instability.

Using gross output as the outcome variable in the regression analysis ensures both scientific substantiation and practical value of the study, allowing for a precise determination of which factors of the institutional environment truly

shape production volume and what the focus of the sector's support policy should be.

The linear equation obtained from the regression analysis is the most suitable tool for assessing the impact of institutional environment factors on gross output, as it provides a direct and quantitative reflection of the relationships between variables. Each coefficient in the linear equation is interpreted as the expected change in gross output with a unit change in the corresponding factor, which allows for an unambiguous assessment of the strength and direction of the influence of each indicator and highlights critical intervention points to improve the institutional environment. Unlike logarithmic, exponential, or other transformation models, the linear equation does not complicate interpretation and does not require additional data transformations, which is particularly important when working with complex social, economic, and political indicators. The linear form allows modeling of cause-and-effect relationships without distortion, clearly demonstrating how individual components of the institutional environment—such as the level of resource availability, the quality of administrative services, or personnel support in the veterinary field—impact the final result in terms of gross production. This ensures transparency, scientific validity, and practical value of the study, making the conclusions clearer for formulating support policies and development strategies for the sector.

To form the econometric model of the impact of institutional environment factors on livestock production volumes, a univariate regression analysis was carried out at the first stage of the study. The purpose of this stage is to preliminarily select factors that have a statistically and economically significant impact on the outcome variable.

The density of the relationship between each factor of the institutional environment and gross milk yield was assessed based on the correlation coefficient, which was interpreted according to the Cheddock scale. According to this scale, depending on the value of the correlation coefficient, the relationship between the variables can be characterized as functional, very high, high, significant, moderate, weak, or absent.

Table 1. Value of the correlation coefficient and the strength of the relationship according to the "Cheddock scale"

Correlation strength level	Characterization of relationship strength
1,00	Functional relationship
0,90–0,99	Very high
0,70–0,89	High
0,50–0,69	Significant
0,30–0,49	Moderate
0,10–0,29	Weak
0.00	No relationship

Source: (Ugur Turan 2020)

The use of the Cheddock scale allows for an objective assessment of the strength of the relationship between explanatory and result variables, minimizing the inclusion of random or weakly correlated indicators into the model, which could distort the results of multifactor analysis.

In this study, the factors of the institutional environment that demonstrate a moderate, significant, or high level of correlation (i.e., those with a correlation coefficient between 0.30 and 0.89 according to the Cheddock scale) were selected for further modeling. These factors indicate a stable statistical relationship with the result variable and can be considered as potential determinants of dairy farming development.

Factors with a weak relationship (correlation coefficient below 0.30) or no relationship were excluded from the further analysis, as their influence on livestock production volumes is insignificant or statistically unsupported. This approach improves the quality of the econometric model, enhances its interpretability, and ensures the scientific validity of the results obtained.

As a result, a refined set of factor indicators was formed, which serves as the foundation for building the econometric model. The final selection was made based on the elasticity coefficients, allowing for the identification of the most sensitive institutional environment factors. In cases where several indicators reflected the same institutional process, the indicator with the higher elasticity value was included in the model, as it provides a greater relative increase in the result variable. This approach ensures the methodological validity of the built model, increases its interpretability, and provides a reliable basis for further forecasting the development of the livestock sector in Ukraine.

The construction of multifactorial regression models was carried out through a sequential experimental selection of factors based on their statistical significance and the results of preliminary two-factor analysis. At the initial stages, the analysis was conducted using models with two factors, which allowed

for the evaluation of the individual and combined effects of each pair of variables on the gross output of livestock products. Based on the obtained results, factors with significant or moderately significant effects were selected for inclusion in more complex models. The model was sequentially expanded using the stepwise inclusion method, where the changes in the determination indicators ( $R^2$ ), regression coefficients, and their statistical significance were evaluated. This approach ensured a systematic check of the combined influence of factors and the formation of an optimal multifactor model capable of explaining a larger portion of the variation in result variables.

The linear equation obtained from the regression analysis is the most suitable tool for assessing the impact of institutional environment factors on the gross output of livestock products, as it provides a direct and quantitative representation of the relationships between variables. Each coefficient in the linear equation is interpreted as the expected change in gross output for a unit change in the corresponding factor, allowing for a clear assessment of the strength and direction of the impact of each indicator, as well as identifying the most critical points for intervention to improve the institutional environment. This approach ensures the transparency and logical coherence of the results: changes in factors directly correlate with changes in the result variable, making the conclusions of the study more understandable for practical application in the formation of industry support policies.

Milk Production. Next, a multifactorial regression model is constructed to assess the impact of the institutional environment factors on the gross milk yield. The goal of this stage is to determine the comprehensive effect of social, economic, and political factors on the outcome variable and identify the most significant determinants of milk production. The model is built through a stepwise inclusion of factor indicators, starting with two-factor models and expanding to five factors, while simultaneously evaluating their statistical significance, regression coefficients, and determination indicators ( $R^2$ ). This allows for a quantitative assessment of both the direct and inverse impacts of individual components of the institutional environment on gross milk yield and helps identify the factors with the largest effect across different regions of the country.

Table 2. Correlation-regression assessment of the impact of financial factors on beef production

No.	Result/Factor Indicator	Fisher's Criterion	Correlation Coefficient	Coefficient of Determination	P-Value
1	Financial leasing volumes, million UAH	12,0583	0,595	0,354	0,0022
2	Financial support for agricultural producers, UAH	9,6381	0,5519	0,3046	0,0052
3	Pre-tax profit of enterprises by types of economic activity by regions (excluding banks) (livestock), thousand UAH	5,0664	0,4326	0,1872	0,0347
4	Total number of services provided by administrative service centers	4,9485	0,4285	0,1836	0,0367
5	Capital investments by types of economic activity (livestock), thousand UAH	4,9051	0,427	0,1823	0,0374
6	Number of active enterprises by types of economic activity (livestock) by regions (units)	4,4592	0,4105	0,1685	0,0463
7	Volume of insurance payments, thousand UAH	0,0035	0,0127	0,0002	0,0595
8	Number of employees in full-time equivalent in enterprises by types of economic activity (livestock) by regions (persons)	3,9353	0,3895	0,1517	0,0599
9	Credit funds attracted by agricultural producers, thousand UAH	3,542	0,3724	0,1387	0,0731
10	Volume of insurance premiums, thousand UAH	0,0074	0,0184	0,0003	0,0863
11	Volume of funds attracted under the "Affordable Loans 5-7-9%" program, thousand UAH	3,1551	0,3542	0,1254	0,0895
12	Interest rates on new loans to non-financial corporations by deposit corporations (excluding the National Bank of Ukraine) by regions and types of economic activity (agriculture, forestry, and fisheries)	2,7746	0,3347	0,112	0,1099
13	Number of veterinarians	2,7394	0,3328	0,1107	0,1121
14	Labor costs of enterprises by types of economic activity	2,4989	0,3194	0,102	0,1282

	(livestock) by regions, thousand UAH				
15	Direct investments in Ukraine (capital participation instruments), million USD	2,4745	0,318	0,1011	0,13
16	Graduates in specialized fields	2,3832	0,3126	0,0977	0,1369

Source: based on the author's own calculations

Based on the results of the one-factor regression analysis of 16 institutional environment factors and their impact on milk yield, it was established that there is a varying degree of statistical correlation between the result variable and the factor indicators. According to the Chadok scale, the factors under study generally show a moderate or significant level of correlation with gross milk yield, with correlation coefficients ranging from 0.31 to 0.59. A significant level of correlation was observed for financial leasing volumes, with a correlation coefficient of 0.595, and for financial support to agricultural producers, with a coefficient of 0.552. The remaining factors showed a moderate level of correlation, particularly for the profit of livestock enterprises before taxation ( $r = 0.433$ ), the total number of administrative services provided ( $r = 0.429$ ), capital investments in livestock ( $r = 0.427$ ), the number of operating enterprises ( $r = 0.411$ ), the number of hired workers ( $r = 0.390$ ), and the involvement of credit resources ( $r = 0.372$ ).

The analysis of the coefficients of determination indicates that the variation in gross milk yield is explained by certain institutional factors within the range of 9.8–35.4%. The models with financial leasing volumes ( $R^2 = 0.354$ ), financial support to agricultural producers ( $R^2 = 0.305$ ), and livestock enterprises' profit ( $R^2 = 0.187$ ) show the highest explanatory power. The statistical significance of the regression relationships is confirmed by Fisher's criterion values ranging from 4.46 to 12.06 and p-value significance levels  $< 0.05$  for six models, indicating a substantial impact of the corresponding factors on gross milk yield. At the same time, factors related to insurance payouts and insurance premiums show almost no correlation with the result variable, as the correlation coefficients are 0.013 and 0.018, respectively, and the coefficients of determination do not exceed 0.001, justifying their exclusion from further analysis.

The selected indicators reflect the institutional and organizational conditions for conducting economic activities, which determine the efficiency of interaction between livestock entities and the regulatory environment and financial-administrative infrastructure. Their functional role lies in reducing transaction costs, accelerating management and production decisions, and enhancing the adaptability of enterprises to changes in the regulatory framework, which indirectly affects production outcomes and the organizational stability of the sector.

The set of selected indicators characterizes the socio-economic and investment potential of livestock development, which defines the sector's capacity for long-term growth. Their significance manifests in the formation of human capital, the preservation of production competence, and the creation of prerequisites for structural modernization of the industry. In the current Ukrainian context, these factors do not ensure an immediate increase in milk production volumes, but they lay the necessary foundation for its restoration and gradual growth in the medium- and long-term future.

The results of the one-factor regression analysis enable a substantive interpretation of the selected indicators and their role in the current conditions of Ukraine's agricultural sector development. Collectively, they reflect the basic economic, financial, and organizational conditions for the functioning of dairy livestock farming, forming the level of financial capability of enterprises, the possibilities for updating production resources, and the ability to maintain the continuity of production processes. Through these mechanisms, the institutional environment ensures relative production stability and reduces the sector's vulnerability to short-term economic and market shocks.

The obtained data allow us to conclude that the two-factor configuration of factors outlines the basis for building a multi-factor model, in which both personnel and economic, financial, and institutional components will be integrated for more accurate forecasting of gross milk yield.

Table 3. Results of the multifactor regression analysis of the impact of institutional environment factors on gross milk yield

Factor Variable	X Variable	p-value	Relationship
Number of veterinarians, persons	0,44227374	0,022655963	Significant
Profit before tax of enterprises by type of economic activity by region (excluding banks) (animal husbandry), thousand UAH	0,000204544	0,037144103	Significant
Insurance premiums, thousand UAH	-0,0000781	0,000639826	Significant
Interest rates of deposit corporations (excluding the National Bank of Ukraine) on new loans to non-financial corporations, by region and type of economic activity (agriculture, forestry, and fishing)	-37,14133371	0,081254495	Moderately significant
Capital investments by type of economic activity (animal husbandry), thousand UAH	0,00007276	0,091151808	Moderately significant



Intercept	671,164751
Multiple R	0,80249929
R Square	0,6440051102655
F	6,512504712

Source: based on the author's own calculations

The model of the impact of institutional environment factors on gross milk yield will have the following form.

$$y=671,164751+0,44227374x_1+0,000204544x_2-0,0000781x_3-37,14133371x_4+0,00007276x_5(1)$$

The results of the multifactor regression analysis indicate that the gross milk yield in Ukraine is shaped by a combination of personnel, economic, and financial factors of the institutional environment, among which there is a stable interaction. The obtained results confirm that institutional conditions are crucial in determining the ability to maintain and develop milk production under current unstable conditions.

The most pronounced positive impact on the gross milk yield is the number of veterinarians: the regression coefficient is 0,4423 with statistical significance of  $p = 0,0227$ . This highlights the key role of personnel support in livestock farming, as proper veterinary care helps reduce animal diseases, increase productivity, and stabilize production processes. Thus, human capital serves as a fundamental institutional factor for the growth of gross milk yield.

A positive and statistically significant impact is also demonstrated by the pre-tax profit of livestock enterprises: the coefficient is 0,0002045 with  $p = 0,0371$ . The growth in the financial performance of enterprises creates conditions for reinvesting funds in production, updating material and technical resources, and implementing modern technologies, which directly contributes to increased productivity in dairy farming.

Insurance premiums have a statistically significant negative impact on gross milk yield. The regression coefficient is  $-0,0000781$  with  $p = 0,00064$ . This result is related to the conditions of the full-scale war in Ukraine, which has significantly raised the level of production, logistics, and property risks in the agricultural sector. Amid military instability, enterprises are forced to allocate significant financial resources to insure assets, animals, and infrastructure in order to minimize potential losses. This leads to a diversion of funds from investment in technological upgrades, feed base improvements, and herd productivity enhancements, thereby causing a negative impact on the volume of gross milk yield. The negative sign of the coefficient reflects not the destructive role of insurance as an institution, but the forced redirection of financial flows by enterprises in response to military threats.



Interest rates on new loans to non-financial corporations in the agricultural sector have a negative and moderately significant impact on the result: the coefficient is  $-37,1413$  with  $p = 0,0813$ . This confirms the inhibiting role of credit policy in conditions of high borrowing costs, which restricts enterprises' access to the financial resources necessary for modernizing production capacities and expanding operations.

Capital investments in livestock farming demonstrate a moderately positive impact on gross milk yield: the coefficient is  $0,0000728$  with  $p = 0,0912$ . Although their effect is less pronounced in the short term, investments create an accumulated potential for the sector's development, laying the material foundation for improving production efficiency in the medium and long term.

Overall, the model demonstrates a sufficiently high explanatory power: the coefficient of determination  $R^2 = 0,644$  indicates that over 64% of the variation in gross milk yield is explained by the factors included in the model, and the F-statistic value of  $6,51$  confirms its statistical adequacy. The results obtained prove the complex nature of the institutional environment's impact on milk production, where a combination of human resources and financial-economic capabilities ensures positive dynamics, while high risks and limited access to credit serve as a restraining function.

The impact on milk production comes from factors belonging to different sectors of the economy, and it is important to consider them as components of a single institutional network. Each of these factors not only has an individual impact but also interacts with others, creating a complex effect. Personnel support, particularly the availability of qualified veterinarians, is closely linked to economic conditions (profit, investment), as well as financial instruments (loans, insurance), which together form the prerequisites for sustainable dairy production development.

Building an effective economy in modern conditions requires the creation of an institutional network system that considers the interconnections between various components of the economic environment and the establishment of flexible mechanisms. This allows reducing the industry's vulnerability to external shocks and ensuring its stability in the face of change, contributing to sustainable long-term development.

The competitiveness of such a system is determined not by individual components, but by the ability of network participants to effectively coordinate their actions, exchange resources, and respond promptly to changes in the external environment. Production capacities, material resources, and personnel can be quickly redistributed among business entities, allowing for the continuity of production processes and minimizing losses even in critical conditions.

J. Browning emphasized that under the conditions of the emergence of the new economy, intellectual labor becomes the decisive factor of development, while traditional material resources gradually lose their role as the main source of



competitive advantage. According to his approach, the foundation of economic growth is knowledge, information, and the ability of economic agents to effectively generate, accumulate, transform, and apply them in production and managerial processes. The intensification of global competition is directly related to the rapid development of communication and digital technologies, which fundamentally transform the nature of economic interaction by ensuring the prompt exchange of data, synchronization of decisions among market participants, and the formation of complex network structures of economic activity (Browning J., Reiss S. 2002).

Within such a network economy, enterprises in the livestock sector are gradually transforming from relatively autonomous production units into integrated elements of a multilevel system of interaction that brings together producers, processors, logistics operators, research institutions, financial organizations, and public regulatory bodies. The use of digital platforms, sectoral information systems, analytical tools, and knowledge-sharing technologies creates conditions for increasing production productivity, optimizing resource utilization, reducing transaction costs, and enhancing enterprises' adaptability to changes in market conditions, technological challenges, and regulatory requirements (Browning J., Reiss S. 2002).

Under these conditions, the competitiveness of the livestock sector is increasingly determined not only by the scale of production capacities or the volume of material resources involved, but primarily by the ability of network participants to form and effectively use intellectual capital, implement innovative technologies, develop cooperative ties, and integrate into national and global value-added chains (Browning J., Reiss S. 2002).

Within the framework of the "Third Wave" concept, E. Toffler characterized the contemporary stage of societal development as a qualitatively new model of the economy based on knowledge, information, and symbolic forms of interaction. Unlike the industrial economy, which was primarily oriented toward mass production of material goods, the "Third Wave" economy is based on the intensive exchange of information, ideas, data, and meanings, which become the main carriers of value and sources of economic efficiency. In this system, knowledge is transformed into a strategic resource, and the ability to create, disseminate, and use it determines the competitive positions of economic actors (Toffler A. 1999).

An important feature of the "Third Wave," according to Toffler, is the decentralization of economic processes and the transition to flexible forms of production organization implemented through network structures and horizontal linkages among market participants. Information and communication technologies ensure continuous exchange of knowledge and ideas, reduce temporal and spatial constraints of interaction, and contribute to the formation of new models of cooperation. Under such conditions, enterprises, including those

in the livestock sector, gain the opportunity to rapidly adapt production processes, implement innovations, and coordinate their activities with other participants in sectoral and intersectoral networks (Toffler A. 1999).

Within the logic of the “Third Wave,” the competitiveness of economic systems is increasingly determined not by the scale of material production, but by the intensity of information flows, the level of development of knowledge resources, and the ability of economic actors to integrate into networks of exchange of ideas, technologies, and symbolic products, which ensures sustainable development in a dynamic and globalized environment (Toffler A. 1999).

A significant contribution to the understanding of these processes was made by M. Castells, who substantiated the concept of the “network society.” He considered information as a special type of resource that easily transcends borders, and the information age as an era of globalization based on network structures. The scholar introduced the concept of “global informational capitalism,” in which traditional capitalists are replaced by collective capitalism—a “meta-network” of capital goods—while the value of companies is determined not by the production of material goods, but by the creation and processing of information (Castells, Manuel, Cardoso, Gustavo 2005).

According to M. Castells, the network economy represents a modern and efficient form of organizing production, distribution, and management processes. The implementation of such network structures has contributed to a significant increase in productivity growth rates in the United States and other countries that adopt new models of economic organization. Castells emphasizes that the role of network organization today is no less important than the role played by vertical integration of production in large corporations during the industrial era (Castells, Manuel, Cardoso, Gustavo 2005).

Networks of small and medium-sized enterprises formed around large corporations can participate in strategic partnerships across various dimensions, including products, production processes, markets, functions, and resources. As a rule, each project is unique in nature, and the network created for its implementation may be transformed after the project’s completion, giving rise to new network structures aimed at implementing other project initiatives (Castells, Manuel, Cardoso, Gustavo 2005).

The establishment of a network-based institutional framework for ensuring the competitive development of the livestock sector constitutes a strategic approach capable of enhancing the efficiency and competitiveness of the Ukrainian livestock sector at both national and international levels. This is achieved through the integration of large enterprises, state and regulatory institutions, research organizations, financial structures, and local communities. The key mechanism linking the network model with competitiveness is the synergistic effect that arises as a result of active interaction, exchange of

resources, knowledge, and technologies among network participants, as well as through institutional support and coordination.

The network-based institutional framework for ensuring the competitive development of the livestock sector is a flexible, multi-level system of interconnections among institutions, organizations, norms, rules, and economic actors (including public authorities, business enterprises, communities, and farmers), which forms a dynamic environment for coordinating interests and for the joint use of resources, values, and practices in the livestock sector. It differs from market mechanisms dominated by competitive transactions, as well as from hierarchical models based on administrative control, by a higher level of trust among participants, greater flexibility of communication, and an enhanced ability to reduce risks through social cohesion, institutional coherence, and the adaptability of economic processes. This form of organization ensures competitive development through the integration of sociological factors related to ethical standards of production, animal welfare, and the preservation of local traditions; political factors, including state support programs, regulatory mechanisms, and institutional stability; and economic components, such as investment, innovative development, and efficient logistics. Taken together, these elements form a more resilient model of operation capable of rapidly responding to external shocks and systemic challenges, including military threats and global crisis processes, thereby ensuring long-term stability and adaptive development.

Within the network-based institutional framework for ensuring the competitive development of the livestock sector, the role of the state should be positioned not as a directive administrator, but as an “architect of rules” and a coordinator of interaction among all sector participants. The state shapes the regulatory framework, establishes quality and safety standards, defines strategic development priorities, and introduces mechanisms to stimulate innovation and cooperation, while refraining from interference in the day-to-day activities of enterprises.

This vision corresponds to contemporary European practices of adaptive governance and network-based management, in which the state creates coherent rules of the game, stimulates cooperation, and ensures access to resources and information, while preserving the autonomy of enterprises and cooperatives in making operational decisions. As a result, flexibility increases, the speed of adaptation to external shocks improves, and the sector’s ability to maintain competitiveness under unstable conditions is strengthened.

At the core of the network-based institutional framework for ensuring the competitive development of the livestock sector lies the regulatory and legal subsystem, which shapes the institutional boundaries of its functioning and ensures the coherence of interaction among network participants. It encompasses a set of formal rules and norms, including legislative and subordinate regulatory acts that govern relations among public authorities, business enterprises, farms,



and communities, define the procedures for land use, establish environmental requirements, product quality standards, and biosecurity regulations.

The economic subsystem of the network-based institutional framework for ensuring the competitive development of the livestock sector provides financial and resource support as well as economic incentives for network participants through a system of state and regional instruments, including subsidies, tax preferences, credit programs, and investment mechanisms. It forms the economic mechanism of the network's functioning as a set of methods, instruments, and measures aimed at efficient resource management, enhancing competitiveness, and strengthening the resilience of livestock enterprises under conditions of European integration processes and military challenges.

The socio-cultural subsystem of the network-based institutional framework for ensuring the competitive development of the livestock sector supports the development of horizontal linkages among local communities, business entities, and educational and research institutions based on shared values, ethical norms, traditions, and established social practices. It contributes to the formation of trust, social cohesion, and the activation of local initiatives, thereby strengthening the resilience of the network under conditions of instability. The implementation of the principles of corporate social responsibility within such a network enables enterprises to integrate economic, social, and environmental objectives, stimulating territorial development, improvement of local infrastructure, expansion of employment opportunities, and the implementation of social programs.

The scientific and technological subsystem of the network-based institutional framework for ensuring the competitive development of the livestock sector serves as a driver of its functional renewal and innovative development by fostering productivity growth at enterprises, defining the directions and pace of technological change, and creating prerequisites for the emergence of new economic actors, which strengthens the network structure as a whole. This subsystem focuses on the implementation of digital solutions, precision livestock farming technologies, genetic monitoring systems, innovative feed components, and biotechnologies, while scientific and educational institutions provide network participants with applied innovative developments and the training of highly qualified personnel.

The environmental subsystem of the network-based institutional framework for ensuring the competitive development of the livestock sector completes its structural architecture by orienting the activities of all participants toward the balanced use of natural resources, the reduction of the negative environmental impact of production, and the effective management of waste at the regional level within the framework of network-based interaction among stakeholders. It encompasses mechanisms for controlling emissions and pollution, rational waste management, the implementation of biogas facilities, resource



reuse technologies, the conservation of local animal breeds, and the promotion of the principles of the “green” economy, thereby ensuring a comprehensive approach to reducing waste generation, facilitating waste utilization, and integrating secondary raw materials into the production cycle.

## Conclusions

The study confirms that the development and competitiveness of the livestock sector in Ukraine are significantly determined by the quality and structure of the institutional environment. The results of the correlation and multifactor regression analysis demonstrate that livestock production, particularly milk output, is formed under the combined influence of human capital, financial and economic conditions, and institutional mechanisms, which interact in a stable and systematic manner. The findings substantiate the decisive role of qualified personnel, financial sustainability of enterprises, and investment activity, while high risks and limited access to credit exert a restraining effect on production growth. The research proves that an effective network-based institutional framework, integrating economic, social, political, and technological components, enhances the resilience of the livestock sector to external shocks and creates prerequisites for its sustainable long-term development under conditions of economic instability and military challenges.

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## Abstract

The paper provides a comprehensive justification for the expediency of forming a network-based institutional framework to ensure the competitive development of the livestock sector under conditions of economic digitalization, deepening globalization processes, and increasing external risks, including military and crisis-related challenges. It is emphasized that the contemporary model of livestock enterprises' functioning is increasingly based on a network form of organization, which implies close interaction among business entities, governmental and regulatory institutions, research and educational organizations, financial institutions, and local communities. This model ensures the integration of material, financial, informational, and human resources, facilitates the exchange of knowledge and technologies, and enhances the adaptability and resilience of production processes in an unstable environment.

The key theoretical approaches to the interpretation of the network economy are generalized and systematized, in particular the concepts of J. Browning, E. Toffler, and M. Castells, which emphasize the growing role of knowledge, information, and network structures in shaping contemporary economic systems. It is demonstrated that under such conditions competitiveness is determined not so much by the efficiency of individual enterprises as by the quality and intensity of interactions among network participants, their ability to coordinate actions, jointly use resources, and rapidly respond to changes in the external environment.

Special attention is paid to the role of the state, which within the framework of network governance is considered not as a directive regulator but as a coordinator and an "architect of rules" that shapes the regulatory framework, establishes quality and safety standards, defines strategic development priorities, and creates incentives for innovation and cooperation. This approach is consistent with modern European practices of adaptive governance and contributes to enhancing the flexibility and effectiveness of sectoral management.

A structural model of the network-based institutional framework for ensuring the competitive development of the livestock sector is proposed, which includes regulatory, economic, socio-cultural, scientific and technological, and environmental subsystems. It is substantiated that their coordinated and interrelated functioning generates a synergistic effect, activates innovation processes, increases enterprise productivity, promotes the sustainable use of natural resources, and strengthens social cohesion at the local and regional levels. In conclusion, it is proven that the proposed network model of institutional support forms a more resilient and adaptive foundation for the long-term competitive development of the livestock sector under conditions of contemporary global transformations.

**Keywords:** network economy, livestock sector, competitiveness, institutional support, network governance, digitalization, synergistic effect, sustainable development

*JEL Classification:* Q13, L14, O33