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Evaluation of the Development of Agro-Industrial Complex

Case for Ukraine's regions

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INTRODUCTION

Agro-industrial complex is one of the priority spheres of Ukrainian economy. It influences the country's place in the international division of labor and the level of its competitiveness and food security. Agro-industrial complex (AIC) of Ukraine is a leading intersectoral territorial-industrial unit, from the level and balance of development of components of which depends on the provision of population needs in food products and its welfare. Management of rational molding, regulation and development of AIC regions is the primary task of the activities of the authorities of all levels, since its functioning is called to ensure satisfaction of vital needs of the population. Transformational processes taking place in the agro-industrial complex of Ukraine require in-depth research of all transformations in its structure and functioning, development and implementation of effective measures.

Theoretical-methodical and applied aspects of the issues of organizational and economic mechanism of agro-industrial regions development are investigated in the works of many scientists-economists and practitioners. Among foreign scientists it should be noted: R. Bauer, M. Himmman, D. Stone, V. Tana, V. Heuhera, R. Holta et al. A significant contribution to the solution of the problem was made by V. G. Andriychuk, V. M. Bondarenko, O. M. Borodina, M. P. Butko, P. I. Gaydutsky, V. P. Halushko, V. M. Geets, B. M. Danylyshyn, M. I. Dolishniy, L. V. Deyneko, Zh. V. Deriy, M. Ya. Demianenko,

V. P. Ilchuk, A. Ivanko, M. F. Krapivko, A. S. Livitskiy, M. A. Lendel, Yu. O. Lupenko, M. J. Malyk, B. J. Paschater, G. Pidnosetsky, V. Rossokha, P. T. Sabluk, M. A. Khvesyk, Y. Hudolej, L. H. Chernjuk, S. Škarlet, O. Y. Chubukova, V. P. Yakovenko and others.

Paying tribute to their scientific heritage, it should be noted that they need further improvement of theoretical and methodological aspects of the organizational and economic mechanism for the development of agricultural regions in the conditions of institutional change, primarily aimed at evaluation of the efficiency of agricultural development in the regional business systems.

The methodological basis of this monograph constitutes the general scientific methods of research and special techniques of scientific knowledge. In particular, the work used:

- historical-logical approach – in the process of detection of genesis of scientific thought of the theory of regional economy on the functioning of AIC regions;

- dialectical method – for establishment of interrelations of organizational-economic mechanism and determination of contradictions between agricultural subjects of regions;

- the monographic method and generalizations method – to compare the peculiarities of AIC regions and to justify practical recommendations concerning the direction of the organizational and economic mechanism on the intensification of AIC regional development and systematization of methodical approaches to assessment of efficiency of organizational and economic mechanism of agro-industrial regions development;

- method of analysis and synthesis – to distinguish the most important factors influencing the development of AIC regions and the functioning of the organizational and economic mechanism for the intensification of the agro-industrial industry development and comparison of the peculiarities of economic processes in development of AIC regions;

- statistical method and modeling method – for diagnostics, formation of prognostic estimates of AIC regions, improvement of methodological approach on estimation of efficiency of organizational-economic mechanism of agro-industrial complex development;

- economic analysis – to diagnose the state of organizational and economic mechanism of agro-industrial regions development;

- method of abstraction and formalization – for substantiation of conceptual provisions of functioning of organizational-economic mechanism.

The information base of the study is the Constitution of Ukraine, legislative acts of Ukraine, normative legal acts of the Cabinet of Ministers of Ukraine, analytical materials of the Ministry of Economic Development and Trade of Ukraine, Ministry of Agrarian Policy, Information materials of international associations and rating agencies, materials of the State Statistics Service of Ukraine, research of domestic and foreign scientists, official results of branches surveys, reports of enterprises and bodies of state and regional authorities, Internet-resource.

In the monograph the authors investigated the essence and logic of the relationship of conceptual and categorical apparatus of the theory of regional development of agro-industrial complex. The components of the organizational and economic mechanism of agro-industrial regions

development are substantiated. The further development of the conceptual and categorical apparatus of the theory of regional economy and the theory of regional development of agro-industrial complex due to clarification of *the interpretation of notions*:

- "development of the agro-industrial complex", reflecting changes in the state and interrelations of the agro-industrial complex and its components aimed at transition to a new state, under the influence of environmental and external factors;

- "organizational and economic mechanism"-a collection of elements of organizational and economic character, interconnected and interacting with each other with moving internal and external connections, the effectiveness of which depends on the ability create missing links, items, incentives at specific moment;

- "organizational and economic mechanism for intensification of the development of agro-industrial complex" – a set of interconnected and interconnected elements of organizational and economic nature as a system, which makes it possible to intensify not only development of the agro-industrial complex and its subjects, but also determines the production and socio-economic developments in the regions.

The authors of the monograph are analyzed the development of AIC regions on the basis of the improved methodological approach to assess the agro-industrial areas' development, which includes a sequence of *stages such as*:

- definition of valuation indicators of agricultural regional development;

- using the method of mathematical expectation of rationing of valuation indexes development of agricultural regions;
- evidence of validity of certain estimates of the agro-industrial complex development by using plural regression;
- calculations of the agricultural development appraisal index of the agro-industrial complex using the method of plural regression;
- definition of the development of AIC regions using factor analysis and calculation of development dynamics coefficient;
- by using the cluster analysis method, group regions according to the designed for values of the integrated index of agro-industrial development valuation regions.

Pilot inspection of the proposed methodical approach was carried out.

The monograph proposes a methodological approach to assess the effectiveness of the organizational and economic mechanism for the development of agro-industrial areas using mathematical model of nonlinear dynamics and methodical approach to forecasting of agricultural development of Ukraine's regions. Approbation of methodical approaches was carried out.

The monograph materials may be useful for research workers in different fields of activity, representatives of business and government bodies, ministries and departments, and can be used by students, postgraduates, and teachers of higher educational institutions in the process of studying special disciplines related to the development of productive forces and the regional economy.

CHAPTER 1

THEORETICAL AND METHODOLOGICAL FOUNDATIONS OF THE ORGANIZATIONAL AND ECONOMIC MECHANISM OF AGRO-INDUSTRIAL COMPLEX OF THE REGIONS

1.1. Conceptual and categorical apparatus of the theory of regional development of agro-industrial complex

At the present stage of functioning of the domestic economy the agro-industrial complex acts as a strategic component of Ukraine's economic development, which defines the development of the state in future. The basis of the creation of life goods in society is the agro-industrial complex, development of which has priority importance in the guarantee of food security of the state, provision of raw areas of processing industry and population needs in foods relevance research development of agriculture in modern conditions of management caused by features that are inherent in agriculture, because the instability of the internal and external environment significantly affects the parameters of its development.

This and another causes: research of concepts of structuring the economy, on the basis of which the scientific idea of the agro-industrial complex is formed; definition of the entity of concepts: "agro-industrial

complex", "agro-industrial complex of the region", "development", "development of agro-industrial complex", "region" etc.

Substantiation of the exclusive role of the agrarian sphere and its special significance regarding the development of the national economy are devoted to the work of many prominent scientists of different economic schools. Physiocrats gave exclusive role in economic relations of land and agricultural sphere. So F. Kene in the work "economic workers" has brought the main role to agriculture in the creation of a pure product, noting that "the role of farmers-the individuals who rent land and make high-productive agriculture, produce wealth and material goods, is the most important for the state and needs the greatest attention from the government" [234, p.88]. At the same time physiokrkrat denied an opportunity to increase income in industrial production and trade.

A. R. W. Turgo did not deny the original value of farming in the created wealth, the development of which, in his opinion, was to preserve the foundations of the natural environment, as well as to ensure a permanent increase in the main benefits. But he argued that industry and trade also take part in creating wealth, speaking auxiliary tools in processing and/or providing circulation of agricultural raw materials. A. G. Turgo noted: "Products of agriculture, made to meet the different needs of man, in the overwhelming part can not serve this goal in the form, in which they give nature... This, in turn, gave rise to the exchange... Between farmers and the rest of the society, which preferred processing or processing of land products instead of their production" [209, p. 58].

Interaction of branches of agriculture and industry, which collectively provide the reproduction of social product and cause economic development, considered other schools, in particular representatives of classical political economy. Its representatives believed that technological processing of agricultural raw materials is possible in conditions of creation of appropriate material and technical basis on the basis of formation of qualitatively new inter-branch relations of agro-industrial production. K. Marx noted that "... The capitalist way of production completes the gap between the original family union of farming and industry, which has combined their undeveloped forms ". But at the same time, he creates the "material prerequisites for a new external synthesis-the Union of Agriculture and industry on the basis of their opposite forms of development" [124, p. 512].

Development of productive forces, expansion of organizational-industrial relations, social division of labor-all this leads to separation of other types of economic activities in the field of agro-industrial production. The macroeconomic model of V. Leontieva gives an idea about the macroeconomic cycle – the flow of production and distribution interconnections, including the agro-industrial complex [248, p. 112]. This continuous flow of dissimilar elements blends a causal form of real communication. Thus, in the process of production, some elements are generated by others, so that those, in their turn, were used during further production and went for final consumption" [247, p. 580-582].

Further research of intra-sectoral and inter-sectoral relations between integration and cooperation of the agrarian sphere, which intensified the teachings of V. Leontieva, were devoted to the work of Clark's knees [237].

So K. Clark put forward the theory of "three sectors" [237], which described the structure of the economy for division in three sectors: primary (agriculture and extractive industries, i.e. raw materials), secondary (manufacturing industry and construction)-types activities that recycle raw materials) and tertiary (services sector – unites areas of activity that serve and contribute to the development of the previous two sectors of the economy).

It should be noted that K. Clark [237] and A. Fischer [244], dividing the economy into three sectors, have somewhat different areas attributed to a particular sector. Also, in our opinion, it is necessary to allocate a theory of the same. Furtheye [245] in which he singled out the fourth sector, considering "the technique of defining factor of social development, which causes a consistent change of civilizations from the primary" agrarian "to the quaternary. To the quaternary sector of the same "spiritual production" took away the forage.

To the present, scientific searches continue in conceptual justification of national economy structuring. Current trends are the division of the economy into four and five sectors. So scholars [79; 189; 246; 249; 250] in the quaternary sector include the field of scientific and information service of the previous three sectors, and to the Pentagon – the industry of information and knowledge.

Thus, according to the concepts of structuring the economy forms a scientific representation of the structure of agro-industrial complex, which is represented by interrelated branches of national economy and plays an important role in economic growth.

The concept of "agro-industrial complex", which was understood as a collection of branches of national economy, occupied by the production of food and raw materials for the processing industry, their preservation,

processing and polishing to the final. The consumer, in the scientific and economical circulation was introduced in 50-ies of the last century in the USSR and was associated with development of collective farms and state farms and events on improving efficiency of agrarian economy.

Over time, integration and cooperation of AIC was strengthened in accordance with the processes of industrialization (development of agricultural engineering branches, production of mineral fertilizers, light and food industry) and changes in socio-economic structure agricultural production. These and other issues were covered in the publications of the scientists of that time [3]. Scientists [1; 4; 218] in addition to the problems of state planning also highlighted the problems in the functional and industrial structure of AIC, inter-sectoral links and their regulation, the development of agricultural territories.

Thus, research of agricultural development on the territory of Ukraine in the USSR on improvement of industrial specialization and territorial organization spent P. P. Pershin; territorial organization of agriculture as a leading level AIC-conducted I. F. Muskomelya; roles and values of economic and climatic peculiarities as factor of agricultural complex formation, application of structural analysis to agrarian-territorial complexes – justified M. D. Pistun; the use of system-structured approach to meaningful essence, structure, patterns functioning and integration of agro-industrial complex is defined by M.M. Palarchuk, etc. [1; 2; 4; 85; 200; 235].

Processes of industrialization led to the need to consider agriculture in terms of a single process of creating agricultural products, its processing and consumption, taking into account the dependence of agriculture from industries that produce means of production and processing agricultural

products. Constant interaction of agriculture and industry contributes to the creation of an integrated system of agro-industrial production, which takes place within the agro-industrial complex.

As the object of research is the process of agro-industrial complex development, in our opinion, it is necessary to define the essence and component structure of AIC as well as to clarify what is implied by AIC of the region. Views of different authors regarding the interpretation of the essence of the concept of «agro-industrial complex» in terms of aggregate are presented in table. 1.1.

Table 1.1

Interpretation of the essence of the concept of "agro-industrial complex"

Authors / or source	Definition of the term "agro-industrial complex"	Definition features and / or deficiencies of definition
1	2	3
Y. M. Vorobyov, T. Gyela [32, p. 16]	Large intersectoral education, organic part of the economy, which includes a set of industries related to the reproduction process, whose main task is to ensure the food security of the country, the optimum norms of food of the population of Ukraine , creation of export potential of raw materials and food	Attention is paid to the process of reproduction, and main goals of AIC, but missing list of branches
Soviet Encyclopedic Dictionary [192, c. 20]	Set of branches of national economy related to the production of food and consumer goods from agricultural raw materials and supply to the population	There is no list of industries, from the point of view of technological chain no processing and preservation of products, not taken into account functional signs of interconnection
Economic Dictionary-Handbook [68, p. 11-12]	Set of branches of the national economy, engaged in production, processing, preservation and polishing to the consumer of agricultural products the set of interrelated branches of the national economy, united by the peculiar function Population of food and items of popular consumption of agricultural origin), developing according to specific natural geographical and socio-geographical features of the Territories	Separation of individual components of AIC component from the standpoint of the technological chain, but there is no list of AIC branches not served at all structure of AIC, focusing on its target destination

Continuation of Table 1.1

1	2	3
P. T. Sabluk [181, p. 4]	Large intersectoral education, organic part of the economy, which includes a set of industries related to the reproduction process, whose main task is to ensure the food security of the country, the optimum norms of food of the population of Ukraine, creation of export potential of raw materials and food	There is no specific essence of the mechanism of interconnection of industry aggregate, their list is absent, emphasis on the process of reproduction and aims of APK
Yu. A. Gorohovets [36, p. 70]	Set interrelated branches of the national economy, the main task of which is to provide the population with food products	Narrow definition, does not consider the nature of the relationship areas
M. A. Kravets, M. S. Hriknoodov, N. A. Kazakova [96, p. 23]	The holistic economic system interrelated in its development industries that provide the production of agricultural raw materials and food, their the workpiece, storage, processing and implementation of the population	Emphasizes the integrity of the interrelated industries system, but the list of industries is absent
I. A. Minakov, O. V. Sokolov, M. I. Kulikov [234, p. 28]	A set of sectors of the economy, related economic relations on the production, distribution, exchange and consumption of agricultural products	The main emphasis on the relationship of economic relations between industries
H. P. Zhuravleva, v. Gromyko, M. I. Zabelyn [69, p. 482]	Functional multi-sectoral subsystem that reflects the interaction of agriculture and related branches of the economy for the production of agricultural machinery, agricultural products, its processing and sale	Defined as the subsystem, but does not specify what it is; focuses on the correlation between agricultural machinery and agricultural production
Great economic dictionary [16]	A set of sectors of the national economy, including agriculture and industry, closely related to agricultural production, carrying out the transportation, storage, processing of agricultural products, Bringing it to the consumer, to provide agriculture with appliances and fertilizers, etc.	The main attention of paid to density of interconnection between branches of agriculture and the industry of their functional purpose
Modern economic dictionary [194]	Set of economic sectors of the country, including agriculture and industry, closely related to agricultural production, carrying out transportation, storage, processing of agricultural products, its supply Consumers to provide agriculture with machinery, chemicals and fertilizers that cater to agricultural production	The density of the relationship between agricultural and industrial sectors is emphasized, as well as their functional prescribing

Continuation of Table 1.1

1	2	3
Economic dictionary [234, p. 458]	A set of branches of the national economy, connected by a economic relationship about the production, distribution, exchange, processing and consumption of agricultural products	The relationship between branches is imagined as an economic relationship
N. A. Popov [160, p. 10]	Complex integrated socio-economic system of interrelated industries, which carry out reproduction of productive forces and industrial relations	Focusing on the complexity of relations, the structure of AIC is not paid
M. Khorunzhiy [219, p. 38]	Integrated organic system, a part of the entire national economy, based on the interaction of the reproducing process in those areas and areas that are directly related to the needs of society in food and non-food products, Obtained from agricultural raw materials	Not defined nature of interrelations between society's needs and the structure of AIC, the main focus paid to the interconnections of spheres and branches of AIC
* When identifying an entity, a approach by which an APK is defined as system and/or aggregate industries		

Source: Authors based on the research [16; 32; 36; 68; 69; 96; 160; 181; 194; 192; 219; 234].

Presented interpretations of the essence of the "AIC" in table 1.1 give an opportunity to determine that AIC is mostly understood as a system and/or a set of branches of national economy engaged in the production, processing, storage and polishing to the end consumer of agricultural products. But there are also other substantiated statements regarding the essence of the concept of "AIC" in terms of combining enterprises and various activities that are presented in table. 1.2.

Table 1.2

*Interpretation of the essence of the concept of "agro-industrial complex"
as an association for different types of economic activities*

Author and / or source	Definition of the term "agro-industrial complex"	Definition features and / or deficiencies of definition
1	2	3
O. O. Tomilin [202, p. 150]	Complex production, which unites different branches of agriculture, the main task of which is to ensure the food and agricultural raw materials	Focuses on the production relations of various branches of agriculture
S. I. Doroguntsov, Yu. I. Pityarenko, Y. Oliynyk and others [177, p. 199]	Determines the socio-economic development of the country, living standards of the population, its provision with food and industry-agricultural raw materials	Does not define the structure, functional interrelations of AIC, focusing only on the target appointment
Ya. A. Zhalilo, O.V. Sokevysh, V. M. Rusan [176, p. 3]	An important sector of the national economy, which unites different types of economic activity in the production of agricultural products, food products, as well as their delivery to the final consumer	Noted on the macroeconomic aspect of the agro-industrial functioning without considering its structure
N. O. Lysenko, N. Beloshkurska, [113, p. 7]	Strategically important branch of the national economy of Ukraine, which combines all production of agricultural products (agrarian Enterprise), its processing (processing enterprises AIC) and agro-industrial service	Focuses on separating agro-industrial services into an independent industry
V. Nebelas [143, p. 97]	A combination of production and interrelated enterprises for the cultivation, storage, preparation, transportation, processing and sale of agricultural products, as well as service and auxiliary enterprises and organizations	Emphasized the features of and target assignment of interrelated enterprises and the availability of service and auxiliary organizations; has no macroeconomic component
Dictionary-Directory of Legal, political, sociological and economic terms [191, c. 9-10]	The interspecies structure, which contains agricultural and other economic activities and operates on the basis of wide application of developed and regulated norms of integration and cooperative relations, covers Production of raw materials for agriculture and related activities, their logistical support and maintenance, all stages of management and implementation of agricultural products and its processing	Emphasized the existence and observance of norms of agrarian law, which affects the nature of interrelations in agriculture and expands the range of economic activities that are part of the agro-industrial complex

Continuation of Table 1.1

1	2	3
O. P. Atamas [12]	Intersectoral territorial-production unit, the level and balance of development of components of which depends on the availability of population needs in food products, its welfare	The level of development of interrelated enterprises is emphasized without defining the structure of AIC
T. Ostapenko [157, p. 30]	Holistic multicomponent formation, consisting of activities of basic production, production and social infrastructure, related technological, organizational and economic ties about the production, Exchange, Distribution and consumption of agricultural products in order to achieve integration goals of the national socio-economic system – ensuring food and agricultural security of the State	The interaction of the main economic activities of AIC and social infrastructure is shown, as well as emphasized the need to ensure the food security of the state
I. Syvachenko, D. Korovyakovskyy [189, p. 10]	System of production and economic Agricultural relations with industries and other sectors of the national economy, which serve it, reaching the level of agro-industrial integration	The main focus is on dependence of agricultural relations and industries on the level of agro-industrial integration
V. Kolyadenko [93, p. 181]	A set of industries and types of activities of the national economy, which on the basis of the systematic distribution of labor provide the production of food and other consumer goods of agricultural origin, as well as the means of production and services for rural manufacturing and processing industries	Attention is concentrated on defining the structure; It does not display APK infrastructure
* In determining the entity is used approach by which the AIC is determined by the varieties of economic activities related to each other technological, organizational, economic ties for agricultural production		

Source: Authors based on research [12; 93; 113; 143; 157; 176; 177; 189; 191; 202]

Generalizing approaches to the definition of the concept of "agro-industrial complex", which are given in table 1.1-1.2 gives an opportunity to state that there are ambiguous interpretations of its essence. AIC considers, as a collection of industries, socio-economic system, a set of industrial-interconnected enterprises, territorial and manufacturing structure, interdisciplinary territorial complex.

But at the same time uniting in the views scholars is that AIC should be considered as a system of forming subsystem of the national economy, which occupies a prominent place in the functioning of the economic complex of the country, its public playing, providing not only food and economic security, but also creating jobs in other sectors of the economy, as well as contributing to the expansion of export potential of the country. Expansion of agricultural production leads to positive shifts in infrastructure development, attracting investment resources in the industry, etc. Branches agribusiness is characterized by vertical and horizontal links.

In our opinion, to determine the essence of the concept of "AIC" in the methodological plan, there is insufficient research of definitions. It is necessary to establish classification and function characteristics. Thus, let's move on to the components of AIC.

In the structure of agriculture, some experts distinguish three [6; 4; 68; 96; 191; 219] or, others – the opinions of which we share, four [12; 66; 81; 144; 230] areas. The division into four components is not new, so in 1974 it was proposed by the Soviet academician A. A. Nikonov. The structure of AIC presented in Fig. 1.1.

The first sphere-the industry, producing means of production for agriculture and other industries that ensure the maintenance of agriculture. This sphere includes: tractor and agricultural engineering, food, elevator and other engineering, the production of mineral fertilizers and chemical plant and animal protection, microbiological and feed mill industry, extraction of peat for the needs of agriculture, capital construction in agriculture, reclamation, etc.

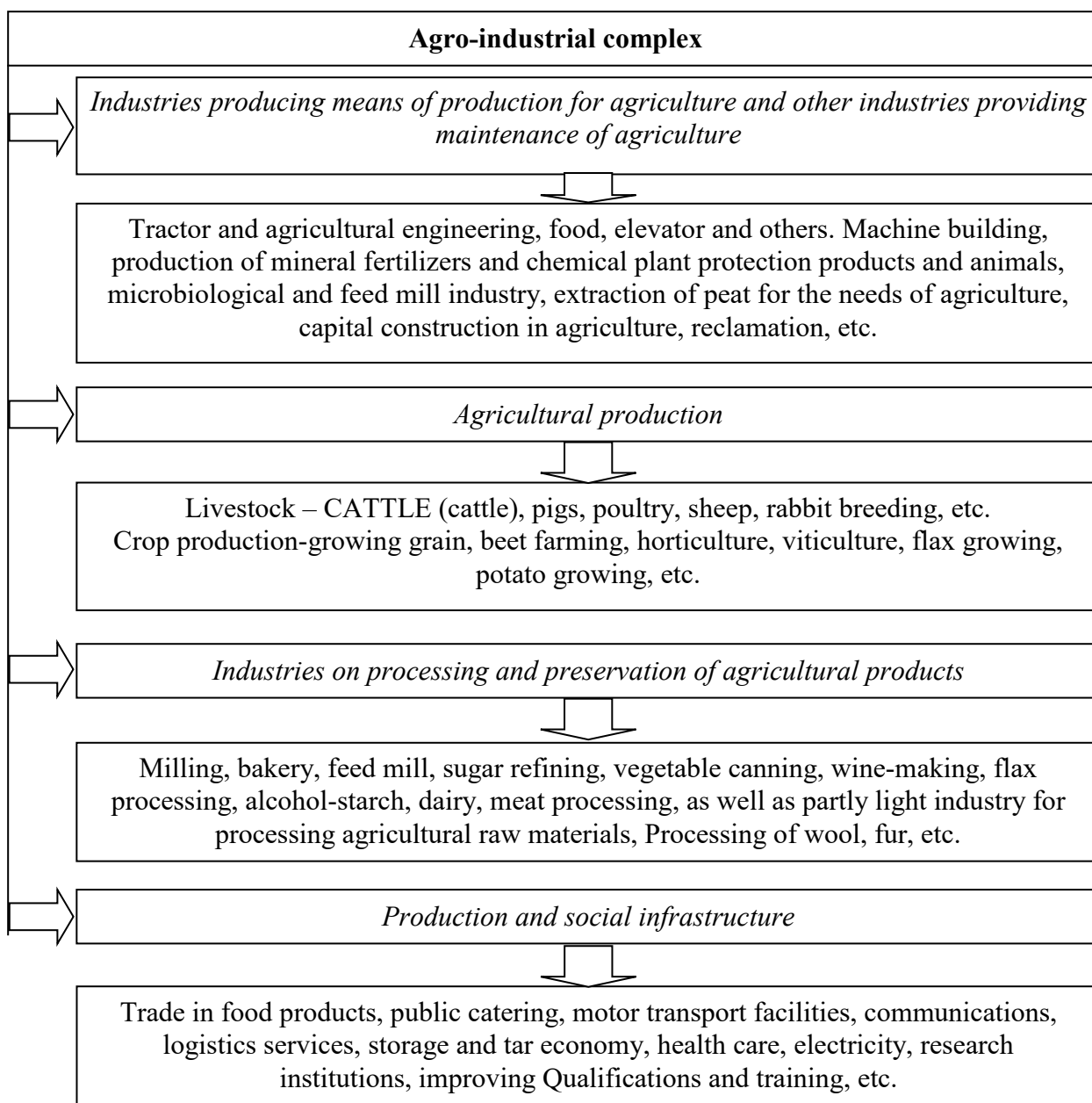


Fig. 1.1. Agro-industrial complex structure

Source: Developed by authors.

Their activities depend on the rhythm, threading and mass production of agricultural products and the final product.

The second sphere is agricultural production, which includes livestock (pigs, poultry, sheep, rabbit breeding, etc.) and crop production (cultivation of grain, beet breeding, vegetable growing, viticulture, flax growing, potato-breeding, etc.).

Agriculture has a leading role in the process of reproduction of the national economy and the AIC system, provides the population with food and raw materials for many other industries. This sphere includes enterprises and organizations of various legal and economic forms that are directly engaged in the production of agricultural products. Rural farm is characterized by the internal driving forces of self-development, but it requires close ties with other industries, including industry, which is also interested in the growth of quantitative and qualitative Indicators agriculture.

The third sphere is the industry for processing and preservation of agricultural products. These include – milling, bakery, feed mill, sugar processing, canned food, wine-making, flax processing, alcohol-starch, milk-processing, meat processing, as well as partly light industry for processing agricultural Raw materials, processing of wool, fur, etc.

The fourth sphere – includes production and social infrastructure.

In general infrastructure is all that is under the structure (literal understanding). In a large encyclopedic dictionary "infrastructure" is interpreted as "a complex of industries that serve the industry, agriculture. It includes the construction of road roads, canals, reservoirs, ports, bridges, aerodromes, warehouses, power plants, rail transport, communications, water supply and sewerage, general and vocational education, the cost of science, health care, etc." [18, p. 291]. Earlier, the infrastructure was usually attributed to production and non-production IE, the social infrastructure. To date, the types of infrastructure also include: financial, informational, ecological, innovative, spiritual and cultural, etc. infrastructure. Thus, the infrastructure provides the necessary conditions for the production and consumption of products, as well as the life of the population.

To the fourth sphere of agriculture include: trade in food products, public catering, road transport, communications, logistics, providing repairs of agricultural machinery etc., storage and turn the economy, research institutions, advanced training, training, etc.

It is also necessary to emphasize the importance of social infrastructure, which is part of this sphere and provides the appropriate conditions for development and satisfaction of material and spiritual needs and safety of life of population in the sphere of labor, family, life, social, political, spiritual, intellectual development, as well as protection of rights, freedoms, order protection and ecology, reproduction and improvement of environment, etc. The development of social infrastructure is of great importance for the socio-economic development of rural areas, providing health care, electricity, communication, etc.

Thus, the production and social infrastructure, which belong to the fourth sphere and is an integral part of agriculture, whose activity is aimed at ensuring effective production of agriculture and industry and to ensure conditions of development and satisfaction of material, spiritual needs and safety of life of population.

Thus, the constituent structure of agro-industrial complex includes four spheres, which are represented: branches, which produce means of production for agriculture and other industries that ensure maintenance of agriculture; agricultural production; industries on processing and preservation of agricultural products; production and social infrastructure. Each component of the AIC is characterized by specific functions. In this agro-industrial complex should be considered as a certain system.

In the reproducing process, all four spheres of AIC function on the principle of close relationship and interaction to achieve a common goal. In general, "reproduction" characterizes qualitative and quantitative changes in the socio-economic development of the region, country, etc. Essence of "reproduction" is in continuous restoration of economic processes and primarily production process, including agricultural products. Its main goal is to meet various growing needs of the population, which in turn is at the same time a prerequisite for reproduction.

Qualitative changes in agriculture are characterized by a constant dynamics of rational proportionality between the totality of resources and needs in the final product of AIC. The stability of reproduction in agriculture, as qualitative changes of the entire complex, are achieved under the conditions of ensuring the optimum pace of economic growth and development of agriculture. The stability of agro-industrial reproduction depends on the ability of subjects to continuously support dynamics and rational proportionality between reproduction factors in AIC and the necessary pace of development.

As already noted, AIC-forming subsystem of the national economy, this should be considered as a system, because *AIC has all the properties that are inherent in any system, namely:*

- Firstly, AIC is a subsystem of the national economy, operating at different levels of social reproduction: state, region, etc.;

- Secondly, speaking the subsystem of the state or regional national economy, agriculture consists of a set of industries, sub-sectors, companies that interact in the course of public reproduction have horizontal or vertical relationships;

- Thirdly, AIC can be considered as a relatively independent system, which has its subsystems, which can also be regarded as separate relatively independent systems.

AIC inherent in such signs of any system, as:

- the integrity and primacy of the whole in the system; in this case, a single whole is not the sum of its parts, and the system itself acquires the properties that are inherent in it;

- structured, intricacy of heterogeneity and structure diversity;

- hierarchical – occurrence as a certain part (subsystem) in a system of higher order and the possibility of separation into certain parts (subsystems), which, in turn, can act as relatively independent systems;

- the actions and/or development of one or more components of the system or its subsystems change the stability or development of the system as a whole;

- interrelation with external environment, being an interconnected system, AIC acts as an open, independent system, which inherent adaptability, continuity functioning and development;

- dimension, reliability, stability, optimal development, etc.

How any open AIC system feels the influence of external factors? Such factors of external influence on agriculture include: changes in law-regulatory field, political situation in the country, instruments of macroeconomic regulation (fiscal, monetary, credit, foreign economic, macroeconomic) social responsibility of the business, interaction with government and regional authorities, corruption, etc.

Thus, AIC can be considered as a self-organizing system (see fig. 1.2), as the AIC is inherent in such properties as: integrity, structure, difficulty inhomogeneous and diversity of the building, the hierarchy of interrelation with the external environment, dimension, reliability, stability, optimal development, etc. At this, agriculture acts as a subsystem of higher order of the national economy, regional complex, etc.

In our opinion, the agro-industrial complex should be considered as a complex integrated socio-economic system of interrelated industries about the production, distribution, exchange and consumption of agricultural products, which are inherent specific (certain) functional signs that carry out the reproduction of production forces and industrial relations.

Thus, despite the heterogeneity of the structure of AIC components of the socio-economic nature of the complex, as a specific subsystem of the *national economy gives the opportunity*:

- consider functioning of a complex from the position of unification of all its spheres as systems;
- taking into account close links between the branches to allocate enlarged spheres of agro-industrial complex providing means of production, production of agricultural products, its processing, preservation, bringing to the consumer;
- to take into account the needs in formation and development of industrial and social infrastructure;
- make strategic decisions to ensure the reproducing cycle of agricultural products obtaining and bringing it to the consumer and the development of agriculture as a whole.

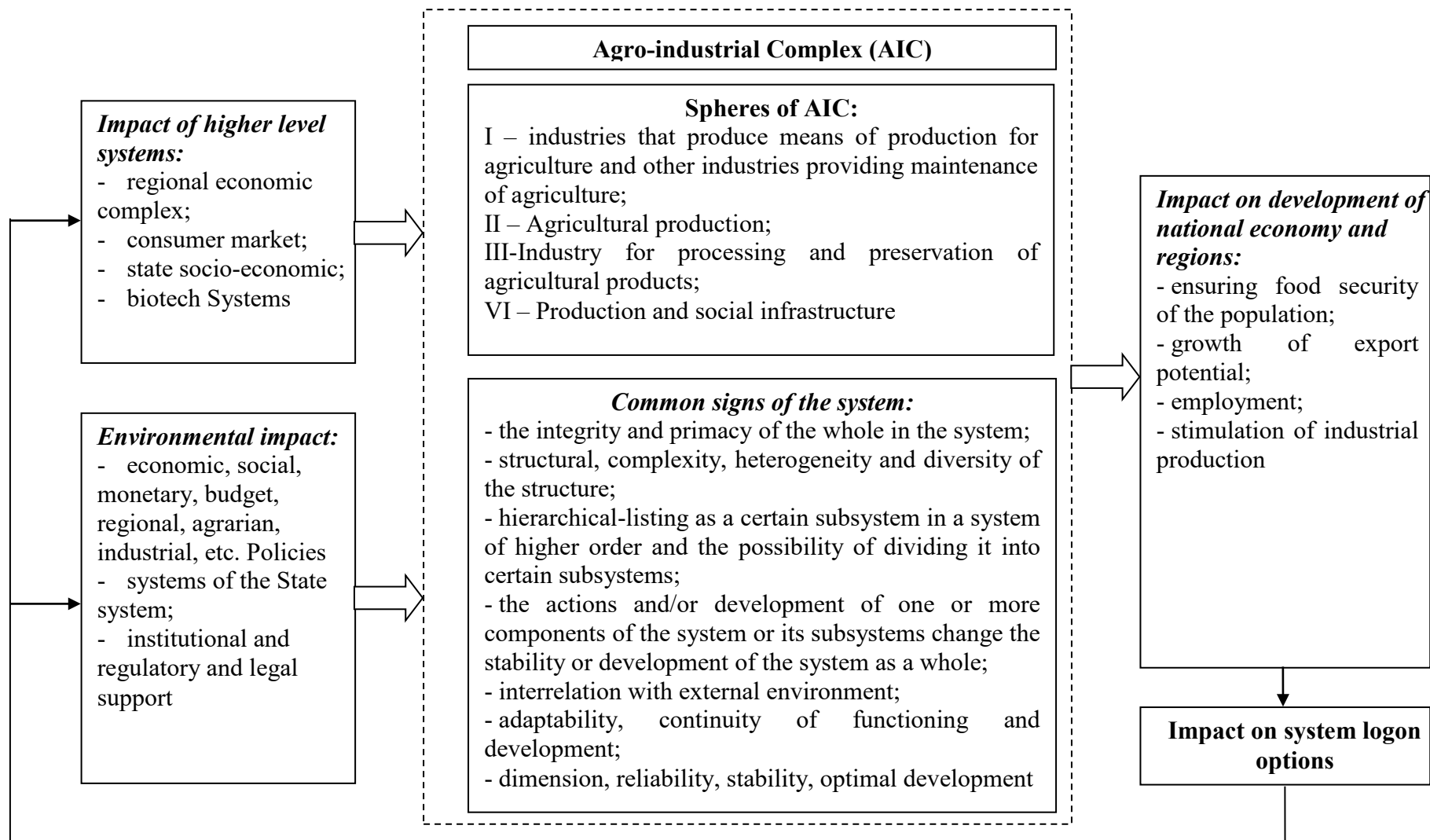


Fig. 1.2. Scheme of agro-industrial complex as a system

Source: Developed and substantiated by the authors.

AIC as a system inherent in a certain condition, which can be characterized by its development.

In general, the concept of "development" in the scientific turnover was introduced by G. F. Hegel, W. L. Byuffon, I. Kanom. This concept describes the mechanism of functioning of many spheres, but there is still no single concept of development, although it is outlined by its main principle, namely, according to the UN Conference on Environment and Development in "Rio + 20" proclaimed that "development must meet the needs of modernity, but it does not compromise the ability of future generations to satisfy their own needs" [150].

Under the development considered "natural changes, the transition from one state to another, the transition from the old quality state to the new, more perfect, from simple to complex, from the lowest to the higher" [148, p. 658]. Also, *under the "development" understand*:

- "dynamic process which is inherent in any phenomena" [130];
- "irreversible directed change of the objects, as a result of which there is their new qualitative state" [167];
- "a set of directed, intensive and qualitative changes of economic nature occurring as a result of contradictions in the internal environment and under the influence of environmental factors" [65, p. 75];
- "the process of comprehensive changes, which aims at transition to a new qualitative-quantitative state of the object under the influence of factors of the internal and external environment, which are in time and space" [22, p. 22];
- "systematic, long-term and massive improvement of the material and spiritual living conditions of people on the basis of productivity and capital growth" [110, p. 85].

It should be emphasized that the development:

- may present with a particular lag of time in the form of irreversible, logical, directed change of the state, parameters, components, relationships, etc.;
- it may be inherent cyclical, in condition of a general tendency to increase, and therefore it can be in the form of both progression and regression;
- is caused by certain influence of external and internal factors and/or certain actions, such as regulation, resource supply, etc.;
- may undergo various stages of development, namely nucleation, leakage, transformation;
- leads to the emergence of new qualities, signs, properties, etc.

Thus, the concept of "development" makes it possible for us to determine that under the development of agro-industrial complex it is necessary to understand the process of aggregate changes of state, interrelations, interaction of agro-industrial complex and its components, operating in space and time, aimed at transition to a new qualitative and/or quantitative status under the influence of internal and external influence factors.

AIC sees agro-industrial integration, which promotes the formation of a single economic complex, which are inherent inter-sectoral relations. For agricultural development it is necessary to balance and to proportional development, interests, purposefulness between components of the complex and its participants. In our opinion, agriculture is appropriately regarded as an interdisciplinary territorial complex, formed at the regional level, which enables to develop strategic measures, taking into account the regional specifics of AIC functioning and needs of the region.

In our opinion, the term "region" is appropriate. In general, there are more than 200 definitions of the concept of "region". Their diversity is due to the fact that "the region" is interpreted from a historical, geographical, political point of view, as well as taking into account the economic and structural characteristics. This led to the use of two approaches to territorial boundaries of the region. Some researchers [9; 20; 91; 144; 207] believe that the region does not coincide with the territorial and administrative boundaries, justifying such statement by geographic and ethnographic peculiarities, development of social infrastructure, natural resource specialization, directionality of production forces, etc.

Other scholars [31; 64; 121; 122; 188; 233] whose minds we share define the region as a territorial formation that has a defined administrative border. This also corresponds to the interpretation of the term "region" by the law of Ukraine "on stimulating regional development", which stipulates that "the region is the territory of the Autonomous Republic of Crimea, the region, the cities of Kyiv and Sevastopol" [74, p. 1]. Definition of the entity of the concept "region", as the territorial formation with a well-defined administrative boundary, having a local authority of the territory, provides an opportunity to consider it as a socio-economic spatial integrity with internal and external connections and interconnected elements, where there is reproduction of social and economic processes of public life provision.

This interpretation of the term "region" makes it possible to consider it a certain administrative territory that has economic cohesion and integrity and take into account the specific features inherent in a particular region, taking into account the existing regional capacity and resources.

As already noted in figuring out the structure of AIC agriculture, acting as one of the spheres of agriculture, plays a leading role in it. The production of agricultural products directly depends on the climatic conditions of a particular region, therefore the regional aspect acquires in the management of agriculture development of special importance.

Natural climatic conditions and regional division of labor stipulate the specialization of agro-industrial regions: territorial concentration of production, processing and storage of certain agricultural products. This, in turn, influences the efficiency of use of natural and human resources and contributes to reduction of the cost per unit of production.

In addition to climatic conditions of operation, the development of agro-industrial complex depends on the level of economic development of territories, provision of human resources with certain qualifications, development of industrial and social infrastructure, population consumption. All these factors can vary significantly at the regional level.

Thus, for example, the specialization of agro-industrial complex is determined by scientifically-grounded standards of food consumption taking into account effective demand per capita in the region. In this case, significant territorial differences traced not only in solvent demand, but also in the consumption of certain types of products, due to demographic, natural, religious and other features.

For agricultural products it is important to spend time on transportation between production, harvesting of raw materials, industrial processing, manufacturing of final products and consumption. This, in turn, determines the territorial concentration of production, processing, manufacturing and consumption of agricultural products. Such territorial

concentration is a unified integrated system of AIC in the region, which is formed by the agro-industrial complex of the country. It should be noted that AIC regions are not functioning separately, but on the basis of cooperation and integration with each other.

The reproducing process in agriculture at the regional level is due to the fact that when using natural, manpower is provided production, distribution, exchange and consumption of products both in the region and beyond. Partial reimbursement of resources and increase of production capacity is primarily due to the resources of the regions.

Conducted research on defining the essence of concepts of "AIC", "region", factors of influence on the formation of agricultural specialization, as territorial concentration of production, processing and storage of certain agricultural products makes it possible to define the concept of "region AIC".

Under the "AIC of the region", in our opinion, it is necessary to understand the component of AIC diversified system, which carries out the process of agro-industrial integration of technologically, organizationally, economically related enterprises of different forms of ownership, including industrial and the social infrastructure, in order to ensure food security and export potential of the region and the country as a whole, taking into account the territorial concentration of production, processing and storage of certain agricultural products.

Thus, in AIC regions of the industry are integrated according to the territorial and production principle, the functioning of which on the basis of cooperation and integration between the country's agriculture as a whole. The development of agro-industrial regions is extraordinary

important not only for food safety, but also for the development of regions and the state in general.

Based on a study of the concepts of structuring the economy, which formed the scientific idea of the agro-industrial complex, different approaches to the interpretation of the essence of concepts "agro-industrial complex", "agro-industrial complex of the region", "development", "development of the agro-industrial complex", "region" has acquired further development of the interpretation of these concepts, which, in its turn, provides an opportunity to move to study of theoretical and methodical aspects of organizational and economic mechanism of AIC development of regions.

1.2. Components of the organizational and economic mechanism of the development of agro-industrial complex of the regions

Analysis of concepts of structuring of economy and clarification of conceptual and categorical apparatus on development of agro-industrial areas allows us to investigate essence of organizational-economic mechanism of agro-industrial areas development and its components.

The concept of the mechanism (from the greek – machine) has come into circulation of economic categories in 60 of the last century from the mechanics, where it was under the mechanism that "a set of interrelated among themselves and tangent elements that allow the physical object to perform the necessary movements and move in space, that is, to move" [193, p. 117]. But the original source of using the concept of "mechanism" is the philosophy and its scientific trends of XVI – XVIII centuries, which were united in a philosophical scientific school called "mechanism". Moreover, philosophers Heraclitus, Kcline, Fales and others adhered to the mechanical concept of the world, which was based solely on the rational laws of the device of the universe since the ancient Greece. In the XVIII century. Such well-known scientists as S. Barasso, I. Bekman, P. Gassandy, T. Gobs, R. Descartes, M. Mercenis, I. Newton due to their scientific achievements argued rationality of the structure of the world and are considered the founders of mechanics as a separate stream in philosophy, and known for their advances in other fields of science. The concept of "mechanism" began to be widely used in the

works of such scholars: P.-P. Laplaza, J. O. Laometer, P. A. Holbach and many others not only in philosophy, but in natural sciences [90, p. 98].

The wide use of the concept of "mechanism" in the economic circulation is due to the fact that with the help of this term it is possible to describe interaction of production and social process that is represented by prototypes of elementary, simple mechanisms [14].

The concept of "mechanism" is regarded by the Nobel laureates in 2007 by L. Gurvits, R. Marerson, E. Maskinin, who argue that "any interaction between economic entities can be regarded as a certain strategic game, the form of which will be the mechanism. The game refers to a description of how the players can act and what any set of actions will lead to" [199]. L. Gurwitz under the mechanism understands "interaction between entities and the centre" [199]. Some scholars have criticized the "gurvits mechanism" as one that does not take into account the resources necessary for its functioning [90, p. 100].

Also, the interpretation of the term "mechanism" is presented in the methodology of 1981 IDEF0 developed within the framework of the automation program for industrial enterprises in the USA, which states that "activity of the enterprise is regarded as a process that is presented in the form of the functional block, which converts the "inputs" to "outputs" in the presence of the necessary resources, the mechanism is considered as a separate resource "[131, p. 49].

The difference in using the concept of "mechanism" is that in technical sciences use the resource approach, and in economic-system or process.

Under the mechanism, using a systematic approach, understand:

- "system of certain parts and elements, which leads to the action of a certain system, or method, a device defining the order of a certain type of activity" [67, p. 355];

- "system defining the fixed order of a certain type of activity" [169];

- "a system that defines the order of a certain type of activity, which has a complex organized system that recycles the incoming conditions prevailing in the desired way – processes" [120, p. 124];

- "system of economic means, forms and methods of action, which includes such elements as: regulatory framework, economic sanctions, pricing, stimulation of labor, criteria of efficiency assessment, etc." [77, p. 29].

Using a process approach under the mechanism understands:

- "the collection of economic process resources and ways of their interaction for the implementation of this process" [226, p. 30];

- "the order of the process, which is based on its stages, which now determine the priority of the tasks" [28];

- a combination of specific forms, methods, algorithms and instruments of conscious choice and influence on economic phenomena and processes;

- "collection of specific forms, methods, algorithms and instruments of conscious choice and influence on economic phenomena and processes" [89, p. 111].

There are also definitions that combine both systemic and process approaches, which are the "mechanism":

- "internal structure, system of something or totality of states and processes, which are of certain phenomena" [27, p. 673];

- "system of parts working in a particular machine, as well as a certain process by which something happens" [212].

In our opinion, it is not possible argue that the mechanism is a complex organized system, but the main thing is that it is constantly accompanied by a certain process, without which the mechanism can not exist, aimed at the performance of specific functions, as well as the process of must be provided with certain resources to get the result.

Thus, a study of the essence of the concept of "mechanism" makes it possible to argue that the genesis of this concept has a significant theoretical basis, but it remains debatable and requires further research. Today in economic science are widely used derivative concepts: "economic mechanism", "economic mechanism", "socio-economic mechanism", "organizational and economic mechanism", "financial mechanism", "market mechanism" and so on.

We agree with the statement by the French scientist Charles Rista, who is considered to have coined the concept of "economic mechanism" [174], and argued that certain initial economic processes lead to the formation of successive phenomena that, in turn, lead to a certain result.

Definition of the interpretation of the concept "mechanism" makes it possible to move to definition of the essence of the concept "organizational and economic mechanism". Despite the fact that the very term "organizational and economic mechanism" is widely used in economic literature, there is still no single view on its essence. Definition of the concept of "organizational and economic mechanism" by various scientists who use system and/or process approaches presented in table. 1.3-1.5.

Table 1.3

*Understanding the essence of the concept
of "organizational and economic mechanism" as a system*

Author and / or source	Definition of the concept	Definition features and / or deficiencies of definition
1	2	3
F. Zynovev [77, p. 29]	The system, which defines the procedure for concrete actions, at the same time he considers organizational and economic mechanism separately. Organizational mechanism-the organizational and technological means of farming rely its potential, using market principles of management (self-reliance, contractual relationships, commercial interest, legal validity Activities etc.). Economic mechanism-system of economic means, forms and methods of action for material interests of workers of production and non-production facilities, including such elements: pricing, stimulation of labor, economic sanctions, regulatory framework, evaluation criteria Efficiency	The system, which defines the procedure, but the organizational mechanism is-the organizational and technological tools that are examined at the macro level, and the economic means the system of economic funds, which is considered in relation to the micro-level
G. Astapova, H. Astapova, D. Loyko [11, p. 143]	System of elements of organizational and economic influence on management process	Controversial is the assertion of the influence of organizational elements in the management itself, and also why only the management
S. Tulchynska [208, p. 92]	State influence at national, regional and micro levels of economic, legal, organizational nature in order to ensure sustainable relations between them, forming mutually beneficial conditions for economic activity	Methods, forms, levers of State influence for the implementation of economic activities
V. Kushniruk, O. Yermakov, O. Shebanina [108, p. 9]	System of organizational and economic forms and methods of farming, which encourages to increase the efficiency of production systems and is aimed at conscious use of economic laws and achieving the set strategic goals Business Entities	Noted that the mechanism operates on the basis of economic laws, but without denying this statement, its action is wider than economic laws, including legal, political, social, etc.
Vikhrov M. [29, p. 67]	The system of economic levers, through which both external and internal economic relations are organized	Economic levers system, but the organizational component is not considered

Continuation of Table 1.3

1	2	3
Y. Lysenko, P. Egorova [114, p. 86]	The system for the formation of goals and incentives, which allows to turn into the process of labor movement of material and spiritual needs of members of society in the movement of means of production and its final results aimed at satisfying effective demand Consumers	The system of goals and incentives aimed at satisfying demand, but this definition does not characterize the peculiarities
A. Goncharuk [35, p. 170]	System of methods, operations, levers, organizational structures and their interrelations that determine the content of the management process	Is reduced to the management, but in our view, the OEM is more broader concept
I. Bile, Y. Lysenko, P. Egorov [13, p. 8]	System of goals and incentives, which allow us to convert in the process of employment the dynamics of material and spiritual needs of society in the dynamics of production and deliverables, aimed at the full and effective satisfaction of these Needs	This definition indicates the need to determine the forms and methods by which the mechanism will be implemented, as the incentive is one of the tools of an effective organizational and economic mechanism
O. Vasylyk, O. Noyanov [39, p. 22]	Integral system of elements of organizational and economic influence on the managerial process, in which the purposeful transformation of influence of controls on a control object and which has incoming parcels and resultant reaction takes place	We consider the OEM as a complete system with elements of influence on the control object
O. Savchenko, V. Soloviev [183]	Part of the system of management in specific period of development of national economy of any country and is a set of two dissimilar but interrelated components-organizational component and economic component	Organizational component and economic component, considering as part of the system of economic
O. Khaetska [214, p. 37]	The system of organizational and economic levers, instruments, factors influencing the economic activity of enterprises, industries, food subsystems, aimed at increasing its efficiency. Due to the organizational and economic factors This mechanism combines objective and subjective aspects of human activity	Definition does not reveal the features of the mechanism

Source: compiled and summarized by the authors on the basis of [11; thirteen; 29; 35; 39; 77; 108; 114; 183; 208; 214].

Table 1.4

*Interpretation of the essence of the concept
of "organizational and economic mechanism" as a process*

Author and / or source	Definition of the concept	Definition features and / or deficiencies of definition
1	2	3
M. Korobeynikov [95, p. 43]	As far as the well-developed, established, balanced head, economic segment of the economic mechanism, such effective is the mechanism of management in the macro-and micro-levels of the economy, its intersectoral complexes, branches, regions, primary Links	considers the core mechanism of the economic component; The definition is very general
O. Datsiy [40, p. 39]	Organizational and economic device, for the successful operation of which requires coordination and "rubbing" of all its units, that is correctly and competently initiated innovative activities, taking into account the factors affecting the organizational and economic mechanism , which creates preconditions for effective innovation implementation	Noted on the coordination of all units of the mechanism, which creates conditions for its effective implementation; Focus on innovation
A. Kulman [101, p. 34]	A certain aggregate or sequence of economic phenomena	The totality of the phenomena does not reflect the effect on object
Modern economic dictionary [194]	A set of organizational structures and specific forms and methods of management, as well as legal forms by which the process of reproduction is realized in operating under specific conditions economic laws	It focuses on the aggregate of organisational structures and management
P. Sabluk [180, p. 4]	Should include mechanisms that Regulate economic activity of enterprises: organizational construction, planning, financing, pricing, stimulation, crediting, accounting and control, internal and external actions	is reduced to the micro-level, regarded as a mechanism for regulating economic activity of the enterprise
A. Tridid [206]	Aggregate (set) of legal and procedural laws, methods, methods, procedures and technologies of decisions that implement the process of enterprise development and exist information or materially in the system of enterprise management	Reduced to micro-level; Noted on the Enterprise management system

Continuation of Table 1.4

1	2	3
V. Shimanska [231, p. 162]	Is a way to ensure the implementation of the requirements of objective laws in the process of subjective human activity; Specifies the rules of the economic game, focusing the activity and behavior of business entities in the direction of realization of certain goals. OEM significantly wider the scope of economic laws and specific forms of their manifestation, as it covers in addition to basic and superstructure relations-political, ideological, moral and ethical, legal and other, actively influencing the basis	Without denying the claim that OEM contains "political, ideological, moral and ethical, legal and other relations..." It is controversial that "OEM significantly wider the scope of economic laws..."
J. Luzan [117, p. 4]	The influence of objective laws on the basis in the process of subjective human activity, covering broad superstructure relations (political, ideological, moral and ethical, legal, etc.)	The OEM is to implement the requirements of objective laws

Source: compiled and summarized by the authors on the basis of [40; 95; 101; 117; 194; 180; 206; 231].

Table 1.5

Interpretation of the essence of the concept of "organizational and economic mechanism" using a comprehensive approach

Author and / or source	Definition of the concept	Definition features and / or deficiencies of definition
A. Onishchenko [1]	Obeys objective laws of development of society, but at the same time it is active self-organized system with flexible, mobile internal and external connections and is in constant development and changes according to changes Social relations	Considered as a mortganized system; Noted on the internal and external linkage mechanism, but the definition more reflects the features of the system, rather than the mechanism
T. Kravtsova [97, p. 95]	Component (the most active) part of the control system, which provides an impact on the factors, the condition of which depends on the outcome	Part of the control system
Great economic dictionary [17]	is a collection of various processes, sequences of state or part of some system, the order of defining economic activity	The wide definition according to which the OEM is regarded as a process as a part of the system and as a procedure for defining economic activity

Source: compiled and summarized by the authors based on [1; 17; 97].

Thus, the definition of the category "organizational and economic mechanism" *based on the systemic and/or approaches evidence that:*

Firstly, there is no single point of view on the essence of this concept;

Secondly, most researchers believe that it should take into account certain goals, objectives and means of achieving them;

Thirdly, it represents a certain system of organizational and economic forms, methods, levers, instruments, procedures, etc., operating at different levels of the economy;

Fourthly, it acts in the framework of objective economic laws with respect to certain objects and subjects, based on certain principles.

Thus, in our opinion, organizational and economic mechanism is a certain set of elements of organizational and economic nature (objects, subjects, goals, objectives, methods of interaction, methods, levers, tools, etc.), interconnected and interconnected with moving internal and external connections on the macro-, meso-, microlevels of the economy, its interbranch complexes, branches, primary links, etc., the effectiveness of which depends on the ability to create absent in the specific Links, elements, incentives, etc.

In different spheres of economic activity organizational and economic mechanism has its specificity. Scholars ' views on the essence of this concept are diverse. Let us analyze some definitions of the term "organizational and economic mechanism of AIC" in the context of regional development. Thus, S. O. Tyvonchuk and I. O. Tyvonchuk give the following definition: "The organizational and economic mechanism of traceability complex development is: the functions of the economic mechanism, methods of their implementation, objects and subjects,

directions for realization of activation of investment activity of entrepreneurial structures, aimed at achieving the competitiveness of functioning of the traceability complex industries and increasing 103 the 201 efficiency. The authors, considering the organizational and economic mechanism in relation to the traceability complex, emphasize the innovative development direction, which is especially important for the development of the entire agro-industrial complex taking into account the unsatisfactory condition of the property, plant and agriculture economy.

M. M. Lesov defines the organizational and economic mechanism of AIC as "the set of economic levers and instruments integrated into the system of economic interrelations, aimed at ensuring the development of rural areas within the framework of organizational structures (collectively, institutions and institutions), with a set of rules and regulations envisaged by them" [112, p. 101]. In this case, the author focuses attention on the development of rural areas.

R. I. Lobatyuk, without giving an interpretation of the essence of the concept of "organizational and economic mechanism of AIC", provides the composition of the components, which, in its opinion, relate to the organizational and economic mechanism of agro-industrial production, namely: "the composition of components includes: the creation of market-type entities; agrarian market infrastructure; organization of land relations; management system of agrarian sector; development of rural entrepreneurship; development of agricultural service cooperatives; rural development programmes; investment and innovation development; the system of state control and logistics; lending and banking services; insurance of agricultural markets; state support; price and customs-tariff

regulation; material and technical support; taxation equity market" [115]. But, in our opinion, such a list of components is incomplete and general at the same time, as well as it is desirable to distinguish it against either organizational and economic components, or to methods, levers, instruments of the mechanism itself.

Scientists D. K. Semenda and O. V. Semenda believe that the organizational and economic mechanism of AIC development is a "set of interrelated instruments and methods of influence and regulation of economic and social stabilization of agriculture and agricultural sector in general to implement the State economic policy to stimulate economic growth of business entities and increase employment of rural population. The components of this mechanism are regulatory, economic and organizational elements" [187, p. 60]. In this case, in our opinion, it is controversial to determine the purpose of the organizational and economic mechanism for development of AIC "on stimulating the economic growth of business entities and increasing the employment of rural population" [187, p. 60], since is taken into account the food security of the country, growth of agricultural workers, expanding export potential of agriculture, etc.

S. M. Khalattur organizational-economic mechanism of AIC defines: "The process of structural changes in the functioning of both private and state-owned enterprises that produce agricultural products; enterprises providing agricultural sector with the means of production, food industry and supporting infrastructure simultaneously with the improvement legislative framework, increasing the level of state regulation and planning of food sector development countries to adapt to modern conditions of escalation of global food problems" [215, p. 116]. Stressing on different

forms of ownership of agricultural enterprises, organizational and economic mechanism is essentially reduced to a mechanism of adaptation to the conditions of global food problem.

V. Yu. Hudolei under the organizational and economic mechanism for the development of agricultural regions understands "active system of certain levers, methods, functions aimed at ensuring development of regional agro-industrial complex with flexible dual external and internal ties, which are in the movement of constant changes under the influence of bifurcational processes of the environment" [225, p. 144]. Using a systematic approach to defining the organizational and economic mechanism, the author stresses the instability of the economy and the synergistic effect of interaction between the mechanism and the environment.

I. O. Kryakova stresses that the organizational and economic mechanism of AIC is "a set of organizational measures (legal, economic, technical and social) and economic activities of external and internal actions that are in the process of interaction and Interrelation actively influence on economic interest of subjects of economic activity in order to increase efficiency of agro-industrial production [98, p. 128]. In our opinion, it is successful separation of measures of organizational and economic nature, but the action of organizational and economic mechanism can not be reduced only to the influence of economic interest of business entities.

Thus, in relation to the definition of organizational-economic mechanism of AIC, *there are following statements of scientists that this is:*

- functions of economic mechanism, methods of their implementation, objects and entities;

- a set of economic levers and instruments integrated into the system of economic interrelations of AIC entities;
- components of the agricultural management system components;
- a set of interrelated instruments and methods of influence and regulation of the agro-industrial complex;
- complex of organizational and economic measures for AIC;
- aggregate forms, methods, economic levers and incentives, etc.

To such a variety of views of scientists on the organizational-economic mechanism of agro-industrial complex, in our opinion, ambiguous interpretation of the concept "mechanism" and "organizational and economic mechanism", but the general, which unites the views of scientists is that organizational and economic mechanism of AIC-part of all economic mechanism is effective factor in the interaction of all members of the agro-industrial complex. The development of agro-industrial regions depends on the established interaction of organizational and economic mechanism with agricultural entities, the degree and character of participation of regional authorities in it.

The study of the concept of "organizational and economic mechanism" made it possible to reveal its essence, characteristic features, uncover deterministic and stochastic relationships with other economic categories and define its methodical instruments.

The study of the essence of the concept of "organizational and economic mechanism" makes it possible to consider it in relation to the development of AIC.

Organizational and economic mechanism of agro-industrial complex development is a set of interconnected and interacting elements of the

organizational and economic nature of agriculture as a system, which makes it possible to intensify not only the development of AIC and its subjects, but also causes production and socio-economic developments in the regions.

Components of the organizational and economic mechanism of agricultural development of regions presented in Fig. 1.3.

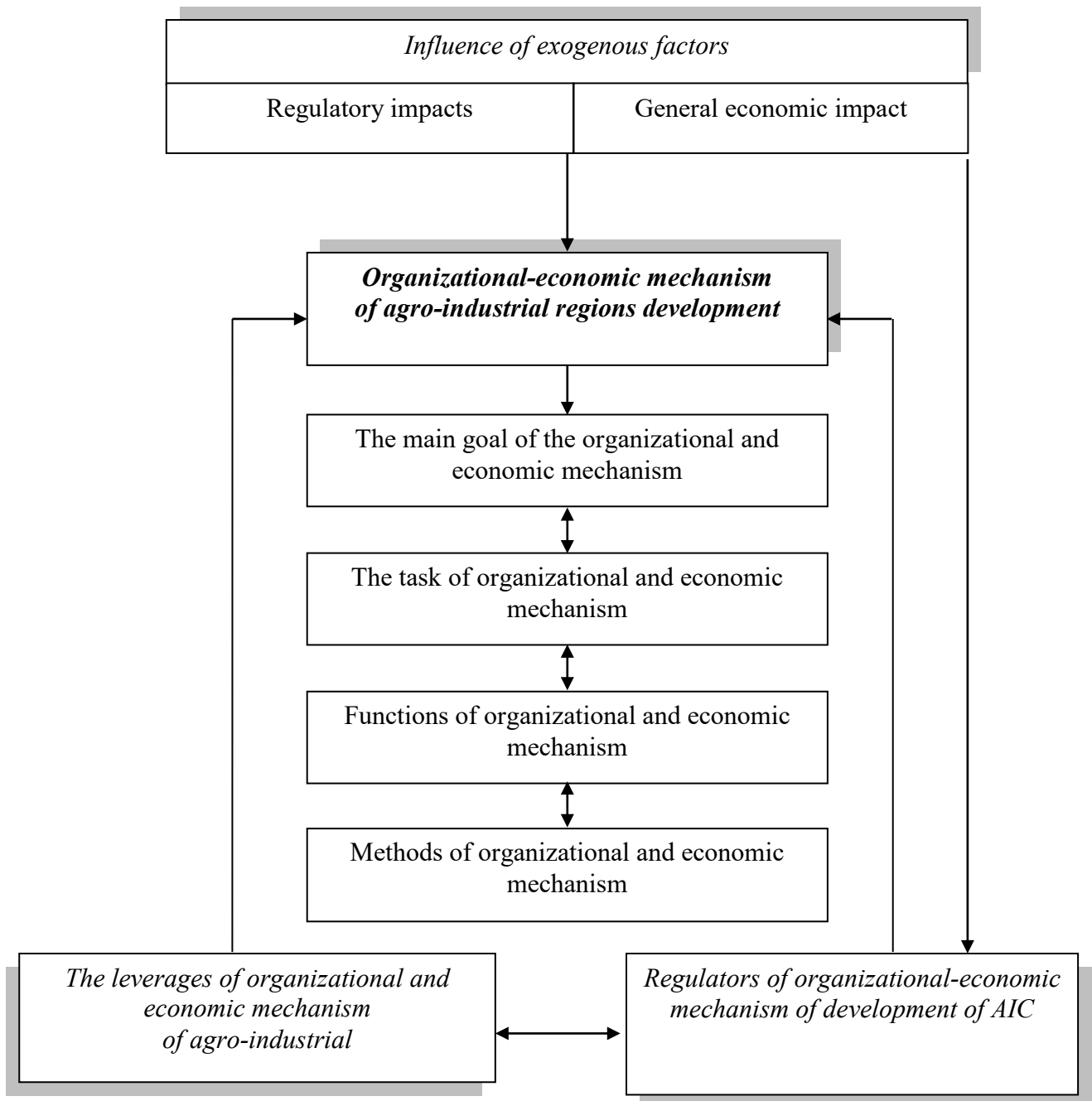


Fig. 1.3. Constituents of organizational and economic mechanism of development of agro-industrial complex of the regions

Source: Developed and suggested by the authors.

The action of organizational and economic mechanism manifests itself in relation to the subjects of AIC on the macro, meso- and microlevel. On the macro level there is a formation of normative and legislative field and creation of favourable conditions for development of AIC. At the regional level, the organizational and economic mechanism primarily considers regional opportunities, peculiarities and needs of the regions, aimed at achieving the strategic goals of the agro-industrial development in the regions. In relation to the microlevel organizational-economic mechanism is aimed at the direct activity of agricultural entities.

As already noted organizational and economic mechanism of agricultural development of regions is an integral part of the economic mechanism, but differs its specifics on the development of agriculture, namely the totality of methods, levers, instruments, objects, actors, etc.

Organizational and economic mechanism of agriculture development reveals its action through functions, under which you understand a steady way of active interaction of things, in which the change of some objects or processes causes change of others, what happens within a specific between entities and objects through direct and inverse relationships between them.

Organizational-economic mechanism performs certain functions. Study of literary sources [29; 36; 40; 66; 98; 108; 113; 201; 219] gave us the opportunity to define the functions of the organizational and economic mechanism in relation to the development of agriculture(see fig. 1.4).

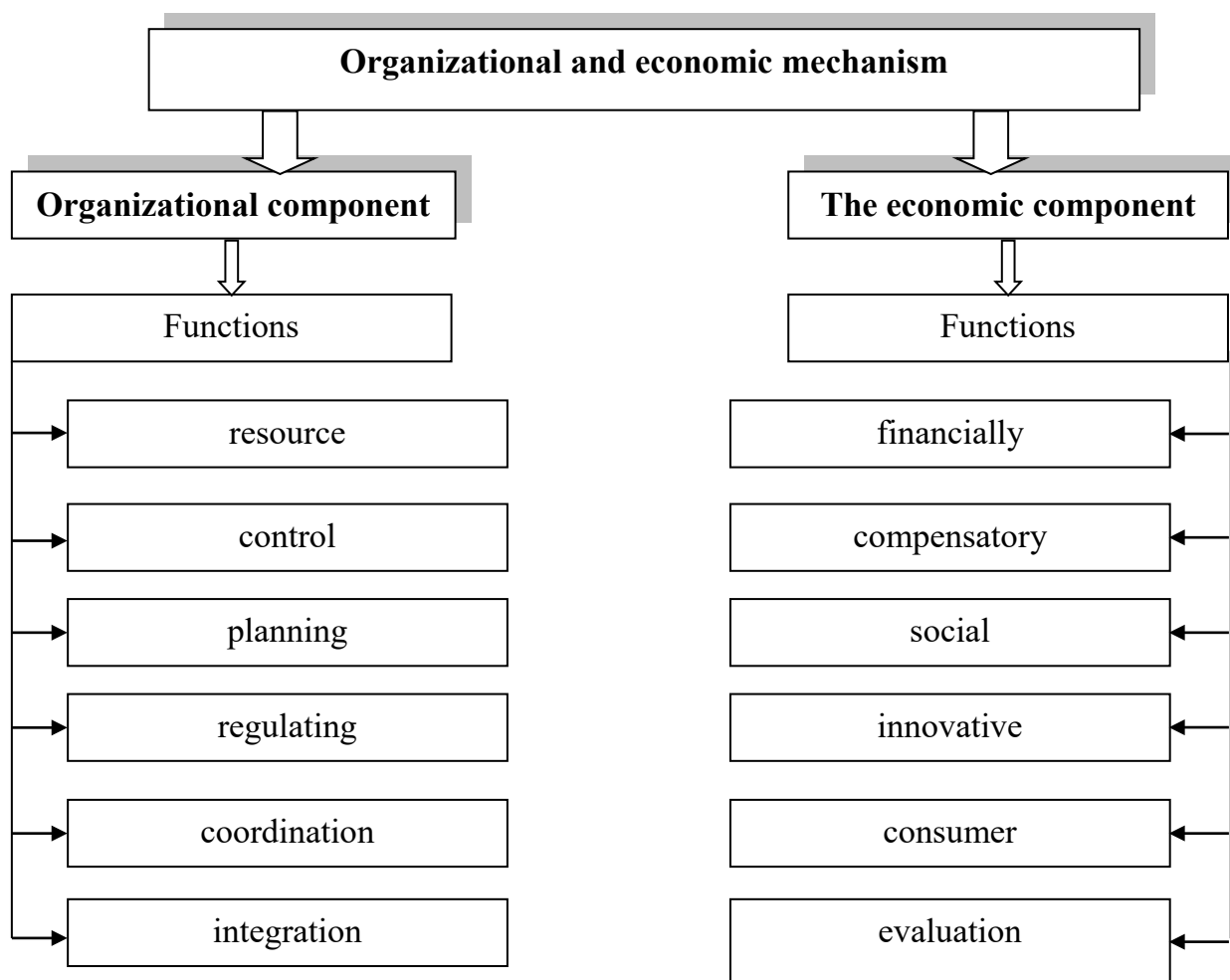


Fig. 1.4. Functions of organizational and economic mechanism of development of agro-industrial complex of the regions

Source: suggested by the authors.

These include functions:

- resource – provides distribution and redistribution of resources mechanism between the spheres of AIC and its entities in order to increase efficiency of their activities, contributes to the involvement, distribution and use of resources of the region in the agricultural sector, takes into account the state and regional support for agricultural entities;
- control – is realized on the basis of information on the development of agro-industrial complex, its spheres and subjects, allows to control the mechanism of attracting resources and obtained results;

- planning – management of agricultural development through establishment of strategic goals and objectives, development of strategic directions of agro-industrial development and its subjects taking into account available and potential resources;

- coordination – coordinates the actions of agricultural entities of regions and local authorities, which promotes obtaining synergy effect of their interaction;

- regulating-is carried out mainly by administrative methods, is to ensure compliance with normative legal acts, provides for regulation of activities in agriculture, establishing the norms of compliance with the level of economic security activities in agriculture and the country as a whole;

- integration – promotes the interaction of agricultural entities, including with state and local authorities, establishing mutually beneficial relationships between them, allows us to realize the integration and globalization processes, identify and remove the obstacle in the way development of agro-industrial complex;

- consumer – is aimed at providing a variety of needs of both the population and economic actors.

- innovative – focused on modernization of agricultural regions, development and introduction of innovative technologies and development of agriculture in general on innovative basis;

- financial – providing favorable conditions for attracting investment resources in the conditions of diversification of their sources;

- compensation – promotes leveling of social and economic imbalances between regions, the difference in income between employees of different spheres of agriculture due to various strategic measures, development programs of agro-industrial complex;

- social – is manifested in increasing prestige activities in agriculture, improving living standards of the regions, social development of the field of infrastructure of agriculture, etc.;

- evaluation – based on adequate assessment of the actual and potential opportunities of agriculture is carried out forecasting the development of agricultural areas and AIC regions in general taking into account the trends of economic development.

All the functions of the organizational and economic mechanism of agro-industrial development of the regions simultaneously act as independent, and are combined with each other dominants the development of AIC regions and its subjects. The direction of functions of the organizational and economic mechanism of agricultural development of regions to solve specific tasks and achieve the goals contributes to obtaining positive effect from the action of the whole mechanism. The functions of organizational and economic mechanism of agro-industrial development are objective and are due to aims of development of AIC regions and also are relatively self-sufficient.

The organizational component of the mechanism involves the implementation of such functions on the development of agricultural regions, as: resource, control, planning, coordination, regulating, and integration. The organizational component should provide interconnection and interaction between spheres, agricultural entities; local and state authorities (see fig. 1.2). The economic component of the mechanism includes: financial, compensatory, innovative, social, evaluation, consumer functions of the organizational and economic mechanism. The economic component is aimed at ensuring the development of agro-industrial complex

of regions and the state as a whole. The organizational and economic component of the mechanism, performing its functions, form an integral organizational and economic mechanism of agro-industrial development, which in practice promotes the development of subjects and spheres of AIC.

Since the organizational and economic mechanism operates on the subjects of AIC on a macro, meso- and microlevel, its main functions are aimed at ensuring interrelations and interaction of the subjects in all spheres of social reproduction and development of agro-industrial regions and the country in general.

At the macroeconomic level, the functioning of the organizational and economic mechanism performs the following functions:

- overcoming socio-economic contradictions;
- implementation of economic laws of development;
- meeting the needs and interests of a person;
- realization of property relations;
- stimulation of human development.

Functioning of organizational and economic mechanism of development of agro-industrial complex provides providing conditions that stimulate effective activity of all its subjects. Effectiveness of organizational-economic mechanism of development of agro-industrial complex depends on consistency of its structure, which ensures achievement of the main purpose of mechanism. The main purpose of the organizational-economic mechanism is to ensure the development of agriculture, its spheres and subjects.

Methods of organizational and economic mechanism of agro-industrial development is shown in Fig. 1.5.

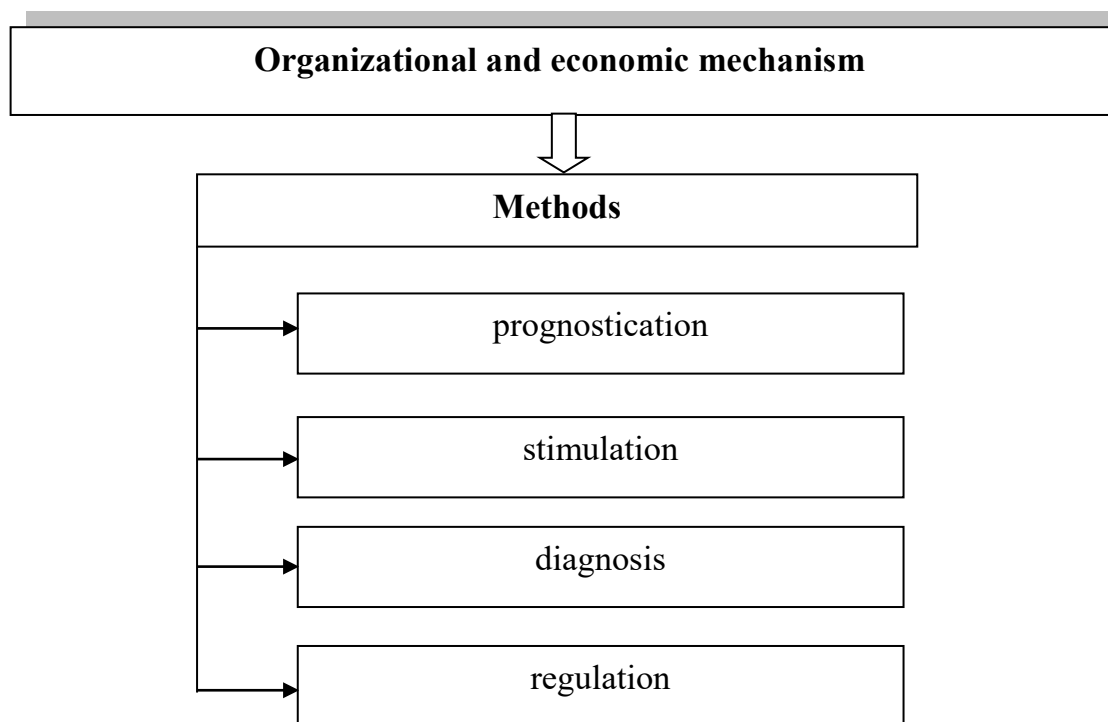


Fig. 1.5. Methods of organizational and economic mechanism of development of agro-industrial complex of regions

Source: suggested by the authors.

The methods of organizational and economic mechanism of agricultural development should include:

- forecasting of results of functioning of mechanism, development tendencies of regions, results of activity of subjects and spheres of agro-industrial complex, as well as development of agro-industrial complex;
- stimulation of effective activity and use of resources of subjects and spheres of AIC;
- diagnosing the mechanism and development of agriculture, planning the involvement and use of resources and potential opportunities for the development of agricultural regions, harmonization of development plans of different levels (state, regional, industry);

- adjusting the playback parameters, coordinating the actions of the mechanism subjects.

Since the organizational and economic mechanism of agribusiness development is a system (which proves the systematic approach to defining the essence of the organizational and economic mechanism), it is like any open system exposed to the external influence, to which it is necessary to influence of exogenous factors: regulatory influence and general economic impact.

Regulatory influence manifests itself in the establishment and provision of legal and regulatory regulation regarding the subjects of the mechanism, ensuring rights and interests, as well as economic security of their activities; optimal correlation between state and market regulation, creation of appropriate information support of the activities of AIC entities.

The general economic impact is manifested through inflationary processes, financial and budgetary and monetary and credit regulation, development of foreign economic relations and international cooperation, level of shadow economy and corruption, as well as efficiency level of effective demand, etc.

Levers of organizational-economic mechanism of development of agro-industrial complex are: tools of attraction of investment resources (crediting, public-private partnership), sanctions and privileges concerning the agricultural entities, amortization norms, taxes, rate of profit, level of competition development, etc.

Financial market regulators – prices, tariffs, dividends, discounting, interest rate, exchange rates and stock values, etc.

Thus, the study made it possible to define the essence of organizational and economic mechanism of agro-industrial complex development, its components, purpose, tasks, functions and establish that the organizational and economic mechanism of agro-industrial regions development cannot be regarded as the abstract totality of certain static components of its elements. Dialectics of elements of organizational-economic mechanism of development of agro-industrial complex apply not only to the subjects of AIC, but also has an influence on the organizational-economic mechanism and its qualitative characteristics.

Conclusions to section 1

1. Research of scientific schools on structuring of national economy and the role of agrarian sphere in development of economy from works of F. Kene, A. R. Turhgo, K. Marx, V. Leontieva, K. Clark, A. Fisher, Zh. Furonet to modern works of scholars makes it possible to assert an exceptional role of agricultural development in meeting the needs of society and economic growth, which in turn has made it possible to form a scientific idea of the structure of agro-industrial complex

2. It is established that AIC should be defined as a subsystem of the national economy, regional complex and as a certain independent system, as the agro-industrial properties are inherent in the system as: integrity, structure, complexity, heterogeneity and diversity of buildings, hierarchy, interaction with the external environment, dimension, reliability, stability, optimal development, etc. In this case, the components (subsystems) AIC can act, in turn, as a relatively independent system interconnection and functional directivity of AIC as the system gives a more resultant effect than the sum of effects of its subsystems, which are four in accordance with the structural structure of AIC.

3. Based on the fact that the scientific search for the definition of the entity and the reasoning of the value of the "agro-industrial complex" is still ongoing, the author's interpretation of this economic category is a complex, integrated socio-economic system of interrelated industries about the production, distribution, exchange and consumption of agricultural products, which are inherent in specific (certain) functional signs.

4. As a result of research it is reasonable that structural structure of AIC is represented by:

- Firstly, industries that produce means of production for agriculture and other industries that provide service to agriculture;
- Secondly, agricultural production;
- Thirdly, industries on processing and preservation of agricultural products;
- Fourthly, production and social infrastructure.

5. Under the AIC region should understand the component of AIC, diversified system, which carried out the process of agro-industrial integration of technologically-organizational and economically related enterprises of various forms of ownership, including industrial and social infrastructure, to ensure food security and export potential of the region and the country as a whole, taking into account the territorial concentration of production, processing and storage of certain agricultural products.

6. Established that development:

Firstly, it manifests itself with a certain lag of time in the form of irreversible, logical, directed change of the state, parameters, components, system connections, etc.;

Secondly, as a certain regularity to it inherent cyclical and different stages of development;

Thirdly, it can be in the form of both progress and regression;

Fourthly, is caused by certain influence of factors of different nature and/or certain actions;

Fifthly, it leads to emergence of new qualities, signs, properties, etc., both systems and its components.

7. Development of agro-industrial complex is the process of aggregate changes of state, interrelations, interaction of AIC and its components, operating in space and time, aimed at transition to a new qualitative and/or quantitative status under the influence of factors of internal and external influence. The need to develop AIC caused by transition from one state of development to another and functional purpose AIC.

8. Research the essence of the concept of "organizational and economic mechanism" made it possible to formulate the author's interpretation of the essence of the concept namely, as a set of elements of organizational and economic nature (objects, subjects, goals, tasks, methods of interaction, methods, levers, instruments), interconnected and interacting with each other with movable internal and external connections on macro-, meso-, microlevels of the economy, its interbranch complexes, branches, primary links, the effectiveness of the implementation of which depends on the ability to create absent at a specific moment relationships, elements, incentives.

9. It is established that the organizational and economic mechanism of agricultural development makes it possible to intensify not only the development of agro-industrial complex and its subjects, which contributes to ensuring food safety of the population, agricultural raw materials, solving social and economic problems, but also determines the industrial and socio-economic developments in the regions. It is substantiated that the development of AIC is a consequence of the implementation of organizational and economic mechanism, but it is reversed dependence. The result of the organizational and economic mechanism of agribusiness development is economic, social, environmental and other effects in accordance with the goal.

CHAPTER 2

ANALYSIS OF THE ORGANIZATIONAL AND ECONOMIC MECHANISM OF THE AGRICULTURE DEVELOPMENT OF THE REGIONS

2.1. Analysis of the organizational and economic mechanism of agro-industrial complex of the regions

As already marked organizational and economic mechanism of agro-industrial development is a system which influences the exogenous factors, which manifests itself in regulatory and general economic effects. As to regulatory influence, the organizational and economic mechanism of agro-industrial development operates in accordance with the Constitution of Ukraine and the Commercial Code of Ukraine, in accordance with the principles of which the State provides: protection of all agricultural entities of the regions, consumer rights, national commodity producers, the security of society and the State; freedom of entrepreneurial activity; free movement of capital, goods and services; restriction of state regulation of economic processes in connection with the need to ensure the social economy, perfect competition in entrepreneurship, environmental protection of the population; prohibition of unlawful interference by state authorities and local self-government bodies, their officials in economic relations, etc. [37].

Regulatory influence is carried out through the state regulatory policy in the sphere of economic activity, including activities of agricultural entities, which, in accordance with the legislation of Ukraine, is defined as the direction of state policy aimed at improvement of legal regulation of economic relations, as well as administrative relations between regulatory authorities or other public authorities and business entities, preventing the adoption of economically impractical and ineffective regulatory state interference in the activities of business entities and elimination of obstacles to the development of economic activity, which is carried out within the procedure and in the manner established by the Constitution and laws of Ukraine [166, article 1]. The general economic influence and vector of development of socio-economic and political relations of Ukraine influence on organizational-economical mechanism of agro-industrial complex development.

According to the Ministry of Agrarian Policy and food of Ukraine [129] activity in the agrarian sector is regulated by 110 legislative acts, which include the Constitution of Ukraine, such codes as: "Land Code of Ukraine", "Tax code of Ukraine", "The budget code of Ukraine", "Forest code of Ukraine", "Code of Ukraine on subsoil", "Commercial Code of Ukraine", laws of Ukraine "On collective farm Entrepreneurship", "On pesticides and Agrochemicals", "On protection of rights to plant varieties", "On Land lease, "on land reclamation", "fauna", "On the Farm", "On the Protection of land", "on state support of agriculture", "on state regulation of imports of agricultural products", "on stimulation of Development of domestic engineering for the agro-industrial complex", "On the priority of social development of the village and agro-industrial complex in folk

economy", "On stimulation of regional development", etc. [129]. It should be noted that changes are constantly taking place in the regulations regarding their clarification and adaptation to the norms of EU legislation.

Organizational and economic mechanism (see fig. 1.3) There are levers and regulators influencing the development of AIC regions, among which, in our opinion, it is necessary to pay attention to the budgetary subsidies that take place in accordance with the recently adopted regulatory acts, namely: resolutions "On Approval of the procedure for maintaining and form a register of the beneficiaries of budget subsidies, as well as the procedure for providing relevant information to the state Fiscal service and the State Treasury service" [163], "some questions on budget subsidy payment for the development of Agricultural commodity producers and stimulation of agricultural production" [161], "On approval of the procedure for allocation of budget subsidies for the development of agricultural producers and stimulating the production of agricultural products in 2017" [165] and order of the Ministry of Finance of Ukraine "On approval of the forms of application for the introduction of agricultural producers to the register of the beneficiaries of budget subsidies and on withdrawal of agricultural. The producer of the registration as the recipient of budget subsidies" [163], which were adopted in 2017, the data of the registry of recipients of budget subsidies and their payments of budget subsidies to agricultural producers and stimulation of production of agricultural products is presented in table. 2.1.

Table 2.1

*Data of the Register of Budget Beneficiaries and Payment
of Budgetary Grants to Agricultural Producers
and Promotion of Agricultural Production*

Regions	Number of payers who applied for entry in the Register for the period: March-May 2018, units	Grants paid for April-September 2018, thousand UAH
Vinnitsia	162	37 767
Volyn	96	24 955
Dnipropetrovsk	67	34 271
Donetsk	53	24 584
Zhytomyr	110	65 702
Transcarpathian	19	1 554
Zaporozhye	62	9 803
Ivano-Frankivsk	42	52 021
Kiev	171	43 938
Kirovograd	62	2 815
Lugansk	35	10 278
Lviv	109	17 101
Mykolaiv	77	8 010
Odesa	113	8 353
Poltava	176	209 916
Rivne	66	16 637
Sumy	87	98 459
Ternopil	153	32 829
Kharkiv	111	60 428
Kherson	74	21 973
Khmelnysky	125	60 483
Cherkasy	174	122 844
Chernivtsi	37	4 667
Chernihiv	168	54 227
Kyiv	38	192 044
<i>Total</i>	<i>2407</i>	<i>2 315 009</i>

Source: cited by data [129].

According to the State program 2801580 "financial support of agricultural producers" in the direction of "budget subsidy for the development of farm goods producers and stimulation of agricultural production", in 2017 there are 4 Billion. UAH, the open appropriations for

2792 billion UAH, paid subsidies for April-September 2018 in the amount of 2315 thousand UAH. The largest amount of paid subsidies accounted for the Poltava region – 209916 thousand UAH, Cherkassy region-122844 thousand UAH and Kyiv – 192044 thousand UAH. The share of paid budget subsidies of three regions is 22.7% of the total amount of subsidies, and taking into account subsidies of the central office – 70.2% of subsidies. The least received subsidies from Zakarpattya – 1554 thousand UAH, Kirovograd – 2815 thousand UAH and Cherkassy – 4667 thousand UAH.

According to the laws of Ukraine "on stimulating the development of domestic machinery for agro-industrial complex" [76], "on the state budget of Ukraine for 2017" [71] it is planned to implement financial support measures Agricultural producers, some of which rushes in the direction of "partial compensation of the cost of agricultural machinery and equipment of domestic production", in accordance with the resolution "the procedure for using the funds provided in the state budget for a partial compensation of the cost of agricultural machinery and equipment of domestic production" [162]. Within the state budget of 2018, the state provides compensation to agricultural producers on a irreversible basis in the amount of 20% of the cost of machinery and equipment (excluding value added tax) specified in the Act Acceptance and other documents confirming payment through the state Bank of machinery and equipment.

It is also one of the levers of the organizational and economic mechanism to attract investment resources. Quantity of investment resources, their cost, amount of mastered investments and quantity of created workplaces in the first half of 2018 are presented in table. 2.2.

Table 2.2

*Quantity, total cost of investment projects in the agro-industrial complex
by region, for the first half of 2018*

Regions	Number of projects	Estimated cost of projects	The need for investment million UAH	The amount of investments spent, mln.	Workplaces, persons
Vinnitsia	20	19804,4		6435,3	11013
Volyn	7	165,4	32,4	133,0	490
Dnipropetrovsk	10	350,3	120,0	115,3	70
Zhytomyr	13	928,9	9,0	66,9	510
Transcarpathian	3	10,9	2,0	8,9	24
Zaporozhye	1	500,0	-	500,0	120
Ivano-Frankivsk	5	127,5	-	4,2	17
Kiev	18	1884,4	6,5	290,1	180
Kirovograd	18	832,7	-	209,4	200
Lviv	14	121,3	8,0	-	432
Mykolaiv	7	1561,4	178,5	13,0	235
Odesa	6	2609,0	77,1	1005,7	417
Poltava	23	731,7	457,0	274,8	255
Rivne	9	305,4	79,9	49,9	29
Sumy	4	2276,9	42,0	416,0	310
Ternopil	4	357,0	-	-	-
Kharkiv	2	165,9	-	26,3	88
Kherson	22	974,9	179,6	746,5	337
Khmelnysky	3	108,7	-	54,0	-
Cherkasy	23	2037,0	158,2	1231,2	921
Chernivtsi	16	344,9	30,5	125,9	-
Chernihiv	5	519,3	-	351,0	177
<i>Total</i>	233	36717,8	1380,6	12657,2	15825

Source: given according to [71], data on Donetsk and Luhansk regions are missing.

Table data. 2.2 certify that in the agro-industrial complex in the first half of 2017 was performed 233 investment projects, the estimated value of which amounted to 36717.8 million UAH. The largest number is accounted for in Poltava, Kherson, Vinnitsia, Kyiv and Kirovograd regions, and their share is 43.3%. The highest estimated cost of investment

projects and the amount of the earned investment accounted for Vinnytsia region, namely 19804.4 and 6435.3 million UAH. This, in turn, influenced the number of jobs created in agriculture in Vinnytsya region, namely provided employment of 11013 persons. In five regions – Vinnytsia, Kyiv, Odesa, Sumy and Cherkasy regions accounted for almost 78% of the cost of investment projects of the agro-industrial complex. On regions such as Vinnitsa, Odessa and Cherkassy regions accounted for 68.5% of the amount of the investment.

In the areas of implementation of investment projects in the agro-industrial complex 49.4% is on the development of livestock, namely the development of cattle accounts for 25.3% of investment projects from the total (59 projects); development of pig production – 14.2% (33 projects); development of poultry farming – 9.9% (23 projects). For processing, storage and processing of grain and industrial crops accounted for 20.6% of the total number (48 projects); the vegetable and fruit storage – 9% (21 project), processing of agricultural raw materials – 6.9% (16 projects), perennial planting – 4.7% (11 projects), irrigation – 4.3% (10 projects), to others – 5.1% (12 projects).

The largest number of investment projects in the agro-industrial complex, namely, 205 projects, which is 88% of the total volume, have a value of up to 100 million UAH. Projects which cost more than 1 bln. UAH, is 2.6% of the total number and such 6 projects. The cost of investment projects implemented in the regions ranges from 0.9 million UAH to 9.6 billion UAH.

However, it should be noted that the main source of funding for capital investments in the agro-industrial complex remains the funds of enterprises and organizations, which is more than 76% of the total investment projects.

A effective lever of organizational-economic mechanism is crediting. The law of Ukraine "on the state budget of Ukraine for 2017" provides for expenditures of 300 million UAH. Under the program 2801030 "financial support of measures in the agro-industrial complex of cheaper credits" [71] According to the resolution of CM of Ukraine "on approval of the procedure for using funds provided in the state budget for financial support Activities in the agro-industrial complex by cheaper loans ". This makes it possible to intensify the development of agro-industrial regions through state support through a partial compensation of interest rates on bank loans without defining the marginal limit of interest rates for the use of loans for subjects the agro-industrial complex, which attracted credits and used them on the determined draft of the purpose, as well as paid the interest in the current year for their use. For small and medium-sized businesses in the agro-industrial complex, which have net income (revenue) from sales of products up to 10 mln. UAH and borrowers that carry out the growing and breeding of cattle, the amount of compensation of the interest rate is given based on the size of the National Bank's discount rate, which is valid on the date of interest accrual for use loans. To other agricultural entities that are borrowers of 50% of the National Bank's rate of credit.

One of the levers of organizational and economic mechanism is programming. The research of regional programs of development of agro-industrial complex according to published data of regional state

administrations showed that 67 programs were operating as of the first half of 2018. Programs have all regions of Ukraine. The largest number of programs in Chernihiv (8 programs), Vinnytsya (7 programs), Kherson (7 programs) regions. There are ten regions in the same agro-industrial complex: Donetsk, Dnipropetrovsk, Zhytomyr, Ivano-Frankivsk, Luhansk, Lviv, Mykolayiv, Poltava, Sumy, and Khmelnytsky regions. The majority of regional programs – 33 programs have a medium-term 4-year validity.

Long-term programs for eight and nine years are: Vinnytsia region – Forestry and hunting programme in forests that have been rendered in the permanent use of the Vinnytsia region communal specialized Forestry Enterprise "Vinograblulis" (decision of 13 sessions of 5 Convocation No. 353 of 25.10.07), increasing the forested area and planting settlements of the region for 2008-2017 years", "program of vegetable growing and processing industry in Vinnitsa region "For the period until 2020" (resolution of 7 Session 6 convocation No 178 from 28.10.11); Kharkiv region – "program of vegetable growing, potato growing and processing industry in Kharkiv region for the period until 2020" (decision of the session of the Regional Council of 01.03.2012, no 354-VI); Chernihiv region – "Program of the use and protection of lands of Chernihiv region for 2011-2020" (decision of 12 fourth session of the Regional Council of 6 convocation from 25.03.2011).

Usually, the number of programs and their terms of implementation do not indicate the quality of their performance and the amount of funding. The volumes of funding for programs published by the data to be analyzed in all regions are impossible.

Thus, the study made it possible to determine that a methodological basis study is a cognitive paradigm. For research of organizational-economic mechanism of agro-industrial complex development it is advisable to use systematic, synergistic, resource and situational approaches that do not cause contradictions among themselves, which, in turn, allows to complement each other, to neutralize the shortcomings of each. *The use of noted approaches for organizational and economic mechanism of agro-industrial regions development, in its turn, enables to:*

- to justify the methods of research of organizational-economic mechanism of agro-industrial regions development using tools of mathematical modelling of economic processes;
- to offer conceptual foundations of action of organizational and economic mechanism on intensification of agricultural development of regions etc.

Conducted research regulatory and general economic impact on the organizational and economic mechanism of agro-industrial complex showed that activity in agriculture is regulated by the Constitution of Ukraine, codes and a large number of other legislative acts. The investigation of leverage of the organizational and economic mechanism certifies that in 2017 the agro-industrial complex has been executing 233 investment projects, the estimated value of which was 36717.8 million. UAH. Analysis of regional programs of agro-industrial development as of the first half of 2017 showed that in regions registered and executed 67 programs, most of which have a medium-term validity of four years.

2.2. Methodological approaches to assessing the effectiveness of the organizational and economic mechanism of development of agro-industrial complex of the regions

In our opinion, it is also necessary to consider the methodological requirements for the assessment of the organizational and economic mechanism of agro-industrial regions development.

Thus, A. V. Chorny [229, p. 105] suggests assessing the effectiveness of the organizational and economic mechanism through the assessment of its components, namely:

$$EM(t) = E(P_j)t - \Delta 0, \quad (2.1)$$

where EM is the effectiveness of the organizational and economic mechanism at the time t ;

$E(P_j)t$ – a probable state (organizational and economic) object of the influence of organizational and economic mechanism at the time of time t ;

P_j – managerial decisions related to change of organizational-economic mechanism;

j – managerial decision variant;

$\Delta 0$ – basic condition (organizational and economic) object of the influence of organizational and economic mechanism.

However, it should be noted that the determination of the effectiveness of the organizational and economic mechanism, depending on making managerial decisions related to the changing of the organizational and economic mechanism, has quite a relative nature, As the result can manifest itself with a sufficiently prolonged lag of time, and its manifestations can be both positive and negative.

Yu. V. Herasymenko [33, p. 84] proposes to count measures to ensure the development of AIC regions and their effectiveness through the determination of the effectiveness of investment programs for the development of agricultural regions by the formula:

$$Cp_{in} = \frac{Vi_f}{Vi_{pl}} \cdot \frac{V_{pf}}{V_{pl}} \cdot \frac{Eef_f}{Eef_{pl}} \cdot \frac{Cef_f}{Cef_{pl}}, \quad (2.2)$$

where Cp_{in} – coefficient of efficiency of regional investment program of agro-industrial complex development;

Vi_f , Vi_{pl} – according to actual and planned indexes of aggregate investments aimed at realization of investment program of agro-industrial complex development;

V_{pf} , V_{pl} – according to actual and planned indexes of produced production (works performed, services rendered) as a result of implementation of the agro-industrial complex development program;

Eef_f , Eef_{pl} – according to actual and planned indicators of economic efficiency of investments (capital efficiency);

Cef_f , Cef_{pl} – according to actual and planned indicators of social efficiency of investments.

By the level of performance investment programs of agricultural regions the author defines three types of regional investment programs of development of agro-industrial complex:

- with a high level of performance ($Kp_{in} > 1$);
- with acceptable level of efficiency ($0.8 \leq Kp_{in} \leq 1$);
- with a low level of performance ($Kp_{in} < 0.8$).

Thus, the determination of the effectiveness of investment programs for the development of agricultural regions provides comparison of actual performance of programs with planned parameters. In our opinion, taking into account the fact that the author proposes to determine the development of agro-industrial regions according to the economic, social and ecological indicator [33, p. 83], it would be appropriate in assessing the effectiveness of investment programs of agro-industrial development in the ecological sphere.

N. I. Chernyak [228, p. 84] proposes to assess the organizational and economic development of AIC regions, based on the fact that the organizational and economic mechanism of agro-industrial development can be considered as two relatively independent, but the organizational and interconnected subsystems, namely controlled (AIC regions) and the control (organizational and economic mechanism) of the subsystem.

There is an interaction between these subsystems, which is represented as multiple variables: x, y, f, r – sets of state variables, observation, excitation and control, respectively, of the managed system, as well as X, Y, F, R – sets of state variables, observation, excitation and management respectively for the management system, with the following:

$$\begin{aligned} x &= \{x_1, \dots, x_n\}, f = \{f_1, \dots, f_n\}; \\ y &= \{y_1, \dots, y_n\}, r = \{r_1, \dots, r_n\}; \\ X &= \{X_1, \dots, X_n\}, F = \{F_1, \dots, F_n\}; \\ Y &= \{Y_1, \dots, Y_n\}, R = \{R_1, \dots, R_n\}. \end{aligned} \tag{2.3}$$

The sets of variables F, x, F, X, R, Y outline the boundaries of this system and at the same time characterize its interaction with the external environment, and sets R and Y bind system with the information system of

a higher level of hierarchy. Set of variables R and y define the informational interaction of the control system. All these variables in the general case have certain limitations.

Thus, the author proposes organizational-economic mechanism of agro-industrial regions development in the way of treating the cybernetic system through its decomposition into two subsystems of the management and managed. The purpose of the management system is to form such an impact on the managed system, which would lead to a certain development according to the established requirements.

V. G. Polischuk and I. M. Ostpuk [159, p. 245] offer to evaluate the functioning of the organizational and economic development of agricultural regions by the integral indicator of assessment of the level of agricultural development stimulation ($I_{st,j}^{SDR}$):

$$I_{st,j}^{SDR} = \frac{I_{st,j}^{SR} + I_{st,j}^{ER} + I_{st,j}^{ESR}}{3}, \quad (2.4)$$

where $I_{st,j}^{SR}$ – the index of encouragement of social development of AICj-th region;

$I_{st,j}^{ER}$ – Index of stimulation economic development of AICj-th region;

$I_{st,j}^{ESR}$ – Index of stimulating ecological development of AICj-th region.

In turn, indexes of stimulation of social, economic and ecological development of AIC regions are calculated based on the accounting of investment-innovative, transfer, institutional and tax incentives. For example, the index of stimulation of social development of AIC j-th region is based on the formula:

$$I_{st,j}^{SR} = \sum_{j=1}^n I_{st,j}^{soc} = I_{inv-st,j}^{soc} + I_{tran-st,j}^{soc} + I_{pod-st,j}^{soc} + I_{ins-st,j}^{soc}, \quad (2.5)$$

where $I_{inv-st,j}^{soc}$, $I_{tran-st,j}^{soc}$, $I_{pod-st,j}^{soc}$, $I_{ins-st,j}^{soc}$ – are the indexes of social promotion of AICj-th region with the help of investment-innovative, transfer, institutional and tax incentives, respectively. In turn, each of the incentive indices is determined based on the standardized values of each of the incentives. For example, the index of incentive social sphere by means of investment and innovative incentives is calculated according to the following formula:

$$I_{inv-st,j} = \frac{f_{inv-st,j} \sum_{j=1}^{27} Q_{aj}}{t_j}, \quad (2.6)$$

where $f_{inv-st,j}$ – is the coefficient of stimulation of social sphere with the help of investment and innovation incentives of j-th region;

t_j – the total number of incentives that are used in the j-th region;

Q_{aj} – is the standardized value of a stimulus that is used in the j-th region.

However, it should be emphasized that the index of the assessment of the level of agricultural development stimulation is not an integral index as indexes of stimulation of social, economic and ecological development of AIC regions. There is also the question, why 27 regions of Ukraine were elected for the calculation of incentive coefficients, i.e. taking into account the cities of Kyiv and Sevastopol.

The analysis of literary sources in which previously documented methodological approaches to assess the organizational and economic mechanism of agro-industrial development in the region gives an opportunity to conclude that most of them are reduced to the evaluation of AIC functioning regions under the influence of factors or organizational and economic mechanism as a whole [19; 38; 93; 109; 119; 184], or to assess the development of AIC regions [33; 34; 99; 100]. The methodological approaches for the definition of the development of AIC regions often use the methods of calculating the integral indices. This is stipulated by the fact that AIC is a system, each of the elements of which, in turn, can be defined by a group of socio-economic indicators. So, consider them in more detail.

A group of scientists under the leadership of Professor V. G. Sadkov [184, p. 10]. The methodology for determining the level of socio-economic efficiency of agro-industrial complex using the following integral indicator is proposed:

$$ISP = \left[1 - \sum_{p=1}^N V_p \frac{|Y_p^n - Y_p^f|}{Y_p^n} \right] 100, \quad (2.7)$$

where ISP – is an integral indicator of the level of economic development;

V_p – "weight" of indicators, $\sum V_p = 1$;

Y_p^n – normative (reference) State of socio-economic process on the indicator "P";

Y_p^f – the actual state of socio-economic process on the indicator "P";

$|Y_p^n - Y_p^f|$ – rejecting the actual state of regulatory.

However, the disadvantages of this approach are: the lack of standard or normative criteria for the efficiency of AIC functioning in Ukraine; not taking into account the potential of regional AIC and their degree of participation in the creation of gross regional product.

Yu. V. Herasymenko [33, p. 83] proposes to define the development of AIC regions by the initial group of indicators, which are divided into three groups of agricultural development indicators in the region, namely:

- economic indicator of agriculture in the region-is calculated by the eighth indicators (the average annual the increase in the volume of agricultural products, %; share of agriculture in the production of gross value added (VA), %; annual rate of change in capital investments in agricultural production, %; profitability of agriculture, %; export share and share of imports of agricultural products in the GROSS value Financing of scientific and technical works in agriculture in the AFI, %; The degree of depreciation of fixed assets of agriculture, %);

- social indicator – contains six indicators (average monthly nominal wages employed in agriculture, the proportion of low-income rural population, %; wage arrears for one agricultural worker, UAH; registered unemployment in rural areas, %; natural movement in rural areas by 1000 people, persons/year; the share of economic crimes in the rural area in their total population, %);

- ecological indicator – includes three indicators (provision of agriculture by nature conservation funds; share of ecological activity financing in the structure of financial expenditures on agricultural production.

But, in our opinion, the above indicators are not enough to assess the development of AIC regions, as well as indicators of agricultural development are reduced to indicators of agricultural development in the region.

Scientists, led by Professor P. Borschevskyi [19, p. 133] suggest defining the efficiency of AIC region with the help of the generalized criterion, which is calculated by means of the ratio of the newly created cost as the sum of output of all its units and industries to costs, which resulted in this result by the formula:

$$E = \frac{NI}{C_i} = \frac{VGo - (Mc + Da)}{Mc + Wf + Da}, \quad (2.8)$$

where E – is the efficiency of AIC region;

NI – national income (clean products), established in the I-th branch of AIC region;

C_i – costs in i-th industry;

VGo – the cost of gross output in i-th industry of AIC;

Mc – material costs in i-th field of AIC (without depreciation);

Wf – the wage fund in i-th branch of AIC;

Da – depreciation of fixed assets in i-th industry of AIC.

Indeed, national income is one of the main macroeconomic indexes of the national accounts system, which reflects the production result. However, it should be noted that the use of the national income indicator to determine the efficiency of AIC regions is controversial because it does not contain re-invoice, and the method of its calculation raises some doubts (the ratio of the value of the net current costs).

I. M. Kuksa and M. A. Rudenko [99, p. 205] offer to assess the development of AIC analysis of cross-industry relations of the "input-output" system. The spheres and the branch of AIC are represented in the form of "input-output" matrix of the regional Intersector balance model. Row totals represent the aggregate regional product (s), and the column values are total regional consumption (r). $X_0 - N \times M$ – matrixes of initial data. RAS is an iterative algorithm, reduced to an intersectoral transaction matrix calculation task, which minimizes Q , which recursively scales rows and columns of a matrix table of transactions to match amounts of columns and amounts of table rows with target regional vectors product (R) and regional consumption (C).

$$r_{ij} = \frac{X_{ij}^o}{\sum_{j=1}^m X_{ij}^o}, \quad c_{ij} = \frac{X_{ij}^o}{\sum_{i=1}^n X_{ij}^o}. \quad (2.9)$$

Defining the difference between a transformed matrix X and an original is done by the formula:

$$Q = \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^m \left(\frac{X_{ij}}{R_i} - r_{ij} \right)^2 w_{ij} + \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^m \left(\frac{X_{ij}}{C_j} - c_{ij} \right)^2 v_{ij}. \quad (2.10)$$

where w and v are arbitrary sets of scales:

$$w_{ij} = \frac{1}{r_{ij}^2}, \quad v_{ij} = \frac{1}{c_{ij}^2}, \quad (2.11)$$

Setting weights results in the following formula of the Q function:

$$Q = \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^m \left(\frac{X_{ij} / R_i}{r_{ij}} - 1 \right)^2 + \frac{1}{2} \sum_{i=1}^n \sum_{j=1}^m \left(\frac{X_{ij} / C_j}{c_{ij}} - 1 \right)^2. \quad (2.12)$$

The algorithm calculates reverse and direct communication by the extraction method, which in the "input-output" system allows analyzing the importance of the sector, hypothetically excluding a separate sector from the "input-output" system. The difference between output and received systems is considered as the index of the importance of the extracted element in the economic system of AIC region.

The importance of the sector is represented in direct and inverse relationships between the originating system and the system without an extracted element. Feedback is calculated using the inversions of Leontiev matrix, and direct communication – using Leontiev's transposed matrix.

However, it should be noted that the results of the analysis of influence industries when using the regional balance Intersector adjusted for the regional product and regional consumption may distort the dynamics of influence industries because they do not Influence and peculiarities of climatic conditions of agriculture, territorial placement of processing industries etc. are highlighted. The rating of branches by indicators of impact on the economy of the region does not reflect the dynamics of agricultural industries. Also, since the agricultural structure of agriculture has the largest number of direct and backlinks, and the impact of this sphere on the development of agriculture and the region will also be the largest.

V. Herasymchuk and V. G. Polishchuk [34, p. 173] proposed to assess the development of agro-industrial regions by means of the integral index of sustainable development of agro-industrial complex (ISDR):

$$ISDR_j = \frac{1}{p}(I_{g,j} + I_{s,j} + I_{r,j} + I_{z,j} + I_{k,j} + I_{b,j}), \quad (2.13)$$

where p – total number of complex indexes of the integral index of the development of agro-industrial complex of j -th region;

$I_{g,j}$ – is the index of harmonious development of AIC j -th region;

$I_{s,j}$ – index of the development of agro-industrial complex of j -th region;

$I_{r,j}$ – equilibrium Index of development of j -th region;

$I_{z,j}$ – the index of the balanced development of the agro-industrial complex of j -th region;

$I_{k,j}$ – index of agricultural development competitiveness of j -th region;

$I_{b,j}$ – security Index of the agro-industrial complex of j -th region.

At this, complex indices that are included in the integral index of the agro-industrial complex development are settled with the help of standardized indexes, which characterize the development of the agro-industrial complex of the region in terms of social, economic and ecological development.

But, it should be emphasized that the proposed integral index in essence is a complex generalizing indicator showing the state of agricultural development of regions, but does not characterize the development itself.

R. O. Kulnych [100, p. 198] proposes to determine the development of regions, including AIC regions, with the help of a comprehensive assessment of the relative indices of the regional development intensity based on calculation of deviations from the average values of indicators,

Included in the calculations, dividing the indicators whose growth positively (stimulants) and negative (destimulators) affect the development of agricultural regions:

$$K_{\theta j} = \sum_{i=1}^{n_1} \left(1 - \frac{x_{ij} - \bar{x}_i}{x_{i \max} - \bar{x}_i} \right)_{x_{ij} > \bar{x}_i}^2 + \sum_{i=1}^{n_2} \left(1 + \frac{\bar{x}_i - x_{ij}}{\bar{x}_i - x_{i \min}} \right)_{x_{ij} \leq \bar{x}_i}, \quad (2.14)$$

$$K_{\theta j} = \sum_{i=1}^{n_1} \left(1 + \frac{x_{ij} - \bar{x}_i}{x_{i \max} - \bar{x}_i} \right)_{x_{ij} > \bar{x}_i} + \sum_{i=1}^{n_2} \left(1 - \frac{\bar{x}_i - x_{ij}}{\bar{x}_i - x_{i \min}} \right)_{x_{ij} \leq \bar{x}_i}^2, \quad (2.15)$$

where $K_{\theta j}$ – is a complex factor of deviations from the average values of relative quantities of regional development intensity;

x_{ij} – value of indexes of agricultural development of region;

$x_{i \min}, x_{i \max}$ – respectively, minimum and maximum value of the agricultural development index in the totality of regions;

\bar{x}_i – the average value of the agricultural development index in the totality of regions;

i, j – subscript, which include values, respectively, to the list of indicators (n-Total number of indicators) and a set of regions (J-Total number of regions of Ukraine);

n_1, n_2 – Number of indicators, which are correspondingly more and less than the average in the totality of regions, $n_1 + n_2 = n$.

The proposed methodological approach by calculating the complex coefficient of variance of deviations makes it possible to determine the rating of AIC regions by indexes of their development intensity based on deviations from the average values of indicators. At this, the lower the coefficient of deviations, the higher the level of development intensity of

the agro-industrial complex and place of the region in their totality. But, this methodological approach inherent in certain shortcomings. This is, for example, the definition of the average value of the agricultural development index of the regions in relation to which the comparison occurs.

O. V. Mazur [119, p. 75] notes that "methodological approach to assessing the effectiveness of agro-industrial complex functioning should include: assessment of conditions, resources and factors of the agro-industrial area functioning; study of structure, patterns, peculiarities and tendencies of their development; research of economic mechanism of AIC regions (management, organization, economic levers of development, state regulation, planning and forecasting); determination of economic and ecological efficiency of agro-industrial complex functioning» [119, p. 75]. That is essentially assessing the development of agro-industrial complex includes estimation of efficiency of organizational-economic mechanism of AIC.

As the author proposes to determine:

- the level of efficiency of the use of industrial, labor, natural resource, scientific and technical potentials;
- peculiarities of the spatial organization of the complex;
- parameters of agro-industrial production and the level of perfection of its sectoral and territorial structure;
- degree of development of infrastructure; Level of development of industrial-technological and socio-economic relations, etc.

As the generalizing is proposed to apply the indicator, calculated as the ratio of growth in production of agricultural products to the increase in the volume of resources used in the production process on the basis and

end periods. The aggregate value of the resources used is determined as the sum of the average annual value of the main equipment of AIC region, expenses for environmental activity, and the costs of reproduction of material, labor and natural resources.

To assess the efficiency of AIC regions it is proposed to use an integral indicator that reflects the ratio of the production of agricultural products of the region to the sum of values of resources used:

$$k_e = \frac{V_{fp} / V_{bp}}{C_f / C_b} = \frac{\Delta n}{\Delta p}, \quad (2.16)$$

$$k_e = \frac{\Delta gva}{\Delta grp}, \quad (2.17)$$

where k_e – efficiency factor in agro-industrial production in the region;

V_{fp} , V_{bp} – the volume of agro-industrial production for the final and basic periods;

C_f , C_b – cost of resources used for the final and base periods;

Δn – increase in the volume of agro-industrial production in the region in the final period compared to the base;

Δp – the increase of resources used in the final period compared to the base;

Δgva – increase of gross value added in AIC branch;

Δgrp – the growth of gross regional product.

After analyzing the suggested methodological approach to assessing the effectiveness of the agro-industrial complex functioning, it should be noted:

Firstly, the evaluation of the agro-industrial complex includes estimation of efficiency of the organizational-economic mechanism of

AIC, which, in our opinion, is controversial, since the organizational-economic mechanism influences the development of agro-industrial regions, and not vice versa;

Secondly, in fact, estimation of efficiency of agro-industrial complex functioning is reduced to definition of efficiency of agro-industrial production in regions, which represents only one sphere of AIC regions;

Thirdly, the proposed efficiency factor is not an integral indicator.

P. M. Hryhoruk, T. Fedorov, believe that to assess the efficiency of agro-industrial complex regions it is necessary to use models of nonlinear processes: "For these processes in the space of phase coordinates it is possible to allocate areas of gravity, hitting in which the economic system can be located there for a more less long time if it is able to develop an adequate management mechanism" [38, p. 228]. To assess the agricultural region, the authors propose to consider it as a dynamic system in the form of:

$$\begin{aligned}\frac{dY}{dt} &= k \cdot Y \cdot (A - Y) - (a + y) \cdot Y \\ \frac{dA}{dt} &= -b \cdot A + a \cdot Y + C \\ \frac{dk}{dt} &= p \cdot k \cdot (B - k) + y \cdot Y, \\ Y(0) &= Y_0, A(0) = A, k(0) = k_0,\end{aligned}\tag{2.18}$$

where Y – the level of economic development of AIC (expressed in the fate of GNP);

A – generalized ecological resource that limits the limit of the economic development of AIC;

k – speed of economic development, which depends on the development and implementation of new technologies in AIC;

B – the boundary level of technological perfection, which is limited by the laws of nature;

C – the speed of self-renewal of ecological environment;

dY – HCJ cost intensity to support the necessary state of the ecological environment;

$y \cdot Y$ – HCJ intensity of the development and implementation of new technologies;

p – the speed of new technologies development;

$Y(0)=Y_0, A(0)=A_0, \text{до } (0)=k_0$ – the initial state of the economic system.

It should be noted that the use of the nonlinear dynamics model for evaluating the development of AIC regions is successful, as it gives an opportunity to consider AIC of regions as a dynamic system, but also has certain drawbacks. In this case, it takes into account the influence of such factors as changes in the state of the ecological environment and introduction and development of new technologies, but the influence of levers of organizational-economic mechanism of agricultural development is much more activity of agricultural entities of the regions.

V. Ladiienko [109, p. 97] proposes to assess the efficiency of AIC regions by defining production volumes of final products and agricultural raw materials in natural quantities with recalculation on the product quality ratio and using the formula, including:

$$E_{AIC} = \frac{V_p}{L_f} \cdot \frac{V_p}{A_c} \cdot \frac{V_p}{W_a} \cdot \frac{PK_u}{M_{pf} + C_m}, \quad (2.19)$$

where E_{AIC} – is the efficiency of agro-industrial region (cumulative score);

V_p – volume of production, designed as a product $(Pf + Am) \cdot Kq$;

P_f – production of final food;

A_m – production of agricultural raw materials;

K_q – product quality ratio;

L_f – land funds;

A_c – the aggregate costs;

Wa – workers engaged in agriculture of the region, on average for a year;

P – profit;

M_{pf} – main production facilities;

C_m – current means;

K_u – utilization factor of basic production facilities.

We can not disagree with the author, that in this approach takes into account the use of resources, namely material, labor, land, basic and negotiable means, but this figure can not be called an integral indicator, and it does not assess the development of AIC region and essentially defines only the efficiency of agriculture, not the entire agro-industrial complex of the region.

V. Kolyadenko [93, p. 186] offers to assess *the effectiveness of the agro-industrial complex development with the help of:*

- analysis of the state structure of commercial complexes of AIC region, which includes: identification of elements of agro-industrial complex of region and scorecard for its analysis; formation of the system of optimal values of quality indicators; analysis of optimality of the agro-industrial complex structure and determination of its effectiveness;

- evaluating the efficiency of agro-industrial production of the region, which includes: estimation of efficiency of agro-industrial complex in the

value and natural indexes, and also estimation of regional agro-industrial complex in the national economy.

Thus, the study of the existing methodological approaches to assess the development of agricultural regions and the organizational and economic mechanism for the development of agro-industrial complex makes it possible to assert that there is no single view regarding the criteria, methods of evaluation and defining the scorecard. Since AIC includes many industries, the method of aggregate indexing is used to assess the development of AIC regions, which makes it possible to define the aggregate and integral indicators by means of various indicators that determined by experts, combined in subgroups, as well as establish interaction between the spheres of AIC, to find out the imbalances in the development of AIC regions, to establish the dynamics of agro-industrial areas, group regions depending on the values received for development of strategic measures at the regional level regarding the development of agriculture and predict their impact on agro-industrial regions and socio-economic development of regions in general, etc. In addition to aggregate indexing, methods are used to assess the development directly: the average quadratic deviation, variation coefficients, dispersion, etc.

Also, there is no single coordinated opinion of scientists on assessing the effectiveness of the organizational and economic mechanism of agricultural development. Evaluation of efficiency of the organizational and economic mechanism is carried out by assessing the effectiveness of its components, determining the effectiveness of investment programs for agricultural development in the regions, assessing the level of incentive agricultural development, etc.

Scientists use different economic and mathematical methods, namely correlation, regressive, factor analysis, multi-dimensional scale, imitation modeling, etc. This, in its turn, requires further research and improvement of methodical approaches of evaluation of organizational-economic mechanism of agro-industrial areas development.

Conclusions to section 2

1. The study of regulatory and general economic impact on the organizational and economic mechanism of agro-industrial complex showed that activity in agriculture is regulated by the Constitution of Ukraine, codes and a large number of other legislative acts. Among the levers of organizational-economic mechanism of agro-industrial complex development it is necessary to note the shift that took place in 2017 regarding the budget subsidies in accordance with the adopted of the State program "financial support of agricultural producers", which Envisages funding in the amount of 4 bln. UAH. In 2017 and also, concerning the cheaper of credits by means of partial compensation of interest rate on bank loans for subjects of AIC in accordance with the law of Ukraine "on state budget of Ukraine for 2017" and state program "financial support of measures in The agricultural sector by means of cheaper loans, which provides for expenditures of 300 million in 2018 UAH.

2. Research of the leverage of the organizational and economic mechanism certifies that in 2017 the agro-industrial complex was carried out 233 investment projects, the estimated value of which amounted to 36717.8 million UAH. 76% of the total cost of investment projects is performed at the expense of enterprises ' own funds. Analysis of regional programs of agro-industrial development as of the first half of 2017 showed that in regions registered and executed 67 programs, most of which have a medium-term validity of four years.

3. As a result of the study of existing methodological approaches to assess the organizational and economic mechanism of agro-industrial development has revealed that there is no universal single methodological approach to the assessment. At that, for calculations scientists use a variety of economic and mathematical methods. The most often used for evaluation is the method of aggregate indexing, which is conditioned by multi-component of AIC regions. The disadvantages of many investigated methods include:

- integral indicators are defined as total complex indicators; at the same time, standardization of the calculation indicators is carried out relatively average of its value by regions, which may distort the resulting estimate in the case where most regions have low values;

- in many methodical approaches, in our opinion, the insufficient quantity of partial indices is used for calculations, for example, such sphere of AIC is not covered as infrastructure; there is no justification for the choice of partial indicators, and in the use of expert estimates the methods of error leveling are not used, for example, as a coefficient of concordance, etc.

- estimation of agro-industrial regions development is reduced to definition of the dynamics of agro-industrial complex of regions for several years, which, in its turn, violates comprehensiveness and completeness of estimation of organizational-economic mechanism of agro-industrial complex development.

4. The survey made it possible to find out that various approaches based on the effectiveness of organizational and economic development are used to assess the effectiveness of the organizational and economical functioning component of the mechanism, determining the effectiveness of investment programs for agricultural development in the regions, assessing the level of agricultural development promotion etc.

CHAPTER 3

IMPROVEMENT AND APPROVAL OF THE METHODOLOGICAL APPROACH TO EVALUATION OF THE EFFICIENCY OF THE ORGANIZATIONAL AND ECONOMIC MECHANISM OF DEVELOPMENT OF AGRO-INDUSTRIAL COMPLEX OF THE REGIONS

3.1. Improvement of the methodological approach to the evaluation of the development of agro-industrial complex of the regions

The study of methodical approaches on evaluation of agro-industrial complex development of regions and organizational-economic mechanism made it possible to define their positive aspects and disadvantages. In our opinion, the proposal of the author's methodological approach to assessing the effectiveness of the organizational and economic mechanism for agricultural development is necessary to assess the agro-industrial development of the regions. Stages of evaluation of agro-industrial complex of regions are presented in Fig. 3.1.

Consider them in more detail. The first stage of the methodical approach of agricultural regional development estimation is the definition of valuation indicators of agricultural regions development. In the first stage of the

methodical approach to assessing the development of agro-industrial areas it is necessary to find out indicators characterizing agricultural regions.

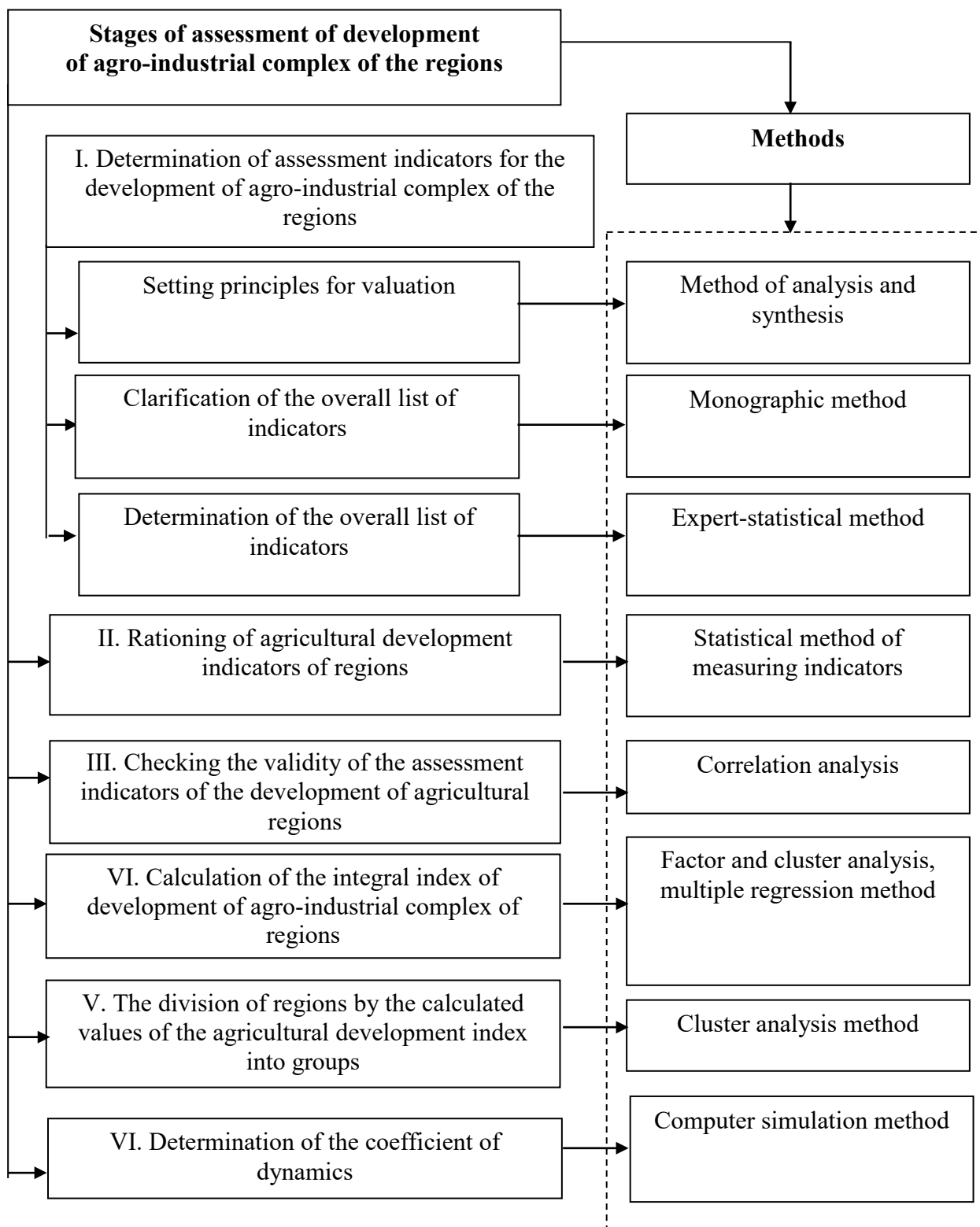


Fig. 3.1. Stages of carrying out an assessment of development of agrarian and industrial complex of the regions

Source: suggested by the authors

The study of existing methodological approaches made it possible to establish that there is no single list of indicators and a single point of view about their choice. ***Therefore, in our opinion, to determine the value indicators of agricultural development it is necessary to implement:***

Firstly, the scientific and theoretical justification for the choice of indicators;

Secondly, the establishment of the general List of indicators that meet the requirements of the scientific and theoretical justification based on the study of existing methodological approaches to assess the development of agro-industrial regions;

Thirdly, clarification of the general list of indicators using the expert-statistical method of selection of valuation indicators.

Thus, in our opinion, the estimated indexes of the agro-industrial complex development must meet certain principles, namely:

- systems that are determined by the definition of the common aggregate of estimates, which fully characterize the subject of research, namely AIC regions, and reflect its specific features, with the list of estimated indicators should be minimum, co-ordered and fully cover each of AIC regions;

- universality, which makes it possible to comprehensively, fully characterize the agro-industrial complex of regions and its spheres, but the estimated indicators should be universal relative values, the available quantifiable dimension that will facilitate the evaluation of AIC for each region due to their rationing and mapping of the obtained results for further research both among the regions of Ukraine and with regions of other countries due to the methodological principles of the National invoicing system calculations of official statistics of the State Department of Statistics of Ukraine with international;

- consistency, value indicators should be meaningful and logically related, but they should not be duplicated, depend on each other, which is mathematically expressed due to the correlation coefficient, which must be a maximum of between any selected pair of evaluation indicators.

Compliance with the determination of the value indicators of these principles makes it possible to assess the development of agricultural regions and its spheres in a certain period of time, to determine the influence of the organizational and economic mechanism for the development of AIC regions and predict development of agricultural regions as a result of mechanism action.

The agro-industrial complex is a leading sector in economic development of Ukraine. In modern conditions for the development of agribusiness, timely effective organizational and economic measures, levers for intensification of its development, and determination of the effectiveness of these measures are important. This and another determine the need to assess the effectiveness of the organizational and economic mechanism of agro-industrial regions. However, the study of methodological approaches to assess the efficiency of agro-industrial complex makes it possible to assert that the significant value for assessing the organizational and economic mechanism has the definition of valuation indicators for the development of agricultural sectors.

Conducted research papers on assessing the effectiveness of agricultural regions made it possible to establish the indicators that are most often used for evaluation in accordance with the reasonable spheres of AIC regions represented in table. 3.1.

Table 3.1

Analysis of the use of partial indicators in methodological approaches to assess the level of development of agro-industrial complex of regions

Indicators for assessment of the development of the agricultural sector of the regions	Frequency of use of the indicator
1	2
<i>Sphere of industries producing means of production for agriculture</i>	
Capital investment in agriculture, hunting and related services, % of total regional investment	4
Purchase by agricultural enterprises of new agricultural machinery, pcs.	6
Innovatively active enterprises, in total, units	3
Sale of compound feed to agricultural enterprises, thsd.	4
Purchase by energy companies of millions of m ³	3
Purchase of mineral fertilizers by agricultural enterprises, thsd.	5
Purchase by agricultural enterprises of plant protection products, thousand tons (thousand l)	5
Availability of tractors, combines and agricultural machinery at agricultural enterprises, end of year, pc.	6
Sale of petroleum products to agricultural enterprises, thousand	2
<i>Agriculture</i>	
Agricultural production indices, in% compared to the previous year	4
Livestock production indices, in% compared to the previous year	4
Production of meat, (in slaughter weight), thousand tons	7
Milk production, thousand tons	7
Egg production, mln.	7
Purchase by agricultural enterprises of plant protection products, thousand tons (thousand l)	5
Availability of tractors, combines and agricultural machinery at agricultural enterprises, end of year, pc.	6
Sale of petroleum products to agricultural enterprises, thousand	2
<i>Agriculture</i>	
Agricultural production indices, in% compared to the previous year	4
Livestock production indices, in% compared to the previous year	4
Production of meat, (in slaughter weight), thousand tons	7
Milk production, thousand tons	7
Egg production, mln.	7
Livestock products (at constant 2010 prices), mln.	5
Profitability of cattle meat production, %	6
Profitability level of pork meat production, %	6
Profitability of poultry meat production, %	6
Profitability level of milk production, %	6
Profitability level of chicken eggs production, %	6
Indices of crop production, in% compared to the previous year	4

Continuation of Table 3.1

1	2
Production of cereals and legumes, thousand tons	6
Production of sugar beet (factory), thousand tons	6
Sunflower production, thousand tons	6
Production of potatoes, thousand tons	6
Production of vegetables, thousand tons	6
Production of fruits and berries, thousand tons	6
Crop production (at constant 2010 prices), mln.	5
Profitability of cereals and legumes production, %	5
Profitability level of sugar beet production (factory), %	5
Profitability level of sunflower seeds production, %	5
Profitability level of potato production, %	5
Profitability level of open-source vegetable production, %	5
Profitability of fruit production, %	5
<i>Manufacturing industry</i>	
Production of sausage products, thousand tons	4
Production of fatty cheese, thousand tons	4
Production of unrefined sunflower oil and its fractions, thousand tons	4
Production of liquid processed milk (pasteurized, sterilized, homogenized, baked, peptized), thousand tons	4
Production of yogurt and other fermented or fermented milk and cream, thousand tons	3
Production of flour, thousand tons	5
Production of bread and bakery products, short-term storage, thousand tons	3
Production of white crystalline sugar, thousand tons	5
Manufacture of food products, beverages and tobacco, in% of the previous year	4
Textile, clothing, leather, leather and other materials, % of previous year	6
<i>Sphere of industrial and social infrastructure</i>	
Commissioning of housing in rural areas, thousand m2 of total area	3
Capital investment in transport, warehousing,% of total investment in the region	5
Capital investment in temporary accommodation and catering,% of total regional investment	2
Capital investment in information and telecommunications,% of total regional investment	3
Capital investment in education,% of total regional investment	2
Capital investment in health and social assistance,% of total regional investment	2
Capital investment in professional, scientific and technical activities,% of total investment in the region	2
Retail trade, except of motor vehicles and	2
Internal current expenditures on scientific and scientific-technical works, performed by the own forces of scientific organizations, at actual prices, ths.	1

Source: compiled and summarized by the authors based on the analysis [19; 33; 34; 38; 78; 93; 99; 109; 119; 159; 184; 228; 229]

The research of existing methodical approaches of agricultural regional development assessment and estimation of effectiveness of organizational-economic mechanism of agro-industrial complex development made it possible to set the initial list of indexes 3.1. To select the valuation indicators of agricultural regions were involved experts who proposed the initial list of indicators that are representatives of agricultural entities, namely: experts of the Financial and analytical Department and specialists of the department of agro-industrial development of Nizhyn region state administration. In total, 17 experts were involved in the substantiation of the choice of value indicators of agricultural regional development, and their number was determined by the formula:

$$0,5 \cdot \left(\frac{3}{e} + 5 \right), \quad (3.1)$$

where e – change in valuation, $E = 0.11$ [5].

The estimate scale equals from 0.006 – 0.060 with grabe 0.006 [5]. Thus, in our case, taking into account the fact that 17 experts have been involved:

$$0,5 \cdot \left(\frac{3}{0,11} + 5 \right) = 16,136.$$

Experts' agreement of the estimation indicators of the development of the agro-industrial complex of the regions on the example of the indicator "Purchase by agricultural enterprises of new agricultural machinery", pcs. are presented in table. 3.2.

Table 3.2

Substantiation of the experts' agreement on the selection of the agricultural development indicator of the regions by the example of the indicator "Purchase by agricultural enterprises of new agricultural machinery", pcs.

Value	Expert assessments																	Explanation
1	2																	3
Decision-making experts in ranking order	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	17 experts were selected
Expert assessments to justify the evaluation indicator	0,006	0,024	0,012	0,024	0,030	0,012	0,006	0,012	0,024	0,012	0,030	0,036	0,012	0,024	0,012	0,042	0,054	Built depending on the rank of the expert
Rank correlation		+	+	+	+	+	0	+	+	+	+	+	+	+	+	+	+	If R is greater than 0.3 per module then examination is accepted (agreed estimate)
			-	0	+	-	-	-	0	-	+	+	-	0	-	+	+	
				+	+	0	-	0	+	0	+	+	0	+	0	+	+	
					+	-	-	-	0	-	+	+	-	0	-	+	+	
						-	-	-	-	-	0	+	-	-	-	+	+	
							-	0	+	0	+	+	0	+	0	+	+	
								+	+	+	+	+	+	+	+	+	+	
									+	0	+	+	0	+	0	+	+	
										-	+	+	-	0	-	+	+	
											+	+	0	+	0	+	+	
												+	-	-	-	+	+	
													-	-	-	+	+	
														+	0	+	+	
															-	+	+	
																+	+	
																	+	

The evaluation indicator selected for approval by experts: "Purchase by agricultural enterprises of new agricultural machinery", pcs.

$R_x = \frac{(N+) + (N-)}{N}$, where N = 136 - the total number of compounds from 17 to 2 (expert rating scale 0.006-0.060); (N +) - number of positive approvals (in this case 80); (N-) - number of negative approvals (in this case 33)

Estimation calculation: $R_x = (80-33) / 136 = 0,346$ - the indicator is accepted

Source: compiled and calculated by study authors.

By the same principle, an examination is carried out for other valuation indicators of agricultural regions.

Thus, as a result of adherence to the principles on the estimates of the agro-industrial complex development and clarification of its list by using the expert-statistical method was selected the valuation indicators of each area of AIC regions (see fig. 1.2), the list of which is presented depending on the sphere of AIC in table. 3.3-3.6, and the values of indicators for the studied period 2013-2018 bienniums filed under Appendix A.

Table 3.3

*Indicators of the sector of manufacturing industries for agriculture
and other sectors providing agricultural services*

№	Indicator
x_1	Capital investment in agriculture, hunting and related services,% of total regional investment
x_2	Innovatively active enterprises, in total, units
x_3	Purchase by agricultural enterprises of new agricultural machinery, pcs.
x_4	Availability of tractors, combines and agricultural machinery at agricultural enterprises, end of year, pcs.
x_5	Sale of compound feed to agricultural enterprises, thsd.
x_6	Purchase of energy materials by agricultural enterprises, million m ³
x_7	Sale of petroleum products to agricultural enterprises, thousand
x_8	Purchase of mineral fertilizers by agricultural enterprises, thsd.
x_9	Purchase by agricultural enterprises of plant protection products, thousand tons
x_{10}	Purchase by agricultural enterprises of plant protection products, thousand l.

Source: justified by the authors of the study.

Table 3.4

Estimated indicators of agriculture

№	Indicator
1	2
x_{11}	Production of meat, (in slaughter weight), thousand tons
x_{12}	Milk production, thousand tons
x_{13}	Egg production, mln.
x_{14}	Livestock products (at constant 2010 prices), mln.
x_{15}	Financial results of activity of the enterprises of the branch of agriculture of animal husbandry, net profit (loss), ths.
x_{16}	Production of cereals and legumes, thousand tons
x_{17}	Production of sugar beet (factory), thousand tons
x_{18}	Sunflower production, thousand tons

Continuation of Table 3.4

1	2
x_{19}	Production of potatoes, thousand tons
x_{20}	Production of vegetables, thousand tons
x_{21}	Production of fruits and berries, thousand tons
x_{22}	Crop production (at constant 2010 prices), mln.
x_{23}	Financial results of activity of the enterprises of the branch of agriculture of animal husbandry, net profit (loss), ths.

Source: justified by the authors of the study.

Table 3.5

*Estimated indicators of the sphere of industries for processing
and storage of agricultural products*

№	Indicator
x_{24}	Production of sausage products, thousand tons
x_{25}	Production of liquid processed milk (pasteurized, sterilized, homogenized, melted, peptized), thousand tons
x_{26}	Production of fatty cheese, thousand tons
x_{27}	Production of unrefined sunflower oil and its fractions, thousand tons
x_{28}	Production of flour, thousand tons
x_{29}	Production of bread and bakery products short-term storage, thousand tons
x_{30}	Production of white crystalline sugar, thousand tons
x_{31}	Production of yogurt and other fermented or fermented milk and cream, thousand tons
x_{32}	Manufacture of food products, beverages and tobacco, in% of the previous year
x_{33}	Textile, clothing, leather, leather and other materials, % of previous year

Source: justified by the authors of the study.

Table 3.6

Estimated indicators of industrial and social infrastructure

№	Indicator
x_{34}	Capital investment in education, % of total regional investment
x_{35}	Capital investment in professional, scientific and technical activities, % of total investment in the region
x_{36}	Retail trade, except of motor vehicles and motorcycles, mln. UAH
x_{37}	Capital investment in wholesale and retail trade, repair of motor vehicles, % of total investment in the region
x_{38}	Capital investment in transport, warehousing, postal and courier activities, % of total regional investment
x_{39}	Capital investment in temporary accommodation and catering, % of total regional investment
x_{40}	Capital investment in health and social assistance, % of total regional investment
x_{41}	Commissioning of housing in rural areas, thousand m ² of total area
x_{42}	Capital investment in transport, warehousing, % of total investment in the region
x_{43}	Capital investment in information and telecommunications, % of total regional investment

Source: justified by the authors of the study.

It should be noted that the indices x_3 , x_4 , x_8 , x_9 , x_{10} , – are total indicators and include several or more components.

Thus, the figure x_3 – purchase agricultural enterprises of new agricultural machinery includes purchase: tractors of all kinds; plows cultivators harrows seeders manure and fertilizer spreaders; water pumps and pumping stations; hay mowers; header rollers; press packers; combine harvesters; grain cleaning machines, milking plants and apparatus; machines and mechanisms for preparation of feed; manure-cleaning transporters; trailers and semi-trailers of agricultural; trucks with diesel and semi-diesel internal combustion engines.

The figure x_4 – presence of tractors, combines and agricultural machinery in agricultural enterprises, at the end of the year, includes: tractors; grain and corn-harvesting harvesters; beet harvesting machines; irrigation units and units; machines and devices for watering; water pumps and pumping stations.

Indices x_8 – purchase of agricultural enterprises of mineral fertilizers, contains: nitrogen, phosphate, complex fertilizers.

Indices x_9 , x_{10} – purchase by agricultural enterprises of plant protection products, includes: insecticides; fungicides herbicides plant growth regulators and other pesticides.

It should be noted that with the help of the estimation indicators, which are justified by taking into account the principles (systematic, universality, consistency), it is possible to carry out analytical researches not only development of AIC of regions, but also its spheres.

At the second stage of evaluation of agricultural development of regions the estimation of development of agro-industrial regions is carried out.

Since all the defined value indexes of agro-industrial complex development have different units of measure and different order of values, which, in turn, can affect the increase in influence of higher order indexes, for making calculations apply rationing. Rationing indicators enables to bring all the selected indicators to a single scale, while maintaining all functional dependencies between them. To do this, we use the statistical method of evaluating indicators and the method of mathematical expectation:

$$X_{ij}^r = \frac{x_{jir}}{x_{jcpir}}, \quad (3.2)$$

$$X_{ij}^r = (x_{1ir}, x_{2ir} \dots x_{jir}) \quad (3.3)$$

where X_{ij}^r – normalization value of the J-th estimation indicator of the agro-industrial regions $j = 1 \dots 43$, which characterizes the and-th region ($i = 1 \dots 24$);

r – period of study (years) ($r = 1 \dots 6$);

x_{jir} – the natural value of the j-th partial indicator;

x_{jcpir} – an estimation of the mathematical expectation of j-th selected indicator of the i-th region for the investigated period;

X_{ij}^r – matrix of certain indicators.

In the third stage of estimation of agro-industrial complex development, after rationing of indexes, it is proved justification on clarification of the availability of autocorrelation relations of estimation indices of agro-industrial complex development by means of correlation analysis.

Correlation analysis provides an opportunity to confirm the validity of certain estimates of the agro-industrial complex development, excluding the multicinity and siderativeness of the dependences equations, by means of finding the autocorrelation between indicators expressed in the receipt of zero values of square matrices of paired correlations [175].

Calculation of the evaluation of agro-industrial complex development is carried out in accordance with the four spheres of AIC regions, calculations of the bundle, namely the estimates and indexes of agricultural fields more accurately reproduce the real state of the development of AIC regions, what use normal averaging settings. The value of the correlation coefficient between the indicators should be less than $|0.7|$ by using the software MathCAD-15 [88] According to the formula [87; 111]:

$$K_{xp,xq} = \frac{\text{cov}(x_p, x_q)}{D[x_p^2] \cdot D[x_q^2]}, \quad (3.4)$$

where I_s – Index of AIC sphere ($s = 1, \dots, 4$), which is simulated;

X_I – a matrix of normalized estimates of each of the agricultural areas of the regions for a certain period (six years, $R = 6$), has the following form:

$$X_1 = \begin{pmatrix} x_{11} & x_{12} & x_{13} & x_{14} & x_{15} & x_{16} \\ x_{21} & x_{22} & x_{23} & x_{24} & x_{25} & x_{26} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ x_{j1} & x_{j2} & x_{j3} & x_{j4} & x_{j5} & x_{j6} \\ \dots & \dots & \dots & \dots & \dots & \dots \\ x_{js1} & x_{js+1} & \dots & \dots & \dots & x_{js+1} \end{pmatrix}, \quad (3.6)$$

Where x_{j_s} – Normalized value indicators.

To determine the impact coefficients, a matrix is built which is quadratic. Similarly, a matrix of integral index of AIC regions is calculated.

Calculated influence coefficients, which are weight coefficients, are recorded in the form of regression equations, namely:

$$Is = K_{j_0} + K_{j_1} \cdot x_{j_1} + \dots + K_{j_s} \cdot x_{j_s}, \quad (3.7)$$

where K_{j_s} – coefficients of impact of the valuation indices on indexes of agro-industrial areas;

Is – agricultural Sector Index of the regions.

The regression equation in the sum from a certain approximation is shown in the form of equations, which is determined by the formula:

$$\hat{f}(X; Kn) = Kn_0 + \sum_{i=1}^p Kn_i x^{(i)}, \quad (3.8)$$

where the odds of influence $Kn = (Kn_0, Kn_1, \dots, Kn_p)^T$ are determined by the the following formula already (3.5).

Definition of indexes of agricultural sectors allows to obtain an integral index of agricultural development evaluation of regions, namely:

$$I = f_{\Sigma}(f^{(i)}) + \delta(f^{(i)}), \quad (3.9)$$

where $f_{\Sigma}(f^{(i)})$ – calculated by Formula 3.6;

$\delta(f^{(i)})$ – the error of transformations of estimation indicators.

Consequently, a multidimensional sequence of evaluable indicators $x_{j_1}, x_{j_2}, \dots, x_{j_6}$, ($j = 1, \dots, 43$) using the econometric model (see Formula 3.5), using the MathCAD-15 software functions, provides an opportunity to move from specified correlated evaluable indicators $^{(1)}, x^{(2)}, \dots, x^{(p)}$ to

impact coefficients values $f^{(1)}, \dots, f^{(p')}$. Impact coefficients are coefficients of the regression function, which characterize the impact of estimates on indexes of AIC spheres, which, in turn, affect the integral index of AIC.

At the fifth stage of the calculations, after defining the integrated index of the agro-industrial sector development estimation using factor and cluster analysis and the method of plural regression, we propose to allocate regions at the received indices values to groups with high ($I = 0,67-1.0$), medium ($I = 0,34-0,66$), low ($I = 0,0-0,33$) level of agricultural development, which will contribute to the development of directions of the organizational and economic mechanism for the development of AIC regions.

To determine the development, except for the integral index of AIC regions, we must, in our opinion, calculate the coefficient of dynamics related to the next sixth stage of the proposed calculations. The dynamics coefficient (kD) characterizes the dynamism of the development of AIC regions in time and is calculated by the formula:

$$kD_r = \frac{I_i}{r_i}, \quad (3.10)$$

where r_i – the function of dependence of the i -th region over the years (from 1 to 24, the integral index of the Autonomous Republic of Crimea is not calculated since in 2017-2018 there are no statistical data of valuation indicators), in our case, six years from 2013 to 2018;

I_i – the integral index of agro-industrial regions development by years (by which the ranks of regions are defined);

The final formula of the speaker coefficient for the i -th region takes the following form:

$$kD_i = \sqrt{\left(\frac{ri_0 - ri_1}{Ii_1}\right)^2 + \left(\frac{ri_1 - ri_2}{Ii_2}\right)^2 + \left(\frac{ri_3 - ri_4}{Ii_3}\right)^2 + \left(\frac{ri_4 - ri_5}{Ii_4}\right)^2 + \left(\frac{ri_5 - ri_6}{Ii_5}\right)^2 + \left(\frac{ri_6 - ri_{cp}}{Ii_6}\right)^2} \quad (3.11)$$

Thus, the proposed methodological approach on assessing the development of agricultural regions makes it possible to estimate the development of each of the spheres and agricultural regions as a whole, as well as to determine the development of AIC using the dynamics coefficient.

3.2. Approbation of the methodological approach for estimation of development of agro-industrial complex of the regions

Conduct experimental and experimental check of the adequacy of the improved methodical approach for assessing the development of agricultural regions, in accordance with the proposed stages (see fig. 3.1), taking into account that 24 regions of Ukraine are taken to assess the development of AIC, Crimea is not calculated, since the statistics for 2016-2018 missing.

It should also be noted that the data for the 2016-2018 biennium In Donetsk and Lugansk regions are given by enterprises, establishments, organizations that have submitted reports to bodies of the State Statistics Service of Ukraine, and also without taking into account part of the anti-terrorist operation zone. This, in turn, complicates the calculation of integral indices on these regions.

If you analyze the emission index of farming products, in the Donetsk region in 2015 production was released 14187 million. UAH, in 2016 by 16322 mln. UAH, in 2018 by 16161 mln. UAH. The share of the region in total for these years amounted to 4.5%, 4.3% and 2.9%. In Luhansk region, according to the years it was released products for 7932 million. UAH, 7733 mln. UAH, 9536 mln. UAN. In total amounted to 2.5%, 2.0%, and 1.7% [190].

If we speak about the gross regional product's share in the general result, the share of Donetsk region in 2015 was 10.8%, 2016 – 7.6%, 2018 – 5.8%. The share of Lugansk region in 2015 amounted to 3.6%,

2016 – 2.0%, 2018-1.2%. The share of Donetsk region in creation of gross regional product in 2016 in relation to 2013 was decreased by 1.9 times, Lugansk region decreased by 3 times [25].

Thus, in connection with the fact that the state statistics service of Ukraine in Donetsk and Luhansk regions provide data without regard to the zone of anti-terrorist operation and only by these enterprises, institutions and organizations that provide reporting, it may To distort the real economic situation in these regions and to influence the results of calculations of the integral index of the organizational-economic mechanism of agro-industrial development.

Stages of evaluation of agro-industrial regions development. Scheme of agriculture of regions as the system is represented in Fig. 3.2.

The development of agriculture is characterized by the integral index of the development of AIC (I_i) i -th region ($i = 1-24$), which is determined by the archives of four indexes of agriculture, namely areas: industries that produce means of production for agriculture and other industries that provide maintenance of agriculture ($I1$) (scale 0-0.25); agriculture ($I2$) (scale 0-0.25), industries for processing and preservation of agricultural products ($I3$) (scale 0-0.25); and social Infrastructure ($I4$) (scale 0-0.25).

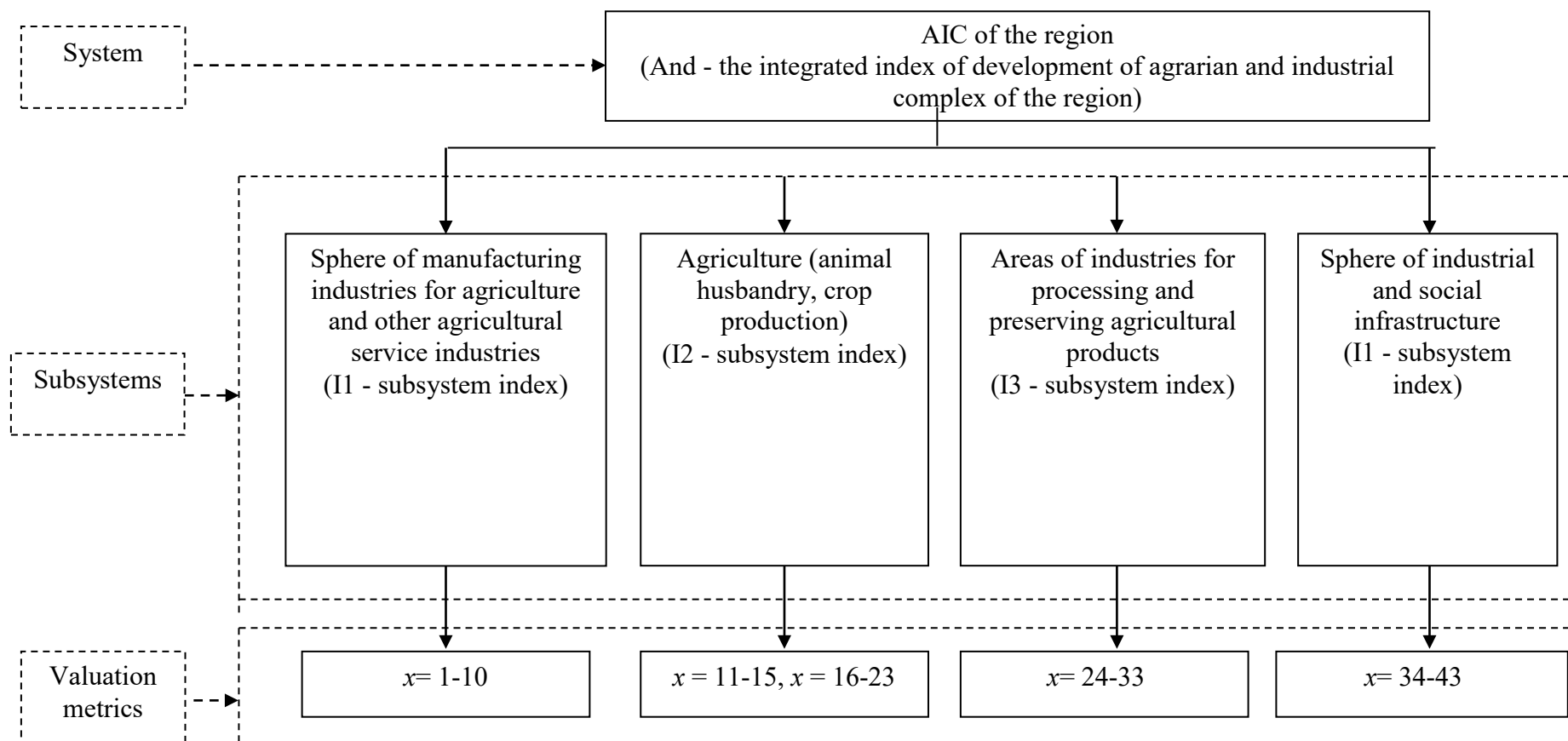


Fig. 3.2. Structural-logical scheme of the structure of the agro-industrial complex for qualimetric calculation of the integral index of assessment of the development of agro-industrial complex

Source: suggested by the authors of the study.

In its turn, each of the spheres of AIC region, characterized by the indexes of sub-systems of AIC obtained as a result of the bundle of estimated indicators (x_1 - x_{43}). All calculations are carried out according to the proposed stages (fig. 3.1) for the period from 2013-2018 ($r = 6$) and forecast to 2031 by the use of the MathCAD-15 software. Examples of calculations of the Kiev, Chernigov, Sumy and Kharkiv regions are presented in annexes B, D, E. Region selected in view of certain groups of regions for the calculated integral index of agricultural development estimates of the regions arbitrarily.

The table 3.7 presents the results of calculations of the integrated index of agro-industrial regions development for 2013-2018.

Asymmetry for the average integral index of agricultural development estimates between the Zaporizhia ($I = 0,724$) and Kherson ($I = 0,284$) regions is 2.5 times, and asymmetry on the average between groups of regions belonging to the group with a high (average group of 0.687) and low (on average in group 0.315) the level of agricultural development is almost 2.2 times.

Calculation of the average integral index of the agricultural development appraisal of the regions in all the regions over the years shows a tendency to drop the values of the average index in the 2014-2018 bienniums. In relation to the index value in 2013 in which it was – 0.537, which is the largest value in the study period. The smallest value of the average integral index for all studied regions was in 2014 – 0.477. In the 2013-2014 bienniums the index was 0.521. And in 2018 – 0.520. The average value of the integral index for all regions under the studied period was – 0.510. Thirteen regions belong to the middle group by the integral Index.

Table 3.7

Integrated Index of Development of AIC of the Regions for 2013-2018

Region	2013	2014	2015	2016	2017	2018	The average integral index of agro-industrial complex of regions
Vinnitsia	0,800	0,500	0,800	0,807	0,590	0,556	0,675
Volyn	0,193	0,111	0, 379	0,622	0,411	0,228	0,324
Dnipropetrovsk	0,713	0,687	0,612	0,614	0,743	0,756	0,688
Donetsk	0,599	0,380	0,798	0,694	0,385	0,228	0,514
Zhytomyr	0,677	0,501	0,198	0,679	0,345	0,619	0,503
Transcarpathian	0,256	0,577	0,604	0,581	0,418	0,453	0,481
Zaporozhye	0,810	0,607	0,815	0,641	0,643	0,829	0,724
Ivano-Frankivsk	0,529	0,656	0,539	0,478	0,537	0,553	0,549
Kiev	0,778	0,585	0,752	0,575	0,747	0,722	0,693
Kirovograd	0,493	0,643	0,380	0,393	0,500	0,681	0,515
Lugansk	0,705	0,481	0,403	0,512	0,501	0,460	0,510
Lviv	0,419	0,621	0,617	0,340	0,478	0,620	0,516
Mykolaiv	0,364	0,755	0,602	0,437	0,483	0,353	0,499
Odesa	0,514	0,400	0,562	0,447	0,559	0,586	0,511
Poltava	0,756	0,763	0,376	0,547	0,431	0,402	0,546
Rivne	0,571	0,079	0,527	0,492	0,369	0,701	0,457
Sumy	0,358	0,150	0,435	0,418	0,246	0,429	0,339
Ternopil	0,339	0,211	0,422	0,297	0,281	0,380	0,322
Kharkiv	0,541	0,837	0,549	0,732	0,794	0,589	0,674
Kherson	0,280	0,128	0,252	0,415	0,374	0,253	0,284
Khmelnysky	0,754	0,561	0,704	0,593	0,727	0,784	0,687
Cherkasy	0,341	0,248	0,170	0,341	0,422	0,308	0,305
Chernivtsi	0,608	0,399	0,558	0,473	0,536	0,509	0,514
Chernihiv	0,495	0,567	0,303	0,383	0,193	0,492	0,405
<i>The arithmetic mean of the integral index across all regions</i>	<i>0,537</i>	<i>0,477</i>	<i>0,521</i>	<i>0,521</i>	<i>0,488</i>	<i>0,520</i>	<i>0,510</i>

Source: calculated by the authors on the proposed methodical approach of assessing the development of agricultural regions.

In table. 3.8 ranks of regions by the value of the integral index of the agro-industrial development assessment. In the studied period from 2013-2018, no region, would not change its rank by the integral index. The data table 3.8 illustrate that all regions of changed rank according to the integral index of AIC development of regions, it is not necessary to trace positive or negative dynamics in the changes of ranks by regions during the investigated period.

Table 3.8

Integrated Index of Development of AIC of Regions and Rank of the Regions for 2013-2018

Region	2013		2014		2015		2016		2017		2018	
	<i>I</i>	rank of the region	<i>I</i>	rank of the region	<i>I</i>	rank of the region	<i>I</i>	rank of the region	<i>I</i>	rank of the region	<i>I</i>	rank of the region
Vinnitsia	0,800	2	0,500	14	0,800	2	0,807	1	0,590	6	0,556	11
Volyn	0,193	24	0,111	23	0,379	19	0,622	6	0,411	17	0,228	23
Dnipropetrovsk	0,713	6	0,687	4	0,612	7	0,614	7	0,743	3	0,756	3
Donetsk	0,599	10	0,380	18	0,798	3	0,694	3	0,385	18	0,228	24
Zhytomyr	0,677	8	0,501	13	0,198	23	0,679	4	0,345	21	0,619	8
Transcarpathian	0,256	23	0,577	10	0,604	8	0,581	9	0,418	16	0,453	16
Zaporozhye	0,810	1	0,607	8	0,815	1	0,641	5	0,643	5	0,829	1
Ivano-Frankivsk	0,529	13	0,656	5	0,539	13	0,478	14	0,537	8	0,553	12
Kiev	0,778	3	0,585	9	0,752	4	0,575	10	0,747	2	0,722	4
Kirovograd	0,493	16	0,643	6	0,380	18	0,393	20	0,500	11	0,681	6
Lugansk	0,705	7	0,481	15	0,403	17	0,512	12	0,501	10	0,460	15
Lviv	0,419	17	0,621	7	0,617	6	0,340	23	0,478	13	0,620	7
Mykolaiv	0,364	18	0,755	3	0,602	9	0,437	17	0,483	12	0,353	20
Odesa	0,514	14	0,400	16	0,562	10	0,447	16	0,559	7	0,586	10
Poltava	0,756	4	0,763	2	0,376	20	0,547	11	0,431	14	0,402	18
Rivne	0,571	11	0,079	24	0,527	14	0,492	13	0,369	20	0,701	5
Sumy	0,358	19	0,150	21	0,435	15	0,418	18	0,246	23	0,429	17
Ternopil	0,339	21	0,211	20	0,422	16	0,297	24	0,281	22	0,380	19
Kharkiv	0,541	12	0,837	1	0,549	12	0,732	2	0,794	1	0,589	9
Kherson	0,280	22	0,128	22	0,252	22	0,415	19	0,374	19	0,253	22
Khmelnysky	0,754	5	0,561	12	0,704	5	0,593	8	0,727	4	0,784	2
Cherkasy	0,341	20	0,248	19	0,170	24	0,341	22	0,422	15	0,308	21
Chernivtsi	0,608	9	0,399	17	0,558	11	0,473	15	0,536	9	0,509	13
Chernihiv	0,495	15	0,567	11	0,303	21	0,383	21	0,193	24	0,492	14

Source: calculated by the authors on the proposed methodological approach to the evaluation of the development of agro-industrial complex of regions.

The biggest change rank in the integrated index was held in Donetsk region, for this region the highest rank-3rd place was in 2015, and the lowest-24 place rating observed in 2018, due to the actions of socio-economic situation political situation in the region.

Grouping of regions by the average integrated index of agro-industrial regions is illustrated in Fig. 3.3.



Fig. 3.3. Grouping of regions by the average integral index of development of agro-industrial complex of the regions

Integral Index of agricultural development evaluation of the regions characterizes the changes that have occurred in AIC regions, but does not characterize the dynamics of agricultural development. To determine the dynamics of development, according to the proposed methodological approach, it was proposed to define the coefficient of dynamics of agro-industrial development of the regions, the calculations of which are based

on designed for meanings of the integral Index of development evaluation agricultural regions and ranks of regions by this index.

Calculation of the coefficient of development of agro-industrial complex, grouping of regions by value of average integral index is presented in table. 3.9.

Table 3.9

The average integral index and the coefficient of agro-industrial development dynamics of regions, ranks and groups of regions with the average integrated index

Region	The average integral index of the development of agro-industrial complex	Rank of the region according to the average integral index	Regional Development Level Group by Index Rank	The average coefficient for the development of agro-industrial complex	The rank of the region by the average coefficient of the dynamics of the agro-industrial complex
1	2	3	4	5	6
Vinnitsia	0,675	5	high	31,52	14
Volyn	0,324	21	low	58,22	4
Dnipropetrovsk	0,688	3	high	8,74	24
Donetsk	0,514	11	average	70,12	3
Zhytomyr	0,503	15	average	108,48	2
Transcarpathian	0,481	17	average	52,58	6
Zaporozhye	0,724	1	high	16,72	22
Iv.-Frankivsk	0,549	7	average	24,46	18
Kiev	0,693	2	high	20,01	20
Kirovograd	0,515	10	average	38,89	11
Lugansk	0,510	14	average	20,99	19
Lviv	0,516	9	average	49,23	9
Mykolaiv	0,499	16	average	52,13	7
Odesa	0,511	13	average	28,32	16
Poltava	0,546	8	average	38,91	10

Continuation of Table 3.4

1	2	3	4	5	6
Rivne	0,457	18	average	136,32	1
Sumy	0,339	20	low	49,35	8
Ternopil	0,322	22	low	29,99	15
Kharkiv	0,674	6	high	32,32	13
Kherson	0,284	24	low	14,89	23
Khmelnysky	0,687	4	high	18,42	21
Cherkasy	0,305	23	low	34,41	12
Chernivtsi	0,514	12	average	25,06	17
Chernihiv	0,405	19	average	56,37	5

Source: calculated by the authors on the proposed methodological approach, taking into account the prediction error.

The coefficient of agricultural development dynamics of the regions directly determines the dynamics of development in time, its calculations prove that the high level of the dynamics of agro-industrial complex's development are Rivnenka (kD = 136.32), Zhytomyrska (kD = 108.48), Donetsk (kD = 70.12), Volyn (kD = 58.22), Chernihiv (kD = 56.37) and Transcarpathian (kD = 52.58) regions.

The insignificant level of the development dynamics of AIC regions have Dnepropetrovsk (kD = 8.74), Kherson (kD = 14.89), Zaporizhzhya (kD = 16.72), Khmelnytsky (kD = 18.42), Kyiv (kD = 20.01), Lugansk (kD = 20.99), Ivano-Frankivsk (kD = 24.46) regions.

The difference between Dnipropetrovsk and Rivne regions by the factor of agricultural development dynamics is almost 15.6 times.

Illustration of the regions of Ukraine by the value of the coefficient of development dynamics of AIC is presented in Fig. 3.4.



Fig. 3.4. Illustration of the regions of Ukraine by the value of the coefficient of development of agriculture

The calculated integral index of agricultural development of regions according to the proposed methodological approach enables to group regions by the high, medium and low level of development of AIC (table 3.9).

According to the average integrated index of the agro-industrial complex development of the six regions, namely Zaporozhye, Kiev, Dnepropetrovsk, Khmelnytsky Vinnitsa, Kharkiv, and the region referred to the regions with a high level of agricultural development of the regions. Five regions – Sumy, Volyn, Ternopil, Cherkasy, Kherson regions are among the low level of development in the integrated index of agro-industrial complex development of the regions. The most numerous group of regions with an average level of agricultural development of the

regions, which includes thirteen regions, namely: Donetsk, Zhytomyr, Transcarpathian, Ivano-Frankivsk, Kirovograd, Lugansk, Lviv, Mykolayiv, Odesa, Poltava, Rivne, Chernivtsi and Chernihiv regions.

Thus, based on the results obtained according to the proposed methodological approach of assessing the development of AIC regions in accordance with the proposed stages of its implementation, the results obtained can be inferred that the asymmetry by the value of the average integral. The index of agricultural development assessment of regions between the Zaporozhye and Kherson regions is 2.5 times, asymmetry in the average integrated index of the agro-industrial regions development between the group of regions with a high level of agro-industrial and low development is almost 2.2 times. Asymmetry of the coefficient of development dynamics between Dnepropetrovsk and Rivne regions is almost 15.6 times. In this case, the rank of regions by the average integral index and the coefficient of development dynamics of agro-industrial complex has about the same positions by rank, which certify that regions having better values of integral index have a better value of coefficient loudspeakers. The improved methodological approach of agricultural development evaluation of regions, in its turn, is the methodical basis for elaboration of methodical recommendations on evaluation of organizational-economic mechanism of agro-industrial areas development and development of actions on improvement.

3.3. Introducing the methodological approach to assessing the effectiveness of the organizational and economic mechanism of the development of agro-industrial complex of the regions

The research of existing methodical approaches on evaluation of organizational-economic mechanism of agro-industrial complex development testifies, that most researchers use calculations of integral indices. This, in our opinion, is justified, as the organizational and economic mechanism of agro-industrial regions development is a complex system that is constantly in motion. However, the application of the integrated indicator to assess the effectiveness of the organizational and economic mechanism imposes certain conditions, namely:

Firstly, there should be a breakdown of the evaluation object on the elements assessed by a certain aggregate of indicators that objectively characterize these elements. It should be emphasized that such statistics exist for AIC regions and its spheres, and for the organizational and economic mechanism – no;

Secondly, the integral indexes make it possible to assess the outcome of the object's development, but do not reflect the processes taking place and provide this result. It is suitable for the evaluation of agricultural regions, but not for the organizational and economic mechanism, because it is important for the mechanism to assess the processes occurring under its action and influence the development of AIC regions, which in turn is assessed by the integrated index development of agro-industrial regions.

So, in our opinion, to assess the effectiveness of the organizational and economic mechanism for the development of agricultural regions it is advisable to use the model of nonlinear dynamics in the form of a system of three differential equations, namely:

$$F(t, z) = \begin{bmatrix} z_{2,0} \cdot z_{0,0} \cdot (z_{1,0} - z_{0,0}) - (a + y) \cdot z_{0,0} \\ z_{1,0}(-b) + a \cdot z_{0,0} + c \\ p \cdot z_{2,0} \cdot (B - z_{2,0}) + y \cdot z_{0,0} \end{bmatrix}, \quad (3.12)$$

where $z_{0,0}$ – the level of agricultural development in the region (average integral index of the organizational and economic mechanism);

$z_{1,0}$ – the maximum level of agribusiness in the region (the maximum value of the integral index of the organizational and economic mechanism of the region in the investigated period);

$z_{2,0}$ – speed of changes in the development of agro-industrial complex (coefficient of change of integral index of organizational-economic mechanism);

y – the average value of the organizational component mechanism;

b – the average value of the economic component mechanism;

$c = \frac{A}{B}$ – the ratio of the minimum value of the integral index of the organizational and economic mechanism to the maximum;

A – minimum value of integral index of the organizational and economic mechanism of the region for the investigated period;

B – the maximum value of integral index of the organizational and economic mechanism of the region for the investigated period;

a, b – changes in the levels of investment in the development of agricultural region.

Integral index of the organizational-economic mechanism of agro-industrial regions development is calculated according to the formula:

$$I_{OEM} = \left(\sum_{i=0}^3 K_{2i} \cdot z_i - I \right), \quad (3.13)$$

where K_{2i} – the coefficient of influence of the matrix components of $Z1$ is calculated according to the formula:

$$K_{2i} = \left[(Z_1 \cdot Z_1^T)^{-1} \cdot Z_1 \right] \cdot z_1, \quad (3.14)$$

where: $Z1$ – the matrix of components of the organizational and economic mechanism by years;

$z1$ – integral Index of agricultural development of the region (i) by years.

$$Z_1 = \begin{pmatrix} z_{10} & z_{11} & z_{12} & z_{13} & z_{14} & z_{15} \\ z_{20} & z_{21} & z_{22} & z_{23} & z_{24} & z_{25} \\ z_{30} & z_{31} & z_{32} & z_{33} & z_{34} & z_{35} \end{pmatrix}, \quad (3.15)$$

where $Z2$ – is the influence of the organizational component mechanism (KO) to integral index of agricultural development in the region,

$Z3$ – influence of economic component mechanism (KE) on integral index of agricultural development of the region.

$$kI_{OEM} = \sum_{i=1}^4 (I_{OEM_{ii+1}} - I_{OEM_i}), \quad (3.16)$$

kI_{OEM} – The coefficient of changing the index of organizational-economic mechanism of agro-industrial regions development.

To determine the action of the organizational component of the mechanism for the development of agricultural region it is necessary to calculate the coefficient of organizational component mechanism (CO), which determines the influence of organizational component of organizational-economic mechanism for development agricultural regions and determined by the formula:

$$K_{O_r} = \left| \frac{\Delta I_i}{\Delta r_i} \right|, \quad (3.17)$$

where r_i – the function of dependence of the i -th region over the years (from 1 to 24, the integral index of the Autonomous Republic of Crimea is not calculated since in 2017-2018 there are no statistical data of valuation indicators), in our case, six years from 2013 to 2018;

I_i – the integral index of agro-industrial regions development by years (by which the ranks of regions are defined).

In our case, the final formula of the organizational component for the i -th region takes the following form:

$$K_{O_i} = \left(\sqrt{\left(\frac{I_{i_0} - I_{i_1}}{r_{i_0} - r_{i_1}} \right)^2}; \sqrt{\left(\frac{I_{i_1} - I_{i_2}}{r_{i_1} - r_{i_{21}}} \right)^2}; \sqrt{\left(\frac{I_{i_2} - I_{i_3}}{r_{i_2} - r_{i_3}} \right)^2}; \sqrt{\left(\frac{I_{i_3} - I_{i_4}}{r_{i_3} - r_{i_4}} \right)^2}; \sqrt{\left(\frac{I_{i_4} - I_{i_5}}{r_{i_4} - r_{i_5}} \right)^2}; \sqrt{\left(\frac{I_{i_5} - I_{i_{cp}}}{r_{i_5} - r_{i_{cp}}} \right)^2} \right)^T. \quad (3.18)$$

To determine the economic component of the mechanism it is necessary to calculate the economic component coefficient (KE), which determines the influence of the economic component mechanism on the development of AIC regions and is determined by the formula:

$$K_{E_r} = \sqrt[3]{\frac{I_{i_r} \cdot kD_r \cdot Inv_r}{R_i}}, \quad (3.19)$$

where I_{ir} is an integral index of the 1st year of the r -th region;

kDr – the coefficient of agricultural development dynamics of the region for r -th year;

$Invr$ is the most influential indicator of investments for each of the regions by years;

R – rank i -th region from 1 to 24 on the average integral index of AIC's region.

$$K_{Er} = \left[\sqrt[3]{\frac{li_0 \cdot kD_{r0} \cdot Inv_0}{R}}, \sqrt[3]{\frac{li_1 \cdot kD_{r1} \cdot Inv_1}{R}}, \sqrt[3]{\frac{li_2 \cdot kD_{r2} \cdot Inv_2}{R}}, \sqrt[3]{\frac{li_3 \cdot kD_{r3} \cdot Inv_3}{R}}, \sqrt[3]{\frac{li_4 \cdot kD_{r4} \cdot Inv_4}{R}}, \sqrt[3]{\frac{li_5 \cdot kD_{r5} \cdot Inv_5}{R}} \right]^T; (3.20)$$

where $kD_{r_0} = \sqrt{\left(\frac{I_0}{r_{r_0}}\right)^2} \dots kD_{r_5} = \sqrt{\left(\frac{I_5}{r_{r_5}}\right)^2}$, – the components of the relative indexes of the agro-industrial region.

The model is a system of three nonlinear differential equations. The first two equations describe changes in the time level of the development of agro-industrial complex under the influence of organizational and economic mechanism. The third equation recognizes the changes in the speed of agro-industrial complex under the influence of organizational and economic mechanism. The solution of the system is performed by the Runge-Kutta method of the 4th order, which makes it possible to obtain the result of high accuracy. Effect of the organizational and economic mechanism is manifested in the growth of the level of development of AIC (visualized as a growing surface of the solution system). The results of the solution show the phase space of the coordinate of the organizational-economic mechanism within the growth of integral index of AIC.

The system of differential equations allows estimating the dynamics of agricultural development in time and the action of organizational and economic mechanism on agro-industrial regions in a certain direction of

development that corresponds to a specific trajectory of the system differential equations on surface solution. At the same time, AIC region according to the defined integral index of agricultural development characterizes some point (the state of AIC), which is on this trajectory. If the surface of the solution system differential equations is smooth and without breaks and has a positive slope, it characterizes the direction of development of agro-industrial complex under the influence of organizational and economic mechanism.

Also, estimation of organizational-economic mechanism of agro-industrial development of regions, in our opinion, requires forecasting of further development of agro-industrial complex of regions. The forecast is based on the extrapolation of trends of the most influential valuation indicators of each of AIC regions, defined as a result of calculations for the index of the agro-industrial areas of the regions and the integral index of AIC regions as a whole. This calculation of error forecasting makes it possible to build a forecast of agricultural development in regions by the integral index of AIC regions to 2031 the scheme of forecasting of the integrated index of agricultural development in the regions is presented in Fig. 3.5.

The linear extrapolation of trends of the most influential indicators in the form of a function $y = kx + B$ gives an opportunity to obtain the most accurate prognosis, as the approximate approximation of the projected value of an agricultural regional field estimation is used the result of which adjusts the initial approximation of this metric. At the same time, not less than 3-4 iterations of approximations of the values of the most influential valuation indices are used.

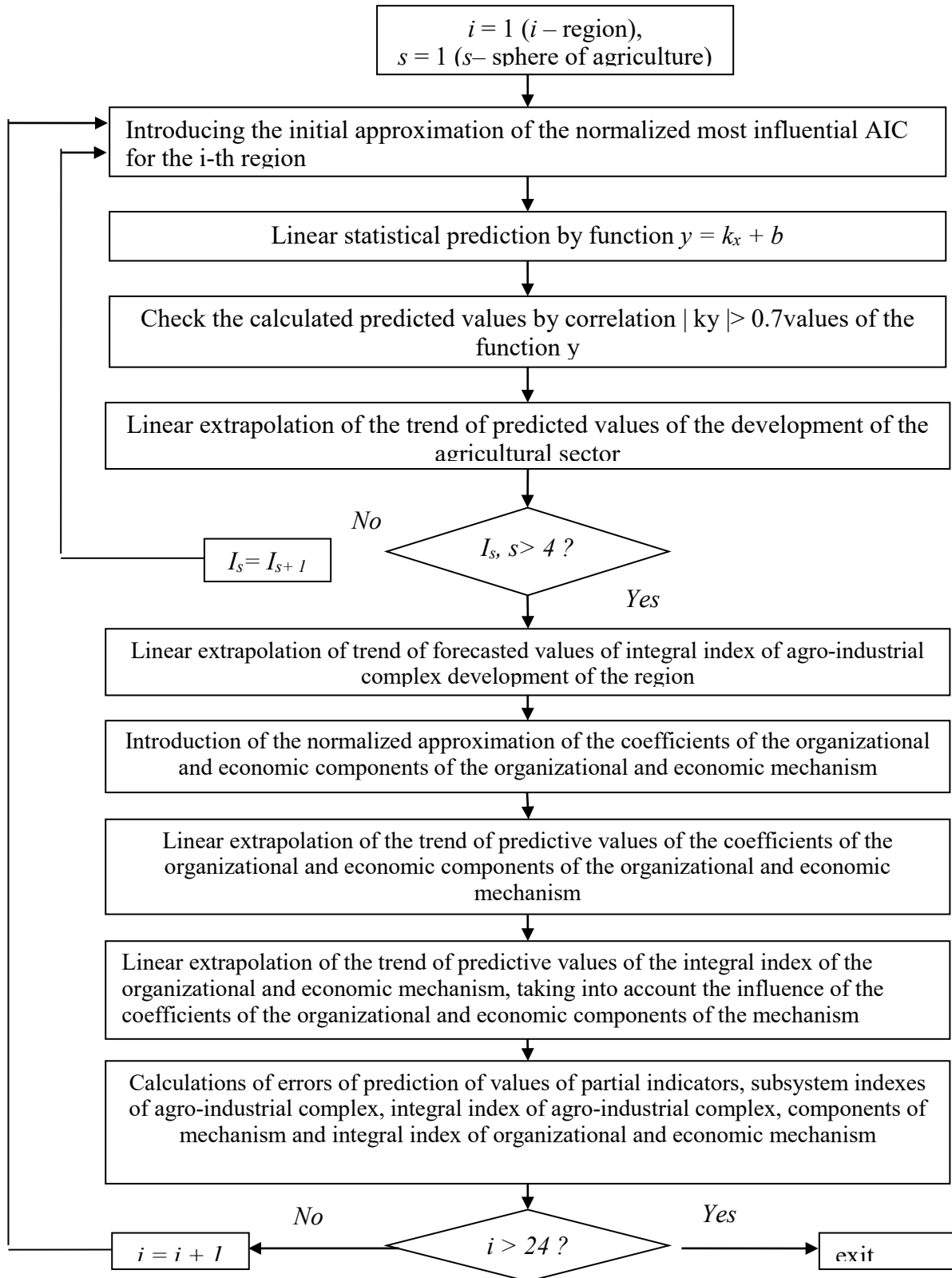


Fig. 3.5. Scheme of algorithm for prediction of integral index of organizational and economic mechanism of development of agro-industrial complex of the regions

Source: Created by the authors.

The methodology of forecasting the development of AIC regions requires accounting and calculation of the prediction error, since the projected period is long-term, namely 15 years to 2031 to obtain more accurate calculations, in our opinion, it is appropriate To predict not just an integral indicator of the development of agro-industrial regions, but to predict indexes of AIC agricultural areas taking into account the impact of the most influential valuation indicators.

Calculation error of indexes of agricultural regions spheres is determined by the formula (dIs):

$$dIs = dx_n + 0,001 + 0,05 \quad (3.21)$$

where dx_n – is the most influential valuation indicator for the s-th sphere of APK regions;

0.001 – scale error of representation of the most influential valuation indicators;

0.05 – error of transformation in determining the index of agricultural regions.

The error of calculation of integral index of development of agro-industrial regions (dI) is determined by the formula:

$$dI = dI_1 + dI_2 + dI_3 + dI_4, \quad (3.22)$$

Error calculation of coefficients of organizational and economic components of the mechanism and organizational and economic mechanism are calculated by formulas:

$$dKo = dz_2; dKe = dz_3 \quad (3.23)$$

$$d_{OEM} = dK_o + dK_E + 10,0 \cdot \max(dz_2, dz_3) \quad (3.24)$$

where dz_2 – error for the calculation of the organizational component of the mechanism;

dz_3 – error for calculation of the economic component of the mechanism;

$10,0 \cdot \max(dz_2, dz_3)$ – the error of transformation when calculating the values of organizational and economic mechanism.

The error of calculation of the integral index development of agro-industrial regions (DP) for the influence of years from 2013 to 2031 p. will be equal to:

$$dp = e^{(2030/2010)}. \quad (3.25)$$

General error of calculations in forecasting the development of AIC regions (p) is calculated by the formula:

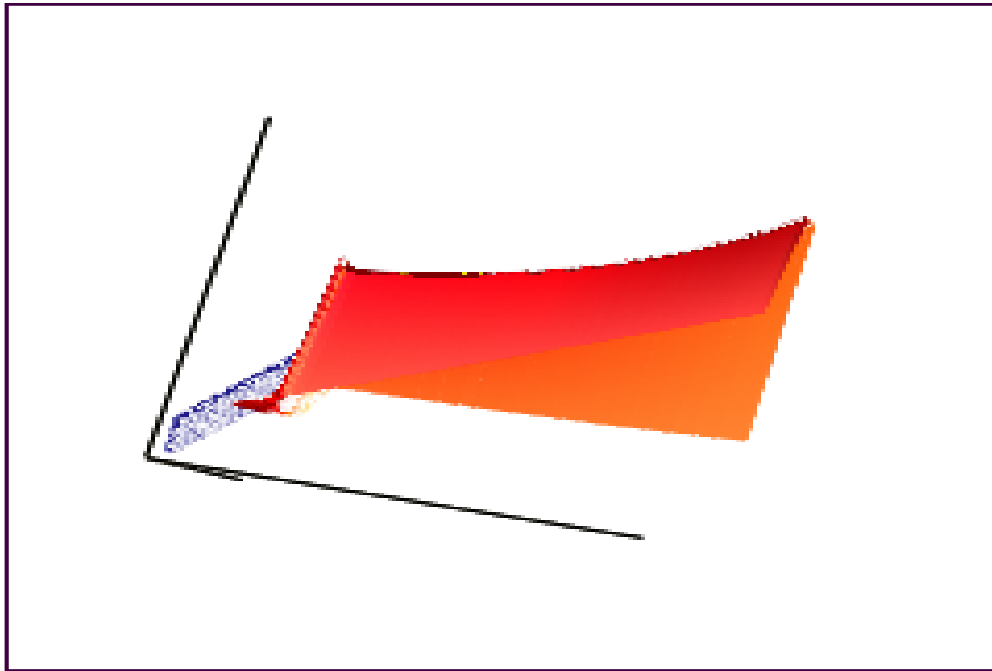
$$P = 0,001 \cdot dI \cdot dp + dp_{OEM} \quad (3.26)$$

Consideration error makes it possible to construct a more accurate forecast to 2031

Thus, the use of nonlinear dynamics allows to evaluate efficiency of organizational-economic mechanism of agro-industrial complex development and to build the forecast of development of agro-industrial complex till March 2031.

Testing of the developed methodological approach on evaluation of agricultural development of regions will consider, as an example, in Kyiv region. To solve the differential equation (see formula 3.12), we substituted the calculated values for the Kiev region (see the methodological approach to the evaluation of AIC regions development and Appendix B, an example of

calculating the integral index of the agro-industrial regions development for Kyiv region), namely: $z_{0,0} = 0.047$; $Z_{1,0} = 0.054$; $Z_{2,0} = -0.011$; $A = 0.041$; $I_n = 0.054$; $i_n = 0.160$; $b = -2.699$; $A = -2.763$; $c = 0.759$; $p = 0.364$. Graphic representation of the system differential equations is presented in Fig. 3.6.



Z, Z_4

Fig. 3.6. Graphic representation of the solution of the differential equation system for the Kiev region, where Z is the plane of solutions, Z_4 is the surface of the phase space

Graphic representation of the system differential equations illustrates the phase space of the integral index of agriculture of the Kiev region, which makes it possible to define a specific trajectory of development of AIC, presented in Fig. 3.7. The specific trajectory of the AIC development is located as a line of Retenin plane Z and the surface of the phase space Z_4 .

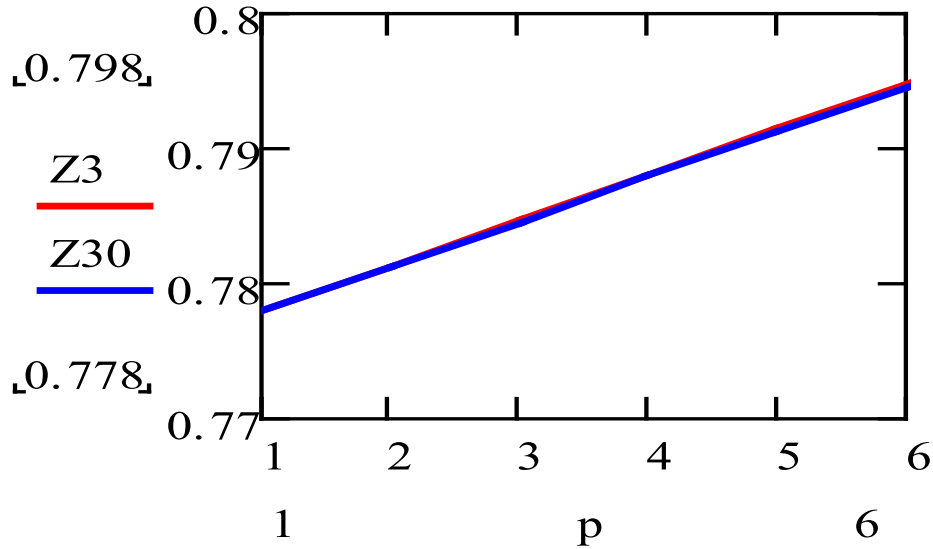
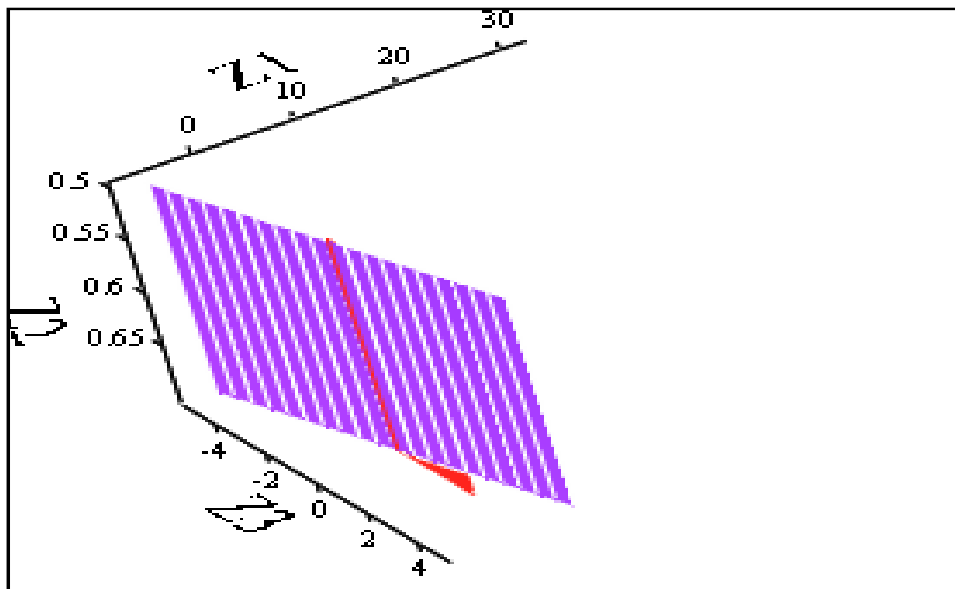


Fig. 3.7. Visualization of the direction of development of agro-industrial complex of Kiev region (line of intersection of plane), where $Z3$ is the value of the integrated index of agro-industrial complex due to the action of organizational and economic mechanism

The plane of the direction of AIC development of Kyiv region under the influence of the organizational and economic mechanism, transferred to the surface of the solution (phase space) system of differential equations to determine the trajectory of agricultural development. In Fig. 3.9 the state of phase variables of agro-industrial complex development of Kyiv region on the selected trajectory of development in the dependencies (interchanges of the systems of differential equations see Formula 3.12).



$Z, Z4$

Fig. 3.8. Graphic representation, illustrating the local plane of the direction of development of agro-industrial complex of Kyiv region under the influence of organizational and economic mechanism, where:

$Z1$ - coefficient of change of the integral index of agro-industrial complex;

$Z2$ - the value of the integrated agricultural index by years;

$Z3$ - the value of the integral index of the agro-industrial complex due to the action of the organizational and economic mechanism, Z - the plane of solutions,

$Z4$ - the surface of the phase space

Illustration of finding the working point of the integral index of the development of AIC on a given trajectory for the Kiev region is presented in Fig. 3.10, where the $Z1$ is the coefficient of change of AIC integral index; $Z2$ – values of the integral index of AIC by years; $Z3$ – value integral index of AIC due to the action of organizational and economic mechanism.

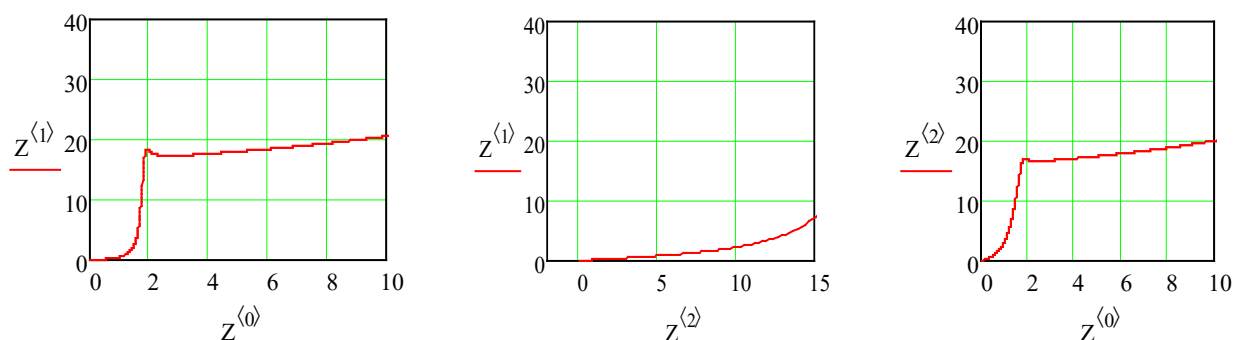


Fig. 3.9. The state of phase variables of the development of the AIC of the Kyiv region on the selected development trajectory, where is the current rate of action of the organizational and economic mechanism on the AIC, the current level of the mechanism's action on the AIC, and the perspective level of the mechanism's action on the AIC

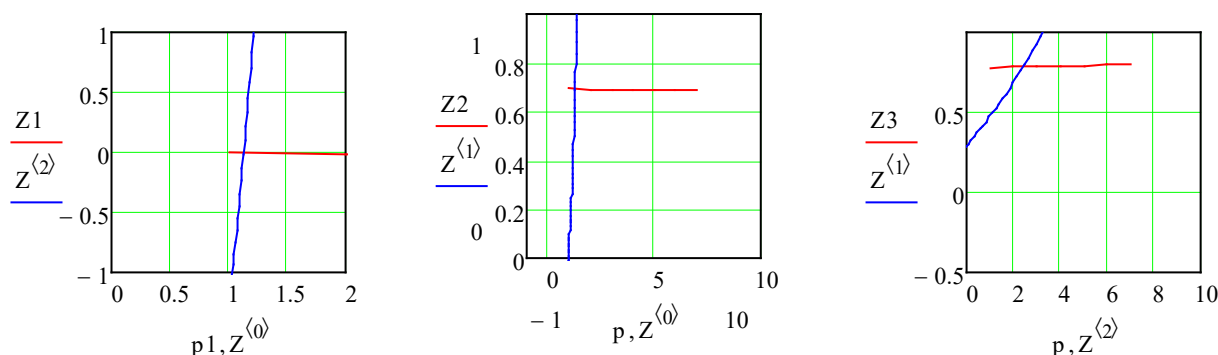


Fig. 3.10. Illustration of finding the working point of values of the integral index of agricultural development in Kyiv region on a given trajectory

In Fig. 3.9 the position of the chosen path of agro-industrial complex of Kiev region is illustrated, that allows to determine the position of the working point of finding the value of integral index of AIC of Kiev region.

Defining the working point of the values of the integral index of the AIC on a given trajectory makes it possible to define an integral index of the organizational and economic mechanism of the agro-industrial

complex of Kyiv region. Calculations of organizational and economic components of organizational-economic mechanism in all regions are presented in table 3.10, and the integral index of the organizational-economic mechanism of agro-industrial regions development is presented in table 3.11.

Table 3.10

*Calculations of the coefficient of the organizational component
of the mechanism of development of agro-industrial complex
of the regions for 2013-2018*

Region	2013	2014	2015	2016	2017	2018	the average of the coefficient
Vinnysia	0,016	0,015	0,017	0,015	0,017	0,020	0,017
Volyn	0,007	0,004	0,003	0,001	0,001	0,001	0,003
Dnipropetrovsk	0,018	0,016	0,020	0,021	0,023	0,026	0,021
Donetsk	0,009	0,018	0,005	0,013	0,007	0,006	0,010
Zhytomyr	0,011	0,005	0,004	0,003	0,005	0,005	0,006
Transcarpathian	0,010	0,007	0,004	0,004	0,001	0,001	0,005
Zaporozhye	0,024	0,026	0,027	0,033	0,035	0,037	0,030
Ivano-Frankivsk	0,015	0,015	0,015	0,014	0,015	0,018	0,015
Kiev	0,019	0,017	0,023	0,020	0,002	0,003	0,014
Kirovograd	0,012	0,014	0,014	0,012	0,009	0,009	0,012
Lugansk	0,010	0,003	0,005	0,001	0,002	0,002	0,004
Lviv	0,013	0,014	0,014	0,013	0,010	0,014	0,013
Mykolaiv	0,010	0,006	0,003	0,003	0,004	0,004	0,005
Odessa	0,010	0,016	0,005	0,011	0,008	0,007	0,010
Poltava	0,014	0,015	0,013	0,013	0,013	0,017	0,014
Rivne	0,009	0,006	0,004	0,004	0,002	0,001	0,004
Sumy	0,007	0,005	0,003	0,001	0,001	0,001	0,003
Ternopil	0,007	0,003	0,002	0,001	0,001	0,001	0,003
Kharkiv	0,016	0,014	0,016	0,015	0,016	0,019	0,016
Kherson	0,005	0,002	0,002	0,001	0,001	0,001	0,002
Khmelnysky	0,017	0,016	0,019	0,016	0,018	0,022	0,018
Cherkasy	0,007	0,004	0,003	0,001	0,001	0,001	0,003
Chernivtsi	0,009	0,017	0,005	0,012	0,007	0,008	0,010
Chernihiv	0,008	0,005	0,004	0,005	0,001	0,001	0,004

Source: calculated by the authors on the proposed methodological approach of evaluating the organizational and economic mechanism of development of agro-industrial complex of the regions.

Table 3.11

Calculations of the coefficient of economic component of the mechanism of development of agro-industrial complex of the regions for 2013-2018

Region	2013	2014	2015	2016	2017	2018	the average of the coefficient
Vinnitsia	0,020	0,020	0,019	0,016	0,014	0,019	0,018
Volyn	0,008	0,005	0,001	0,001	0,001	0,001	0,003
Dnipropetrovsk	0,022	0,019	0,020	0,020	0,025	0,024	0,022
Donetsk	0,009	0,010	0,008	0,012	0,006	0,005	0,008
Zhytomyr	0,007	0,005	0,005	0,001	0,005	0,003	0,004
Transcarpathian	0,008	0,005	0,003	0,002	0,002	0,002	0,004
Zaporozhye	0,034	0,029	0,030	0,029	0,030	0,032	0,031
Ivano-Frankivsk	0,018	0,017	0,016	0,013	0,012	0,018	0,016
Kiev	0,033	0,023	0,024	0,025	0,051	0,033	0,032
Kirovograd	0,011	0,011	0,009	0,011	0,010	0,010	0,010
Lugansk	0,008	0,005	0,006	0,004	0,006	0,004	0,006
Lviv	0,015	0,014	0,013	0,013	0,010	0,013	0,013
Mykolaiv	0,007	0,005	0,004	0,002	0,004	0,003	0,004
Odessa	0,009	0,010	0,007	0,012	0,007	0,007	0,009
Poltava	0,017	0,017	0,015	0,013	0,011	0,017	0,015
Rivne	0,008	0,004	0,003	0,001	0,001	0,001	0,003
Sumy	0,009	0,004	0,002	0,001	0,001	0,001	0,003
Ternopil	0,007	0,005	0,001	0,001	0,001	0,001	0,003
Kharkiv	0,019	0,018	0,016	0,014	0,013	0,019	0,017
Kherson	0,005	0,004	0,001	0,001	0,001	0,001	0,002
Khmelnitsky	0,021	0,014	0,019	0,017	0,015	0,020	0,018
Cherkasy	0,007	0,003	0,001	0,001	0,001	0,001	0,002
Chernivtsi	0,009	0,011	0,007	0,011	0,007	0,004	0,008
Chernihiv	0,008	0,005	0,002	0,001	0,001	0,001	0,003

Source: calculated by the authors on the proposed methodological approach of evaluating the organizational and economic mechanism of development of agro-industrial complex of regions.

Calculations of the integral index of the organizational and economic mechanism of agro-industrial areas development according to the proposed methodological approach is presented in table 3.12 and illustrated in Fig. 3.11.

Table 3.12

Calculations of the integral index of the organizational and economic mechanism of agro-industrial regions development in 2013-2018

Region	2013	2014	2015	2016	2017	2018	The average integral index of OEMs of APC regions	The coefficient of change of the OEM integral index
Vinnitsia	0,052	0,035	0,036	0,031	0,031	0,039	0,035	-0,020
Volyn	0,009	0,006	0,002	0,002	0,002	0,002	0,006	0,005
Dnipropetrovsk	0,060	0,04	0,043	0,041	0,048	0,050	0,043	0,007
Donetsk	0,028	0,023	0,015	0,025	0,013	0,011	0,018	0,015
Zhytomyr	0,012	0,008	0,01	0,004	0,01	0,008	0,01	0,004
Transcarpathian	0,013	0,009	0,004	0,006	0,003	0,003	0,009	0,014
Zaporozhye	0,089	0,062	0,065	0,062	0,065	0,069	0,061	0,034
Ivano-Frankivsk	0,046	0,031	0,031	0,027	0,027	0,036	0,031	0,001
Kiev	0,066	0,043	0,026	0,045	0,053	0,036	0,046	-0,011
Kirovograd	0,037	0,023	0,018	0,023	0,019	0,019	0,022	-0,001
Lugansk	0,011	0,006	0,008	0,005	0,008	0,006	0,01	-0,016
Lviv	0,041	0,027	0,023	0,026	0,02	0,027	0,026	0,013
Mykolaiv	0,011	0,008	0,008	0,005	0,008	0,007	0,009	-0,001
Odessa	0,026	0,021	0,015	0,023	0,015	0,014	0,019	0,005
Poltava	0,043	0,03	0,028	0,026	0,024	0,034	0,029	-0,023
Rivne	0,012	0,008	0,005	0,005	0,003	0,002	0,007	0,008
Sumy	0,008	0,005	0,003	0,002	0,002	0,002	0,006	0,006
Ternopil	0,008	0,006	0,002	0,002	0,002	0,002	0,006	-0,007
Kharkiv	0,049	0,033	0,032	0,029	0,029	0,038	0,033	-0,020
Kherson	0,007	0,005	0,002	0,002	0,002	0,002	0,004	-0,002
Khmelnitsky	0,049	0,03	0,037	0,033	0,033	0,042	0,036	0,001
Cherkasy	0,007	0,004	0,002	0,002	0,002	0,002	0,005	-0,013
Chernivtsi	0,028	0,023	0,014	0,023	0,014	0,012	0,018	0,004
Chernihiv	0,014	0,01	0,003	0,006	0,002	0,002	0,007	0,002

Source: calculated by the authors on the proposed methodological approach of evaluating the organizational and economic mechanism of development of agro-industrial complex of regions.



Fig. 3.11. Illustration of regions by the average value of the integral index of organizational and economic mechanism of development of agro-industrial complex of the regions

Data table 3.12 confirm that regions that have a higher level of the values of the integral index of agro-industrial complex development of the regions have higher values of the integral index of the organizational and economic mechanism.

Forecasting according to the proposed algorithm of forecasting of the integral index of the organizational and economic mechanism of development of agro-industrial regions (see fig. 3.5) for the Kiev region is presented in table. 3.13.

Table 3.13

Forecast of the development of the agricultural sector, the integrated agricultural development index and the organizational and economic mechanism for the development of agricultural industry in the Kyiv region for 2020-2031

Indicator	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	average value
Field of AIC-industry, producing means of production for agricultural and other industries, providing services to agricultural	0,29	0,229	0,231	0,232	0,233	0,233	0,233	0,234	0,234	0,234	0,235	0,235	0,236
AIC – Agricultural production sphere	0,229	0,228	0,228	0,229	0,229	0,230	0,225	0,213	0,209	0,204	0,200	0,204	0,221
Agricultural sector – Industry for processing and preservation of agricultural products	0,243	0,239	0,235	0,231	0,227	0,222	0,218	0,214	0,210	0,206	0,202	0,198	0,227
Agricultural sector – production and social infrastructure	0,192	0,188	0,183	0,180	0,175	0,171	0,167	0,163	0,159	0,155	0,150	0,147	0,175
Integral index of AIC Kyiv region	0,687	0,684	0,680	0,680	0,684	0,687	0,691	0,695	0,699	0,702	0,706	0,710	0,693
Coefficient of organizational component	0,014	0,015	0,015	0,016	0,016	0,016	0,017	0,017	0,015	0,015	0,016	0,016	0,015
Factor of economic component of mechanism	0,032	0,032	0,033	0,034	0,034	0,035	0,035	0,036	0,036	0,037	0,038	0,038	0,034
Integral index of organizational-economic mechanism of AIC development in Kyiv region	0,054	0,055	0,056	0,058	0,059	0,060	0,062	0,063	0,063	0,66	0,068	0,069	0,099

Source: Designed by the authors to determine the error in forecasting in accordance with the proposed methodology for evaluating the effectiveness of the organizational and economic mechanism of development of agro-industrial complex of regions.

The average integral index of the organizational-economic mechanism there is asymmetry. So between the Zaporozhye ($I_{OEMavg} = 0,061$) and Kherson ($I_{OEMavg} = 0,004$) regions it is 15.25 times. At this, this asymmetry is greater than asymmetry by the value of the integral index of agricultural development of regions, which for these areas is 2.5 times. Also, it should be noted that the regions, which belong to the low-development regions under the integrated index of the agro-industrial complex development (see table 3.9), have a small asymmetry according to the integral index of the organizational and economic mechanism, which is 1.5 times between Volyn, Sumy, Ternopil regions (for which $I_{OEMavg} = 0,006$) and Kherson ($I_{OEMavg} = 0,004$) regions. The largest asymmetry in the middle-integral index of organizational-economic mechanism among regions with average level of development between Ivano-Frankivsk ($I_{OEMavg} = 0,031$) and Chernihiv ($I_{OEMavg} = 0,007$) regions. Three regions (Volyn, Sumy, Ternopil region) have the same significance of the integral index of the organizational-economic mechanism ($I_{OEMavg} = 0,006$). Not always the rank of the region by the integral index of the agro-industrial complex development coincides with the rank of the integral index of the organizational and economic mechanism.

Prediction of the integral index of AIC for Kyiv region until 2031 showed that its changes will have a positive trend. Thus, if the average value of the integral index of AIC Kyiv region in 2013-2018 biennium was 0.693, its average value of the integral index for forecasted calculations for the period from 2017-2030 years will be 0.693.

Also, the positive trend is observed for the integral index of the organizational and economic mechanism, which for the Kiev region in the retrospective period was -0.046 , in the forecast -0.099 .

Consequently, experimental and experimental checking of calculation and forecasting of organizational and economic mechanism of agro-industrial regions development proved adequacy of the proposed methodological approach using nonlinear dynamics model in the form of system differential equations. The forecasting of the integral index of AIC regions and organizational and economic mechanism showed positive changes in the values of integral indices.

Conclusions to section 3

1. The analysis of the existing methodological approaches has made it possible to improve the methodological approach to the evaluation of agricultural regions development, which includes a sequence of stages such as: firstly, the definition of valuation indicators of agricultural regions on the basis of Scientific and theoretical justification of their choice under the principles of systematic, versatility, and consistency. As well as clarification of the general list of estimates for each of the fields of AIC regions using the expert-statistical method of selection of valuation indicators. Secondly, using the method of mathematical expectation of rationing of valuation indexes development of agricultural regions. Thirdly, the confirmation of validity of certain estimates of the agro-industrial complex development using the use of set regression for finding of the clot at the solution of matrix equations of estimation indexes of agricultural areas of regions on the basis of correlation. The absence of signs of multicollinearity and symmetry between evaluation indicators in finding the coefficient of pair correlation. Fourthly, the calculations of the integrated index on the development of AIC regions using factor and cluster analysis and the method of plural regression. Fifthly, the definition of the development of AIC regions with the use of factor analysis and calculation of dynamics of development factor. Sixtly, using the cluster analysis method, group the regions depending on the designed for values of the integral index of the agro-industrial complex development evaluation of the regions for elaboration of directions of activities of the organizational-economic mechanism of agro-industrial regions development.

2. Research and experimental checking of the proposed methodological approach to evaluating the development of AIC regions on the basis of calculations of the integrated index of agriculture of the regions gave an opportunity to identify regions with a high level of agricultural development (Vinnytsia, Kyiv, Kharkiv, Khmelnytsky regions), middle level (Donetsk, Zhytomyr, Transcarpathian, Ivano-Frankivsk, Kirovohrad, Luhansk, Lviv, Mykolayiv, Odesa, Poltava, Rivne, Chernivtsi, Dnipropetrovsk regions) and low development (Volyn, Sumy, Ternopil, Kherson, Cherkasy regions).

According to the average integrated index of agricultural regions development there is an asymmetry, so between the Zaporozhye and Kherson regions it is 2.5 times, asymmetry in the average integral index of the development of AIC regions between the group of regions belonging to regions with the high level of agricultural development is and low level of development reaches almost 2.2 times.

Calculation of the average integral index of agricultural development assessment of regions shows a tendency to fall of values of the average index from 2012 to 2014, and from 2015 to 2016 its growth. The determination of the development dynamics of AIC regions, characterized by the rate of development dynamics showed that the high level of development dynamics are Rivne, Zhytomyr, Donetsk, Volyn, Chernihiv and Transcarpathian regions, the insignificant level Dnipropetrovsk, Kherson, Zaporizhia, Khmelnytsky, Kyiv and Ivano-Frankivska regions have the development dynamics of agro-industrial complex regions. Asymmetry by the coefficient of development dynamics between Dnepropetrovsk and Rivne regions by the factor of agricultural development dynamics is almost 15.6 times. Regions that have higher significance of the integral index of agro-industrial complex

development have higher significance of the factor of development dynamics of agricultural regions.

3. To assess the effectiveness of the organizational and economic mechanism for the development of agricultural regions, the use of the nonlinear dynamics model in the form of three differential equations, which is justified by the fact that there are no statistical. The data directly concerning evaluation of organizational-economic mechanism of agro-industrial complex development and also for the mechanism is important not only its presence but its effect. The first two equations of the system differential equations describe changes in time level of development of AIC under the influence of organizational and economic mechanism. The third equation recognizes the changes in the speed of agro-industrial complex under the influence of organizational and economic mechanism. Approbation of the proposed methodological approach gave an opportunity to assess the effectiveness of the organizational and economic mechanism and determine the asymmetry of it between regions. The largest asymmetry between the Zaporozhye ($I_{OEMavg} = 0,061$) and Kherson ($I_{OEMavg} = 0,004$) regions is 15.25 time, which is greater, than asymmetry by the value of the integral index of development of AIC regions.

4. The study made it possible to develop the algorithm of forecasting the integral index of the organizational and economic mechanism of agricultural development, taking into account the error of forecasting. The forecast of the integral index of the organizational-economic mechanism for agricultural development in the Kyiv region until 2031 showed that its changes will have a positive trend. Thus, if the average value of the integral index of AIC Kyiv region in 2013-2018 pp. Was 0.693, its average value of the integral index for forecasted calculations for the period from 2017-2031 will be 0.710.

CONCLUSIONS

1. On the basis of analysis and generalizations of theoretical and empirical researches of evolution and genesis of regional development theory, the essence and logic of the relationship of the conceptual and categorical apparatus of the organizational and economic mechanism of development of the agro-industrial complex of the regions taking into account the dominant of cognitive paradigm are outlined. It is proposed to define organizational and economic mechanism as a set of elements of organizational and economic character, interconnected and interacting with each other, the effectiveness of which depends on the ability to create absent at a specific moment relationships, elements, incentives, etc. The essence and the content of the concept "organizational and economic mechanism for the intensification of agro-industrial development" are detailed as a totality of interconnected and interconnected elements of organizational and economic nature, aimed at transition to a new qualitative and/or quantitative state of the agro-industrial complex as a system, which makes it possible to intensify not only the development

2. It is reasonable that the organizational component of the mechanism is aimed at ensuring the interrelation between spheres, agricultural entities, executive authorities and local self-government, and provides for the implementation of such functions as planning, coordination, organization, motivation, integration, control. The economic component is aimed at ensuring the process of development of the agro-industrial complex of regions and the State as a whole, which includes: marketing, financial,

compensation, innovative, social, communicative, price functions. These organizational and economic components, fulfilling its functions aimed at the interaction of spheres of activity on the production, distribution, exchange and consumption of agricultural products, form a holistic organizational and economic mechanism of agro-industrial complex development within the regional economic systems.

3. Proposed component structure of the organizational and economic mechanism of development of the agro-industrial complex, which must be formed using the resource, process, system and synergetic approaches that do not provoke contradictions among themselves, which, in its turn, allows them to complement, neutralize the shortcomings and makes it possible: to justify the research methods of agro-industrial complex of regions using the toolkit of mathematical modelling of economic processes

4. Analysis and generalization of the existing methodological approaches to the assessment of the development of the agro-industrial complex of regions has allowed to improve the method of parametric characteristics development of agro-industrial complex of regions based on compliance with the principles of systematic, versatility and consistency, using expert-statistical method of selection of valuation indicators and plural regression for finding of clot at solution of matrix equations on the basis of correlation analysis.

5. The methodological approach based on the use of nonlinear dynamics model as a system of three differential equations describing changes in the level of development of agro-industrial complex under the influence of organizational and economic mechanism is singled out. The results of the solution show the phase space of the coordinate of the organizational-economic mechanism within the growth of the integral

index of the agro-industrial complex. It gives an opportunity to estimate dynamics of agro-industrial complex development in time and action of organizational and economic mechanism of agro-industrial complex of regions in a certain direction of development, as well as to build the forecast of agro-industrial complex development regions under the influence of the mechanism taking into account the calculation error.

6. On the basis of calculations of the integral index of agro-industrial complex development of regions defined regions with high level of development of agro-industrial complex (Vinnitsa, Dnepropetrovsk, Zaporozhye, Kiev, Kharkov, Khmelnytsky, Cherkasy, Zhytomyr, Zakarpattia, Ivano-Frankivsk, Kirovohrad, Luhansk, Lviv, Mykolayiv, Odesa, Poltava, Rivne, Chernivtsi, Chernihiv regions) and low-level development (Volyn, Sumy, Ternopil, Kherson regions). In the average integrated index of agro-industrial complex development there is an asymmetry. So between the Zaporozhye and Kherson regions it is 2.5 times. Asymmetry of the average integral index of the development of agro-industrial complex of regions between a group of regions belonging to regions with a high level of AIC development and low level of development reaches almost 2.2 times.

Calculation of the average integral index of the evaluation of the agro-industrial complex of regions shows a tendency to fall of values of the average index starting from 2012 to 2016, asymmetry by the coefficient of development dynamics between Dnepropetrovsk and Rivne regions by the coefficient of agricultural development dynamics is almost 15.6 times. Regions, which have higher value of the integral index of agro-industrial complex development, have higher values of the dynamics of agro-industrial complex development of the regions.

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APPENDICES

Appendix A

Indicators for assessing the development of agriculture in the regions

Table A.1

Indicators for the assessment of industries producing agricultural production and other sectors providing agricultural services to the agricultural sector of the regions

	Capital investment in agriculture, hunting and related services,% of total regional investment						Innovative active enterprises, total, units						Sale of compound feed to agricultural enterprises, thousand quintals					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	7,0	3,2	2,7	...	...	...	37	54	50	...	...	...	103,4	104,9	101,9	...	...	...
Vinnitsia	21,8	27,7	24,8	20,8	26,9	29,1	45	50	55	46	25	45	259,9	102,9	416,8	936,5	524,1	784,1
Volyn region	7,7	8,4	7,7	7,3	8,4	12,8	26	29	23	30	12	26	83,9	126,4	41,3	905,3	964,8	219,6
Dnipropetrovsk	4,5	5,6	5,4	4,8	6,5	6,5	65	78	84	109	63	65	265,4	427,7	103,1	1713,6	1508,9	1435,6
Donetsk	3,0	2,7	1,9	2,9	2,4	6,0	86	91	85	45	28	86	324,9	433,3	216,5	1869,3	61,3	256,7
Zhytomyr	11,5	11,8	17,2	15,8	17,3	20,2	42	54	57	48	28	42	9,2	2,0	16,3	104,2	69,8	111,5
Transcarpathian	2,3	2,4	2,1	2,2	1,6	1,7	27	18	15	16	14	27	15,0	13,7	16,3	95,5	101,8	84,1
Zaporozhye	7,7	10,7	8,1	7,1	8,6	15,6	22	115	115	108	49	22	18,8	14,9	22,7	189,9	22,9	35,3
Iv.-Frankivsk	4,6	7,1	7,0	8,5	5,5	9,7	82	89	87	99	27	82	77,5	71,1	83,8	1031,6	1236,3	500,3
Kiev	8,7	7,9	7,1	7,3	8,1	11,5	39	44	68	66	44	39	149,7	170,7	128,6	2481,4	2458,5	2571,0
Kirovograd	32,0	24,3	28,2	32,1	40,3	45,6	37	46	46	49	25	37	18,0	26,0	10,0	274,5	174,9	50,7
Lugansk	4,6	4,5	5,9	3,6	3,8	13,9	59	64	61	16	9	59	12,0	16,7	7,3	809,5	186,5	30,2
Lviv	3,3	3,5	3,3	4,1	4,7	4,9	102	101	116	129	64	102	169,8	50,3	289,2	522,6	343,6	287,9
Mykolaiv	9,7	14,8	10,4	11,6	18,8	20,5	71	114	81	67	29	71	11,4	6,7	16,0	68,2	308,2	91,8
Odessa	5,6	9,2	3,9	4,7	9,1	11,6	62	83	69	67	36	62	9,7	8,0	11,3	112,4	115,5	34,2
Poltava	13,5	16,0	15,5	19,4	17,8	24,0	45	29	33	33	30	45	237,7	226,1	249,2	2197,8	1702,3	1415,1
Rivne	9,0	13,1	7,7	9,0	10,1	9,2	27	36	39	45	13	27	6,2	6,7	5,6	160,2	261,9	161,9
Sumy	15,5	17,3	20,1	24,2	29,1	33,9	42	41	32	46	23	42	44,1	62,7	25,5	443,9	409,0	344,9
Ternopil	17,7	17,0	21,3	28,5	22,7	23,7	40	50	36	36	16	40	6,4	1,2	11,5	69,5	92,7	137,3
Kharkiv	5,3	5,4	6,6	10,1	11,4	15,9	161	168	182	191	117	161	115,4	109,4	121,4	1842,6	1406,7	736,2
Kherson	28,4	25,4	27,4	25,6	29,9	41,4	39	53	48	54	19	39	48,4	52,2	44,6	1219,5	1661,3	296,0
Khmelnysky	15,1	23,3	33,2	22,7	20,0	22,8	60	78	58	38	18	60	11,2	17,3	5,0	1322,4	1302,4	78,2
Cherkasy	24,9	29,6	27,6	30,2	35,2	35,7	48	50	47	37	25	48	199,0	214,4	183,5	5206,3	6691,7	6294,0
Chernivtsi	10,2	10,3	8,7	10,5	16,1	8,9	30	37	30	34	9	30	37,1	47,1	27,0	431,1	308,3	138,0
Chernihiv	27,7	32,8	34,2	37,5	31,3	35,9	40	43	45	32	15	40	88,3	112,9	63,6	286,9	258,8	272,6

Source: compiled by the authors on the basis of statistics of the State Statistics Service of Ukraine [171; 172; 168].

Table A.2

Indicators for the assessment of industries producing agricultural production and other sectors providing agricultural services to the agricultural sector of the regions

	Purchase by agricultural enterprises of new agricultural machinery, pcs.						Purchase of energy materials (natural gas) by agricultural enterprises, million m ³						Purchase of mineral fertilizers by agricultural enterprises (nitrogen, phosphate, potassium, complex fertilizers), thousand quintals					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	358	461	256	...	...	...	50,8	26,9	23,9	...	...	...	602,6	684,3	520,9	...	...	...
Vinnitsia	931	972	890	855	693	760	26,8	17,8	9,0	20,8	35,7	17,5	3052,25	3111,1	2993,4	3062,4	2894,8	3069,7
Volyn region	201	160	242	270	165	167	19,5	8,7	10,8	11,2	10,3	5,1	447,35	401,4	493,3	618,6	686,1	778,3
Dnipropetrovsk	1150	1342	957	1195	969	979	89,5	40,8	48,7	37,4	34,0	27,6	1710	1865,6	1554,4	1883,7	1838,4	1833,7
Donetsk	885	909	861	674	264	284	55,0	29,1	25,9	20,1	8,6	6,0	1249,8	1218,3	1281,3	1645,2	737,8	1019,8
Zhytomyr	251	214	289	315	264	285	8,7	4,9	3,8	8,3	4,1	2,6	634,7	595,3	674,1	789,0	851,2	965,8
Transcarpathian	18	18	18	11	5	14	2,6	2,1	0,5	0,4	0,2	0,3	39,65	46,9	32,4	48,2	71,4	178,5
Zaporozhye	979	1155	803	569	577	811	3,7	2,2	1,5	1,3	1,5	1,4	1653,05	2046,1	1260,0	1420,5	1414,5	1320,6
Iv.-Frankivsk	86	88	84	278	162	82	12,9	6,1	6,8	5,8	5,5	4,6	300,7	243,4	358,0	509,6	397,1	376,9
Kiev	965	947	983	1027	637	830	227,0	101,4	125,6	131,5	116,5	101,4	2709,7	2468,5	2950,9	2875,9	3006,1	4362,0
Kirovograd	1198	1237	1158	977	980	873	13,4	8,4	5,0	6,1	2,7	3,6	1754,45	1661	1847,9	1903,7	1706,9	1786,0
Lugansk	730	524	937	644	293	305	13,8	8,1	5,7	8,9	3,4	0,6	921,5	817,5	1025,5	1017,4	667,1	700,8
Lviv	185	178	192	193	121	116	27,8	12,3	15,5	29,4	29,5	7,9	1133,4	1155,8	1111,0	1073,6	1084,8	1063,0
Mykolaiv	936	1118	755	629	711	878	0,7	0,3	0,4	0,2	0,2	0,3	1290,3	1395,2	1185,4	1381,2	1450,9	1573,4
Odessa	893	1097	689	849	955	914	4,3	2,8	1,5	1,0	0,5	0,3	1729,4	1810,8	1648,0	2160,8	2423,8	2281,0
Poltava	1132	1186	1078	1384	927	708	48,5	35,3	13,2	30,5	19,0	9,5	2724,75	2865	2584,5	2573,5	2462,5	2281,0
Rivne	193	181	206	181	124	122	14,5	8,2	6,3	9,8	26,1	2,6	799,9	709,4	890,4	968,7	940,6	849,9
Sumy	593	614	573	573	507	636	18,3	8,2	10,1	10,0	6,1	5,5	1409,05	1367,8	1450,3	1745,9	1957,8	1843,2
Ternopil	350	351	350	374	279	329	8,9	4,7	4,2	10,6	10,3	7,7	1565,6	1529,3	1601,9	1849,1	1726,9	1675,2
Kharkiv	1113	1055	1170	1169	823	961	47,0	23,3	23,7	20,3	15,1	7,6	1848,75	1912,2	1785,3	1989,8	2052,7	2063,6
Kherson	632	899	365	383	462	743	2,9	1,4	1,5	1,9	1,4	0,7	808,55	910,3	706,8	893,7	860,3	918,0
Khmelnitsky	592	663	520	465	446	397	13,6	4,9	8,7	8,3	6,6	4,8	2194,1	2091,1	2297,1	2721,3	2471,9	3006,2
Cherkasy	909	807	1011	795	576	455	84,3	53,4	30,9	49,1	42,3	52,4	2277,35	2257,9	2296,8	2553,9	2107,9	2181,2
Chernivtsi	79	69	90	124	62	78	4,3	2,4	1,9	1,6	2,2	0,5	331,3	322,9	339,7	296,1	229,0	182,0
Crimea	677	604	749	676	376	408	31,0	15,3	15,7	18,5	12,3	12,1	1795,7	1487,4	2104,0	2297,5	2330,6	2438,3

Source: compiled by the authors on the basis of statistics of the State Statistics Service of Ukraine [102; 103; 104; 105; 106; 107].

Table A.3

**Indicators for the assessment of industries producing agricultural production and other sectors providing agricultural services
to the agricultural sector of the regions**

	Purchase by agricultural enterprises of plant protection products (insecticides, fungicides, herbicides, plant growth regulators, other pesticides), ton						Purchase by agricultural enterprises of plant protection products (insecticides, fungicides, herbicides, plant growth regulators, other pesticides), thousands liters						Availability of tractors, combines (grain-harvesting, corn-harvesting) and agricultural machinery at agricultural enterprises at the end of the year, pcs.					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	414,6	437,4	391,8	...	...	...	976,1	853,4	1098,8	...	...	...	7982	7719	7558	...	...	...
Vinnitsia	587,95	565,7	610,2	1002,5	1046,5	845,5	3149,6	3035,1	3264,1	3089,5	3807,0	4654,1	14133	13765	13996	13809	12402	12343
Volyn region	43,65	39,9	47,4	51,1	95,3	87,4	545,2	471,4	619,0	854,4	944,5	664,8	4785	4579	4194	3856	3520	3323
Dnipropetrovsk	289,4	336,0	242,8	380,5	292,9	296,6	2077,6	1829,8	2325,3	2720,0	2369,6	2450,8	13599	13563	14452	14180	12823	12986
Donetsk	210,85	114,7	307,0	198,8	522,8	165,6	1303,7	1233,5	1373,9	2099,7	774,0	1268,7	10412	10434	10214	9496	5768	6156
Zhytomyr	128,7	155,3	102,1	291,8	375,5	287,6	671,6	622,3	720,8	855,5	1093,8	1504,8	6421	6018	5988	5427	4836	4441
Transcarpathian	17,9	28,0	7,8	25,1	32,4	127,4	23,8	25,0	22,5	214,1	67,1	184,7	987	704	972	704	744	583
Zaporozhye	215,15	210,4	219,9	179,1	186,8	158,1	1414,1	1276,1	1552,0	1713,3	1756,1	1673,2	11828	11843	11644	11475	11246	10867
Iv.-Frankivsk	31,05	31,4	30,7	16,8	44,3	17,9	259,1	222,2	295,9	859,5	473,6	483,3	1951	1781	2576	1779	1573	2180
Kiev	533	474,0	592,0	598,5	542,2	695,7	2623,1	2425,3	2820,9	3006,3	3604,1	3752,5	11817	11111	11733	11640	11001	11060
Kirovograd	377,85	359,3	396,4	414,4	408,8	370,8	2593,3	2384,0	2802,6	2747,9	2818,4	3209,1	11756	11918	12190	11909	11710	11900
Lugansk	286,7	120,4	453,0	226,1	72,0	97,0	890,0	745,6	1034,3	1394,1	979,9	831,6	6754	6856	7510	6990	4984	5040
Lviv	267,15	272,7	261,6	222,2	179,4	63,0	912,9	845,0	980,7	1389,4	1587,8	1442,9	3814	3790	3710	3373	3279	3350
Mykolaiv	350,7	250,8	450,6	408,6	465,5	394,7	1371,3	1446,3	1296,3	2138,3	1671,0	1798,9	8669	8298	8784	8689	8699	8786
Odessa	518,2	551,8	484,6	586,3	650,4	581,4	1379,5	1341,2	1417,7	1980,9	1794,1	1680,4	13714	13293	13524	12720	12623	11379
Poltava	282,9	261,4	304,4	345,3	283,9	321,5	3895,2	3839,0	3951,4	3398,7	4411,9	4297,5	14170	14000	14185	14271	14518	13650
Rivne	98,35	74,2	122,5	158,4	347,8	88,1	963,0	929,0	996,9	1070,3	997,2	1072,3	3553	3250	3279	3075	2819	2389
Sumy	234,05	225,6	242,5	358,9	273,9	342,6	1651,8	1623,9	1679,7	2298,9	2263,0	2485,0	7646	7149	7286	6806	6476	6207
Ternopil	308,05	316,9	299,2	404,2	288,9	422,6	1855,8	1818,0	1893,6	2117,6	2436,5	2230,7	4579	4307	4200	4221	4000	3893
Kharkiv	370,85	479,7	262,0	366,8	349,7	355,3	2984,8	2577,0	3392,6	3319,9	3070,8	3129,4	12176	11964	12414	12407	11977	11772
Kherson	418,6	481,6	355,6	368,9	521,6	586,0	961,0	988,6	933,4	1779,3	1459,7	1606,7	9279	9427	9799	10063	10328	9951
Khmelnytsky	351,05	425,7	276,4	626,6	411,9	499,4	2584,9	2043,6	3126,1	3294,0	4462,3	4479,3	7600	7366	7209	7069	6703	6634
Cherkasy	481,9	407,8	556,0	489,3	455,4	456,4	2475,8	2309,2	2642,3	2628,5	3058,6	2999,2	10219	10280	10661	10294	9848	9058
Chernivtsi	45,15	42,5	47,8	73,9	112,2	94,7	333,5	324,4	342,6	612,7	382,1	412,0	1759	1670	1670	1613	1625	1366
Crimea	323,15	311,4	334,9	296,1	361,2	385,3	1829,2	1455,8	2202,5	2622,8	3020,8	3553,1	9193	8647	8842	8315	7609	7314

Source: compiled by the authors on the basis of statistics of the State Statistics Service of Ukraine [102; 103; 104; 105; 106; 107].

Table A.4

Indicators for the assessment of industries producing agricultural production and other sectors providing agricultural services to the agricultural sector of the regions

	Sale of petroleum products to agricultural enterprises, thousand					
	2013	2014	2015	2016	2017	2018
Crimea	44,7	48,0	41,4	...	...	...
Vinnitsia	95,5	100,4	90,7	104,0	103,9	95,2
Volyn region	19,4	17,2	21,6	19,1	18,6	22,4
Dnipropetrovsk	84,2	87,4	81,1	85,8	82,2	87,4
Donetsk	71,4	71,1	71,8	67,9	55,8	41,6
Zhytomyr	29,2	26,4	32,0	28,4	31,1	29,7
Transcarpathian	1,75	1,9	1,6	1,7	2,1	16,1
Zaporozhye	69,7	72,3	67,1	65,5	65,3	64,5
Iv.-Frankivsk	8,9	9,0	8,9	9,1	9,2	9,2
Kiev	124,0	97,9	150,2	108,8	111,9	105,2
Kirovograd	78,8	81,5	76,2	80,6	79,5	80,8
Lugansk	41,7	37,0	46,4	43,4	34,2	34,3
Lviv	24,8	24,5	25,1	24,5	23,2	22,4
Mykolaiv	65,1	63,7	66,6	75,2	74,9	77,0
Odessa	79,9	81,8	78,1	86,5	86,3	84,5
Poltava	119,5	123,2	115,8	119,8	210,6	100,3
Rivne	21,8	21,9	21,7	21,7	21,6	17,4
Sumy	53,3	51,6	55,0	56,8	58,1	59,8
Ternopil	51,4	47,9	55,0	50,5	55,3	41,8
Kharkiv	91,5	97,3	85,8	87,0	90,1	86,5
Kherson	48,4	50,2	46,6	50,3	51,0	56,6
Khmelnitsky	55,9	53,0	58,9	67,1	75,4	63,2
Cherkasy	92,3	94,3	90,3	91,9	105,3	90,4
Chernivtsi	8,8	9,4	8,2	8,2	8,6	7,7
Crimea	75,2	63,5	87,0	76,1	75,9	78,5

Source: compiled by the authors on the basis of statistics of the State Statistics Service of Ukraine [103; 104; 105; 106; 107]

Table A.5

Indicators for assessing the livestock sector of agricultural production in the agricultural sector of the regions

	Production of meat, (in slaughter weight), thousand tons						Milk production, thousand tons						Egg production, mln.					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	144,4	147,1	145,8	...	...	...	348,0	330,5	305,9	...	...	...	798,3	779,8	...	...	...	...
Vinnitsia	62,4	65,1	82,7	177,7	264,4	309,4	836,1	838,5	847,4	856,9	852,0	838,4	797,6	846,7	806,2	804,8	804,4	857,4
Volyn region	94,5	91,7	92,7	104,9	116,9	120,5	450,2	450,5	466,5	467,0	459,3	425,2	181,6	197,4	186,0	185,1	190,2	193,9
Dnipropetrovsk	207,4	225,9	225,5	227,4	224,5	230,0	339,8	341,7	343,4	348,0	357,2	344,6	998,2	1092,8	1093,0	954,5	1046,6	923,7
Donetsk	102,8	116,8	126,5	126,1	105,4	90,5	339,1	327,4	332,9	324,8	283,0	227,9	1868,4	2323,5	2215,8	1939,8	1640,6	629,4
Zhytomyr	47,7	48,9	50,3	54,1	51,0	53,4	578,3	569,1	594,9	597,6	589,7	578,4	489,3	489,0	519,4	561,5	600,6	589,7
Transcarpathian	49,6	51,5	58,4	58,6	59,7	53,2	391,8	389,3	401,1	410,3	409,6	358,1	317,2	328,2	332,6	337,5	339,3	339,9
Zaporozhye	56,9	62,7	61,5	62,2	64,3	61,3	261,7	248,1	257,5	264,9	267,5	260,7	740,5	682,4	727,3	731,8	732,1	721,0
Iv.-Frankivsk	64,3	71,7	75,7	78,9	82,6	85,6	465,4	451,8	466,3	470,5	483,3	474,0	730,6	888,8	859,6	875,1	839,2	593,4
Kiev	192,7	211,2	227,4	240,9	235,3	216,1	451,1	438,9	476,3	475,9	467,0	446,3	2007,1	2332,7	2479,0	2545,3	2712,0	2743,2
Kirovograd	45,8	45,3	48,7	50,1	53,2	52,7	343,1	331,5	309,2	322,0	324,3	310,6	499,4	522,0	537,0	523,3	501,3	506,0
Lugansk	45,0	47,4	46,4	50,1	37,5	21,6	284,4	276,0	282,0	279,5	251,6	158,7	844,4	903,3	848,2	803,4	484,2	124,7
Lviv	115,1	116,5	123,3	133,1	124,3	119,9	656,2	629,6	620,7	619,4	601,0	571,2	576,8	544,0	519,9	530,8	519,3	536,6
Mykolaiv	28,7	31,2	31,1	31,2	36,2	32,6	364,0	365,9	367,4	370,7	369,3	343,8	572,7	617,0	553,8	299,6	500,0	284,1
Odessa	45,6	47,2	46,4	46,5	47,1	48,8	403,8	397,3	397,9	402,3	405,9	385,3	584,5	397,1	353,7	355,1	357,7	355,0
Poltava	50,0	50,2	58,2	77,1	78,1	76,0	701,4	725,4	777,8	785,0	814,1	794,5	619,5	600,2	671,8	641,0	621,1	667,8
Rivne	49,9	55,4	56,2	59,1	60,2	54,1	432,7	420,2	442,6	453,4	458,3	436,8	433,8	446,6	490,4	514,9	521,1	565,2
Sumy	40,4	40,6	40,1	42,2	45,0	43,8	430,5	418,3	427,3	427,3	427,1	417,6	267,9	344,2	377,7	425,4	441,4	415,5
Ternopil	37,1	38,3	40,5	47,6	53,9	55,1	416,7	418,1	459,6	485,9	480,6	460,7	369,8	378,7	414,3	427,7	432,8	489,9
Kharkiv	83,2	79,3	76,9	89,8	94,8	94,3	467,2	472,7	513,3	536,7	525,5	524,5	1100,6	1296,9	1140,5	1214,1	1042,2	699,6
Kherson	41,6	42,1	41,8	44,1	48,6	48,9	305,9	302,0	310,5	308,8	302,9	300,0	437,3	479,1	542,5	1201,2	1805,5	1577,8
Khmelnitsky	48,0	49,5	53,4	59,3	67,8	65,4	608,1	598,2	594,7	591,5	602,3	581,4	391,9	661,3	1195,1	1815,1	1928,6	1641,1
Cherkasy	326,3	328,7	322,0	317,9	325,2	313,8	478,9	463,9	498,5	511,7	529,8	530,1	747,1	818,5	798,3	742,7	854,4	668,9
Chernivtsi	38,7	39,6	42,7	41,8	41,5	40,9	308,1	298,0	298,3	298,1	299,3	294,0	408,4	442,5	431,0	375,3	379,7	363,7
Crimea	40,3	39,2	34,7	39,7	42,1	34,7	581,1	578,4	581,3	582,4	572,2	552,6	257,0	264,0	271,1	289,1	293,0	295,4

Source: compiled by authors based on statistics of the State Statistics Service of Ukraine [190]

Table A.6

Indicators for assessing the livestock sector of agricultural production in the agricultural sector of the regions

	Livestock products (at constant 2010 prices), mln. UAH						Profitability of cattle meat production, %						Profitability level of pork meat production, %					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	3365,5	3405,9	3244,4	...	...	...	-38,3 ¹	-21,7 ¹	-17,7 ¹	...	...	...	-6,0	-3,9	-8,2	...	...	...
Vinnytsia	3654,7	3675,1	4032,5	5235,0	5997,7	6785,7	-33,4	-12,6	-21,5	-41,3	-30,0	-8,5	-17,8	-12,0	-0,7	-10,4	-4,4	1,0
Volyn region	2537,1	2559,3	2698,3	2841,2	2937,8	2776,8	-34,9	-18,6	-24,6	-36,9	-24,0	-9,4	-5,1	3,3	14,1	10,8	21,5	15,6
Dnipropetrovsk	4240,1	4508,5	4536,2	4481,2	4576,1	4467,5	-41,3	-32,4	-34,3	-47,8	-50,3	-38,3	-3,1	-6,2	2,3	-2,2	4,1	-1,9
Donetsk	3763,9	4069,7	4215,4	4103,9	3340,2	2468,3	-39,1	-27,3	-34,1	-57,5	-46,3	-15,8	-4,9	-3,8	-3,0	-1,4	-3,6	5,7
Zhytomyr	2684,6	2682,2	2836,1	2871,2	2789,2	2810,9	-35,8	-26,1	-32,7	-39,8	-40,0	-18,8	-10,9	-14,3	-3,4	-3,9	2,2	18,2
Transcarpathian	2067,1	2076,6	2128,7	2184,3	2108,4	1996,6	-45,6	-34,0	-41,4	-22,6	-16,9	5,4	-9,7	-0,6	-4,0	-4,2	-1,6	-0,5
Zaporozhye	2099,6	2054,7	2118,0	2213,8	2211,2	2123,6	-38,9	-29,0	-38,1	-45,2	-40,1	-31,9	0,8	7,1	-2,6	-5,8	9,4	2,8
Iv.-Frankivsk	2737,0	2876,8	2998,8	2999,2	3077,9	2987,9	-32,1	-20,2	-43,9	-8,8	11,7	15,4	14,3	62,6	50,5	39,7	79,0	68,6
Kiev	4736,8	5098,0	5560,4	5662,5	5652,3	5438,6	-45,6	-36,1	-31,7	-45,4	-46,9	-22,2	-10,9	-0,5	-1,1	-5,0	-22,2	-3,5
Kirovograd	1929,0	1882,9	1994,5	1931,2	1938,0	1943,6	-36,1	-26,4	-30,2	-45,8	-41,5	-12,5	-26,9	-18,9	-10,9	-10,5	-8,1	3,4
Lugansk	1876,2	1845,3	1854,5	1856,4	1440,6	877,6	-46,4	-27,0	-37,9	-50,6	-42,5	-28,4	-32,0	-26,7	-18,4	-11,1	-15,6	-10,0
Lviv	3568,6	3496,2	3553,1	3677,4	3615,4	3553,4	-36,4	-19,1	-27,2	-38,8	-30,7	-15,5	10,8	18,7	-7,6	7,3	-1,0	50,4
Mykolaiv	1894,7	1930,5	1906,0	1840,2	1870,5	1693,3	-46,0	-43,6	-46,7	-57,7	-50,0	-30,4	-27,6	-30,8	-27,2	-29,3	-8,9	-7,6
Odessa	2365,4	2172,8	2163,8	2228,1	2075,9	2092,1	-42,5	-35,1	-41,4	-43,5	-34,4	-28,2	-18,9	-17,7	-15,3	-6,7	0,4	2,8
Poltava	2934,5	3045,3	3440,7	3751,7	3817,4	3758,5	-33,1	-30,6	-27,2	-38,2	-30,6	-10,2	-0,6	-9,9	23,3	10,5	34,2	19,6
Rivne	2165,3	2150,5	2218,2	2341,9	2363,4	2260,2	-35,1	-14,2	-29,2	-38,3	-43,9	-24,6	-8,9	4,3	-6,8	-3,3	-10,6	-4,4
Sumy	1953,3	1949,7	2044,4	2098,4	2097,0	2068,0	-28,9	-22,6	-22,1	-34,0	-22,8	-11,4	-19,8	-14,4	-3,9	-9,3	7,5	8,5
Ternopil	1950,5	1916,0	2069,3	2259,4	2322,0	2339,1	-22,7	-10,9	-8,9	-24,6	-13,8	-6,2	-6,8	-3,4	5,4	8,1	10,8	42,4
Kharkiv	3236,6	3271,3	3199,5	3525,1	3325,5	3235,6	-40,7	-35,4	-46,6	-55,2	-45,5	-39,9	-15,1	-33,1	-14,4	-1,0	3,7	0,7
Kherson	1815,2	1850,9	1982,9	2320,3	2585,9	2315,9	-46,6	-34,9	-36,3	-55,2	-52,0	-27,1	-7,5	-8,2	-0,5	3,3	16,9	12,9
Khmelnitsky	2728,8	2748,8	3182,0	3550,2	3639,5	3467,2	-39,5	-25,3	-27,1	-44,3	-39,2	-10,8	-27,4	-24,7	0,5	-7,6	5,5	16,5
Cherkasy	5957,5	5948,6	5922,5	5918,1	5964,4	5766,4	-25,2	-16,5	-21,6	-38,4	-26,6	-10,6	-10,2	-5,9	4,8	0,2	6,7	8,3
Chernivtsi	1705,5	1721,2	1762,0	1728,8	1689,4	1648,9	-33,5	-18,2	-36,8	-55,6	-37,7	-8,2	-5,5	-7,9	6,7	-7,6	9,8	9,1
Crimea	2332,7	2289,0	2328,4	2358,7	2283,6	2152,6	-34,4	-21,0	-30,2	-46,4	-38,6	-26,3	-17,3	-16,0	-7,8	-12,3	-2,0	7,7

Source: compiled by the authors on the basis of statistics of the State Statistics Service of Ukraine [151; 152; 153; 154; 155; 156].

Table A.7

**Indicators for assessing the livestock sector of agricultural production in the agro-industrial complex of the regions
(Profitability level of production of basic livestock products in agricultural enterprises)**

	Profitability of poultry meat production, %						Profitability level of milk production, %						Profitability level of chicken eggs production, %					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	6,5	-15,3	-2,7	...	...	...	17,9	12,8	-6,0	...	...	...	32,2	59,4	39,2	...	...	...
Vinnitsia	-7,3	4,6	9,3	-23,0	-29,3	-3,6	24,6	22,1	6,5	16,5	13,9	12,7	-14,2	3,8	21,7	26,3	30,5	31,3
Volyn region	18,4	59,6	5,3	-2,3	4,6	-5,6	28,1	34,8	8,5	27,3	24,2	21,2	-39,1	-34,7	0,2	-11,7	... ²	... ²
Dnipropetrovsk	10,6	-50,3	-30,2	-29,4	-44,3	-18,7	13,8	15,3	-8,3	9,7	1,2	-8,2	14,4	36,1	39,3	37,6	34,1	7,4
Donetsk	-52,2	-58,5	-31,3	-15,1	-61,4	-69,1	17,3	9,9	0,3	4,1	1,9	0,1	49,3	88,3	79,7	33,7	57,0	33,1
Zhytomyr	-53,4	-65,6	-36,4	-29,5	-19,6	-2,5	14,3	20,9	4,7	15,9	17,8	12,4	-7,1	-8,5	9,9	13,0	16,7	27,4
Transcarpathian	–	2,0	0,9	-7,3	2,6	...	-8,0	0,5	39,4	27,0	3,2	41,1	–	–	-1,9	...	–	-
Zaporozhye	-27,3	-16,3	-12,0	-11,1	-17,6	-20,4	12,3	6,6	-16,8	-3,0	1,4	-1,6	9,6	-4,4	22,3	27,6	36,9	44,9
Iv.-Frankivsk	28,6	-28,1	2,8	-14,5	-18,9	7,7	11,0	16,0	15,7	17,2	12,2	19,4	87,3	79,0	85,5	125,4	157,6	120,2
Kiev	-7,1	38,4	17,7	36,6	9,0	-12,4	10,1	14,7	7,8	7,8	-3,4	13,0	4,7	23,1	26,2	12,8	16,9	28,8
Kirovograd	-3,0	-37,8	-61,2	-32,3	-54,2	20,4	8,0	10,1	-9,4	1,4	4,1	-0,7	-22,6	24,1	84,1	85,0	49,6	-25,3
Lugansk	-0,9	-3,8	-5,3	-2,2	18,3	-0,9	14,5	9,1	-4,1	9,9	10,5	5,4	9,5	41,9	64,1	73,8	... ²	... ²
Lviv	4,0	1,6	-0,4	6,9	-5,2	-5,7	15,0	23,6	3,2	15,8	11,0	15,0	-5,5	-16,7	4,4	12,1	20,7	21,6
Mykolaiv	-41,7	-76,9	-65,6	-68,2	-57,9	-66,3	5,2	13,2	-10,1	19,0	6,0	6,6	23,3	19,9	27,6	7,7	44,3	12,7
Odessa	-63,4	-50,7	-44,2	-52,8	-21,3	-34,6	8,0	2,6	-10,3	-2,2	-0,3	-5,1	-11,2	-41,4	-1,3	10,6	-23,2	27,1
Poltava	-50,0	-41,4	-14,9	-18,6	-18,9	-7,5	29,1	28,7	5,7	17,4	16,0	16,5	0,0	9,3	25,0	12,5	31,9	41,7
Rivne	-9,9	-20,0	15,1	-1,0	5,2	19,3	33,3	17,9	3,6	18,8	13,6	14,0	3,4	3,8	22,1	20,8	19,6	58,8
Sumy	-5,2	-19,0	-64,2	-21,8	-51,5	1,9	3,8	17,1	-4,8	8,6	8,2	16,0	-4,0	-8,7	5,8	11,6	13,1	1,1
Ternopil	10,2	35,6	1,4	-23,0	-13,5	-8,8	33,7	22,1	11,6	15,2	13,5	21,9	1,8	5,5	23,2	24,5	33,2	38,5
Kharkiv	-38,7	-59,6	-44,2	-36,6	-14,7	-11,1	23,6	17,6	9,1	17,7	21,6	17,1	22,1	47,1	56,1	36,2	53,6	15,2
Kherson	-69,5	-38,9	-62,2	-39,9	-42,3	-4,5	25,5	22,5	3,8	19,1	17,2	14,4	27,6	28,4	16,6	70,7	55,2	56,0
Khmelnysky	44,4	19,3	34,3	18,8	7,5	-11,4	13,9	20,3	8,6	18,5	15,7	12,6	53,6	106,9	175,5	155,0	230,1	1,6
Cherkasy	-8,2	-13,4	-3,7	28,7	7,1	1,2	17,0	20,5	2,5	16,6	17,5	16,3	4,3	27,3	59,8	49,5	60,2	33,2
Chernivtsi	-1,6	13,3	8,5	1,8	3,6	-1,3	-12,6	-2,5	-17,0	-2,3	6,9	0,9	12,8	55,5	40,8	66,1	30,0	...
Crimea	-15,2	-20,0	2,2	12,6	-58,4	-51,6	19,9	18,9	-1,2	15,2	9,4	13,6	-8,5	-4,4	5,5	17,2	25,0	34,8

Source: compiled by the authors on the basis of statistics of the State Statistics Service of Ukraine [151; 152; 153; 154; 155; 156]

Table A.8

**Indicators for assessing the livestock sector of agricultural production
in the agricultural sector of the regions**

	Financial results of activity of the enterprises of the branch of agriculture of animal husbandry, net profit (loss), thsd. UAH					
	2013	2014	2015	2016	2017	2018
Crimea	68068,07	226636,9	21439,25	...	...	...
Vinnytsia	268805,3	446483,9	344848,2	151766,1	35886,36	2122803
Volyn region	64182,72	91339,6	124156,1	89713,21	120494	412464,3
Dnipropetrovsk	334990,5	627029,2	540695,4	442328,1	511664,9	1954968
Donetsk	367483	517994,5	549848,6	383954,3	157872,6	750052
Zhytomyr	59732,13	68293,31	81568,54	-24981,32	-79076	639516,6
Transcarpathian	-3992,589	3444,385	8409,315	10040,66	18375,84	82340,16
Zaporozhye	252127,9	273179,7	157539	118803,7	336133,8	1008776
Iv.-Frankivsk	256158,8	164272,1	271068	205027,6	-31862,5	68297,48
Kiev	823520	1135534	1560789	716038,7	1044478	2704566
Kirovograd	294439,4	352222,8	490773,2	206144,3	569079,2	1581943
Lugansk	38612,97	192057,4	276725,2	193961,7	29329,67	318657,4
Lviv	193221,3	128367,3	506244,5	459560,6	483029,7	-146207
Mykolaiv	168672,9	197822,1	162770,3	118954,3	269192,2	723142,5
Odessa	138879,8	175055,4	81350,5	157734,9	355645,9	832013,5
Poltava	497670,1	623946,9	733141,3	449751	1085263	3722021
Rivne	-6059,07	7752,138	31464,26	-75956,71	269742,9	398683,2
Sumy	-30172,55	109529	248300,7	61678,72	147858	1032336
Ternopil	219529,1	263844,9	192317,1	18280,57	-87317,1	379428,6
Kharkiv	188924,6	394916,1	439211	252086,3	220817,7	1319913
Kherson	109960,5	144039,9	75705,71	129388,9	290182,1	973718,6
Khmelnysky	191729,8	249805,8	397269,5	244400,2	255073,1	911499,9
Cherkasy	828100,8	1056406	1072098	520610,5	1100826	3031119
Chernivtsi	79773,69	74668,18	36312	34004,04	45898,65	184790,6
Crimea	467231,9	-112745	249536,1	-32665,06	-112443	1120938

Source: compiled by the authors on the basis of statistics of the State Statistics Service of Ukraine [151; 152; 153; 154; 155; 156]

Table A.9

Indicators for assessing the crop production of agricultural production of agricultural regions

	Production of cereals and legumes, thousand tons						Production of sugar beet (factory), thousand tons						Sunflower production, thousand tons					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	1403,8	1927,8	906,2	...	...	...	-	-	-	-	...	...	36,2 ¹	56,4	73,7	...	...	...
Vinnytsia	3111,3	4243,6	3624,7	4852,3	5063,1	3768,3	2456,5	3012,7	2844,0	2562,3	3044,2	2057,0	274,7	289,0	346,6	507,4	531,2	503,6
Volyn region	579,4	747,8	869,3	902,0	1036,8	1062,3	473,6	635,0	652,5	580,0	650,7	420,2	0,2	1,4	2,6	1,8	4,2	5,2
Dnipropetrovsk	2708,6	3456,1	1554,3	3710,3	3317,8	3866,2	32,6	82,6	44,5	38,3	28,6	31,4	855,5	1034,5	802,9	1172,8	945,6	1198,6
Donetsk	1796,6	2285,6	1642,6	2210,3	2362,8	1536,1	17,0	25,4	19,8	16,3	19,3	10,1	591,9	776,7	741,8	778,2	740,1	528,3
Zhytomyr	1086,9	1507,2	1694,9	2108,6	1907,6	1459,6	304,1	565,1	552,9	424,5	639,8	607,2	26,9	60,6	92,0	104,1	169,1	141,5
Transcarpathian	255,8	321,8	322,1	325,0	343,4	332,4	—	—	—	—	—	—	2,3	4,4	6,5	9,7	6,0	4,7
Zaporozhye	1905,4	2193,2	1196,3	2111,0	2417,6	2728,1	2,7	1,8	—	—	—	—	758,2	1004,2	750,1	921,3	771,1	961,8
Iv.-Frankivsk	346,5	536,6	615,5	677,6	780,0	688,5	80,4	99,5	131,7	69,3	121,4	33,4	4,9	12,5	15,6	20,0	40,5	27,3
Kiev	2003,0	2785,4	3190,0	3343,0	3361,6	2820,0	1093,8	1490,6	1200,2	702,6	1328,7	882,1	121,7	167,2	210,0	297,1	300,9	292,1
Kirovograd	2374,1	3464,9	2339,5	3781,4	3469,1	3313,9	513,3	788,6	628,4	284,3	526,4	483,3	713,4	918,2	908,1	1229,1	1165,5	1170,1
Lugansk	811,1	1268,5	1293,8	1292,9	1226,3	992,8	0,5	0,1	0,0	0,8	2,1	—	382,4	578,7	558,4	639,5	525,7	484,8
Lviv	622,7	961,6	1065,7	1186,1	1421,9	1366,3	529,5	673,8	834,5	653,7	780,8	583,0	0,2	1,8	4,8	18,5	28,9	27,8
Mykolaiv	2200,7	2628,2	1278,3	2803,8	2864,0	2896,4	18,5	22,7	59,0	146,3	65,6	85,4	586,1	632,3	692,6	939,9	727,8	938,7
Odessa	2928,7	3194,3	1880,4	3670,8	3677,2	3489,0	8,1	2,6	10,2	0,9	—	—	328,0	430,8	480,9	777,2	673,6	755,3
Poltava	2853,7	5055,0	3644,7	5639,6	4821,5	5363,2	1802,5	2654,0	2894,9	1546,1	1740,0	1395,8	465,4	543,2	552,7	729,5	710,8	848,4
Rivne	635,8	790,5	918,4	1108,6	1222,7	1101,5	1010,5	1003,1	907,7	531,4	544,1	454,4	3,0	4,5	7,9	4,1	5,9	9,6
Sumy	1323,9	2522,2	2667,8	3588,1	3940,6	3734,5	335,6	821,6	591,9	30,9	77,1	74,6	129,0	237,7	290,7	418,9	423,8	471,2
Ternopil	1261,0	1882,8	2163,8	2228,9	2651,4	2199,0	1554,6	1988,7	1892,4	1002,6	1734,1	726,6	13,3	22,2	23,1	29,9	42,1	74,7
Kharkiv	1266,5	3473,3	2716,5	4201,5	4466,3	4209,7	462,2	985,3	875,6	387,5	840,9	538,7	703,1	913,1	878,8	1117,8	1152,8	1172,2
Kherson	1514,8	2481,1	1055,2	1686,4	2156,2	2621,9	—	—	—	—	—	—	360,5	418,0	296,1	356,9	272,3	486,5
Khmelnysky	1742,8	2180,1	2712,6	3039,5	3289,1	2792,9	1605,8	1754,9	2218,8	1057,7	2362,7	1140,4	42,4	65,2	73,3	77,1	87,5	105,9
Cherkasy	2531,1	3761,9	3310,6	4068,5	3699,7	3745,5	977,0	1439,3	1429,0	481,8	862,7	490,5	303,2	348,5	373,0	487,2	496,8	541,6
Chernivtsi	488,5	592,9	611,9	625,5	669,7	523,5	103,9	148,5	95,0	9,3	109,5	5,6	8,0	11,5	15,5	16,8	10,1	20,8
Crimea	1518,2	2481,4	2939,0	3123,6	3692,9	3514,2	366,5	544,6	555,9	262,8	255,4	311,1	61,0	137,9	189,4	286,4	301,5	410,4

Source: compiled by authors based on statistics of the State Statistics Service of Ukraine [190]

Table A.10

Indicators for assessing the crop production of agricultural production of agricultural regions

	Production of potatoes, thousand tons						Production of vegetables, thousand tons						Production of fruits and berries, thousand tons					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	366,51	461,7	339,7	...	...	...	398,71	428,7	388,1	...	...	...	115,61	86,5	109,1	...	...	...
Vinnitsia	1580,2	1856,8	1732,6	1720,3	1994,5	1836,6	310,9	388,1	366,2	482,0	456,7	460,4	189,2	247,6	252,2	275,4	242,1	292,3
Volyn region	986,4	1135,6	1161,5	1087,0	1132,1	1098,8	248,7	279,5	281,9	282,1	277,1	276,4	34,2	35,5	35,7	37,6	40,2	37,9
Dnipropetrovsk	434,0	561,6	481,7	536,4	658,9	560,3	560,3	674,1	671,6	600,0	709,6	728,3	131,1	156,7	157,1	174,8	133,1	145,5
Donetsk	474,2	733,9	750,5	772,9	778,0	397,7	415,5	527,6	511,9	503,2	485,3	208,0	101,6	109,2	118,1	123,3	122,9	104,9
Zhytomyr	1166,2	1334,2	1343,9	1331,0	1304,1	1176,8	209,4	235,9	242,2	224,7	239,1	271,9	31,6	36,6	41,7	44,3	44,2	50,7
Transcarpathian	500,8	590,1	608,6	614,9	610,9	545,8	245,9	262,5	282,7	289,0	297,0	267,2	97,2	97,9	114,1	118,4	133,0	138,4
Zaporozhye	268,5	284,4	321,0	233,8	272,5	258,5	281,8	324,2	346,1	424,6	430,1	435,7	58,7	55,1	68,8	82,1	64,0	66,7
Iv.-Frankivsk	765,6	886,5	927,6	898,8	915,3	942,5	122,1	143,3	146,5	163,3	166,7	169,8	39,1	42,5	40,5	43,7	42,1	47,2
Kiev	1496,3	1825,7	1741,1	1492,3	1794,8	1433,6	454,9	521,0	568,3	546,3	568,4	511,2	52,0	53,5	56,6	87,6	77,9	71,5
Kirovograd	416,5	517,7	384,0	440,0	542,4	525,5	218,4	234,9	210,5	200,1	236,2	234,8	26,7	25,8	23,3	30,6	18,5	28,5
Lugansk	339,8	389,5	404,4	398,0	284,9	208,0	257,2	304,8	333,3	310,9	181,8	163,3	16,9	33,5	29,8	46,4	33,3	33,6
Lviv	1258,8	1824,9	1830,8	1573,4	1708,9	1622,5	411,9	469,6	471,3	456,7	480,0	483,5	90,1	91,1	93,9	97,3	99,1	106,8
Mykolaiv	171,0	214,4	173,9	211,6	211,8	196,1	354,1	481,0	521,3	463,2	492,2	483,0	37,7	44,2	35,5	47,9	32,3	35,6
Odessa	541,0	554,8	502,6	509,8	536,6	494,6	473,6	526,9	472,9	408,6	437,8	436,5	74,3	88,0	81,2	82,9	74,0	84,9
Poltava	818,8	1272,8	950,9	984,1	1179,5	1137,9	405,6	500,2	491,9	462,6	521,7	517,3	100,7	94,0	91,4	116,2	106,5	106,0
Rivne	1066,4	1377,9	1335,0	1299,2	1304,1	1227,6	216,5	237,1	250,5	255,5	248,7	213,6	85,9	88,1	80,6	113,0	119,2	99,3
Sumy	980,0	1153,4	1128,6	1091,9	1326,4	1068,4	153,7	189,3	185,3	189,4	194,3	189,2	13,7	15,1	13,9	16,0	16,4	17,2
Ternopil	830,7	1247,1	1284,6	1206,2	1282,7	927,8	193,5	252,3	254,8	252,2	270,8	255,4	18,5	26,3	42,7	56,2	65,7	70,7
Kharkiv	475,0	973,0	980,4	1007,6	1114,7	1029,0	464,5	702,6	698,4	707,7	665,8	689,8	64,7	54,4	74,9	91,7	79,4	88,4
Kherson	249,6	263,2	276,1	272,5	278,7	287,2	841,5	1123,8	1287,7	1161,2	1282,3	1251,5	58,8	87,2	80,0	82,1	75,2	64,7
Khmelnitsky	1083,7	1473,6	1591,2	1305,7	1509,6	1064,9	208,8	235,0	225,4	209,4	209,2	187,4	158,3	140,9	154,2	166,6	153,3	205,2
Cherkasy	760,4	925,1	762,7	747,8	807,6	778,2	281,2	353,6	368,6	361,6	356,2	365,3	37,1	39,7	43,8	55,1	37,8	56,9
Chernivtsi	496,4	628,5	601,9	597,1	617,0	586,3	219,0	229,3	228,3	232,1	232,2	222,3	97,2	119,4	140,5	162,9	171,2	178,5
Crimea	1178,0	1755,9	1630,8	1519,2	1527,4	1434,7	174,7	203,8	207,8	209,8	198,3	192,2	15,6	14,3	15,1	16,2	17,7	21,4

Source: compiled by authors based on statistics of the State Statistics Service of Ukraine [190]

Table A.11

Indicators for assessing the crop production of agricultural production of agricultural regions

	Crop production (at constant 2010 prices), mln. UAH						Financial results of activity of the enterprises of branch of agriculture of crop production, net profit (loss), thousand UAH					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	3829,1	4739,5	3271,1	...	...	...	77376,53	315556,6	21611,45	...	...	...
Vinnytsia	8946,6	11389,9	10459,7	12637,4	13846,9	11435,7	658109,5	1383368	895613	366207,1	82942,64	3583657
Volyn region	2736,2	3221,9	3485,2	3503,7	3806,3	3657,6	69253,28	114844,6	160605,5	110539,5	155868,4	542314,1
Dnipropetrovsk	8108,2	9967,0	6999,2	10647,3	9665,7	10673,9	641658,2	1389142	835119,9	1052023,6	1082307	4672043
Donetsk	5813,5	7394,8	6647,8	7384,3	7347,1	4469,8	567588,3	941144,9	867286,9	691548,0	346512,7	1356836
Zhytomyr	3660,2	4540,4	5109,2	5536,9	6048,2	5252,3	81478,57	115785,7	146914,8	-48277,7	-171164	1192909
Transcarpathian	1771,2	1968,2	2078,6	2128,6	2199,9	2099,3	-3414,811	3269,815	8209,885	9802,5	19202,56	86736,14
Zaporozhye	5542,9	6682,5	4965,2	7309,5	6992,7	7932,1	664700,8	889286,9	369347,3	393281,0	1064424	3772153
Iv.-Frankivsk	1830,7	2299,4	2502,7	2614,6	2888,1	2709,4	171485,2	131181,4	226304,5	178919,3	-29886,5	62041,22
Kiev	6753,9	8529,8	9230,7	9323,9	10210,6	8715,6	1175315	1900652	2590245	1178243,5	1889448	4338575
Kirovograd	6576,1	8659,4	6969,4	9530,8	9321,7	9056,8	1002651	1615502	1710003	1020905,4	2739521	7355588
Lugansk	3075,4	4357,3	4425,7	4645,8	3748,3	3158,1	63268,23	452430,6	661326,2	484226,1	76172,73	1149810
Lviv	3802,2	4904,7	5200,3	5135,9	5683,7	5471,5	205996,2	180207,9	740663,2	642503,3	758691,8	-224877
Mykolaiv	5567,5	6443,7	5030,5	7553,9	6896,4	7257,9	495393,5	658550,5	429121,6	487955,5	994620,8	3103008
Odessa	7015,7	7847,5	5883,1	9127,8	8985,0	8550,0	412230,6	631651,5	221067,7	647034,8	1536088	3391405
Poltava	8064,7	11877,2	9959,1	12271,2	11703,1	12902,2	1366263	2434616	2119549	1472261,8	3326374	12747097
Rivne	3236,5	3842,5	3971,9	4222,5	4542,3	4148,5	-9050,83	13841,56	56424,74	-136807,2	518979	730731,1
Sumy	3798,5	5910,4	6183,4	7314,6	8226,3	7779,5	-58570,25	332120,2	752912	214907,5	580506,5	3883550
Ternopil	3875,1	5379,0	5880,0	5792,0	6847,4	5806,7	435781,5	739367,8	547364	46774,8	-257810	942622,1
Kharkiv	5709,5	9999,3	8999,3	11119,4	11774,9	11443,9	332966,6	1203935	1237167	793915,0	782899,3	4679690
Kherson	6327,1	8113,4	6351,3	7490,8	7729,5	8520,2	383135,7	630367,9	242385,5	418869,0	865921,7	3576368
Khmelnysky	5647,5	6929,5	7980,2	7972,4	9652,1	8131,5	396398,4	629792,2	996658,6	549107,1	675850,7	2136995
Cherkasy	6360,8	8540,5	8106,3	9028,8	8745,9	8855,7	882851,2	1513925	1468419	794062,4	1617262	4662077
Chernivtsi	2193,6	2597,4	2601,3	2785,7	3014,5	2638,5	102774,8	112470,1	53569,2	54779,4	81952,75	295184,9
Crimea	4177,8	6166,2	6823,5	7053,4	7831,3	7772,3	837885,1	-303288,2	732889,5	-97474,6	-385091	4044675

Source: compiled by authors based on statistics of the State Statistics Service of Ukraine [190]

Table A.12

**Indicators for assessing crop production in agricultural production in the agricultural sector of the regions
(level of profitability of production of basic crop products in agricultural enterprises)**

	Profitability of cereals and legumes production, %						Profitability level of sugar beet production (factory), %						Profitability level of sunflower seeds production, %					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	-3,5	19,7	-6,2	...	...	...	—	—	—	...	...	...	84,2	51,2	26,2	...	...	...
Vinnytsia	20,0	30,1	16,6	7,1	23,6	35,2	9,2	25,0	8,8	0,2	22,2	-15,6	61,7	42,6	35,7	32,6	25,1	61,7
Volyn region	20,5	24,8	19,1	8,1	30,1	55,0	24,5	8,8	12,8	38,9	55,1	6,6	93,2	43,6	41,6	29,5	29,7	69,9
Dnipropetrovsk	13,2	24,0	-6,4	3,2	26,8	49,4	-2,1	28,1	-0,3	-9,4	27,2	...	79,7	73,7	46,9	36,0	45,0	98,2
Donetsk	7,7	18,5	8,7	-5,9	11,8	32,3	-8,0	19,4	39,3	4,8	... ²	...	47,0	47,0	37,9	16,6	27,7	93,4
Zhytomyr	15,3	21,6	23,5	-0,3	21,9	32,6	-14,5	18,0	26,0	10,3	54,6	102,4	7,9	17,7	55,3	23,3	28,1	76,8
Transcarpathian	-21,1	-4,6	1,2	-5,0	0,4	20,3	—	—	—	—	—	-	8,2	46,2	5,9	-20,1	6,4	23,6
Zaporozhye	10,9	22,5	-0,7	-6,6	20,3	44,5	-1,0	71,2	148,5	—	—	-	72,3	63,5	38,8	24,0	34,6	93,1
Iv.-Frankivsk	5,0	8,6	13,9	-12,3	36,3	33,1	1,1	9,7	-8,0	-2,1	-26,4	93,3	101,4	-28,1	19,9	16,5	23,3	49,9
Kiev	26,6	40,0	26,1	3,1	26,3	30,3	-0,7	23,2	4,4	-6,0	46,9	26,2	53,6	44,8	58,3	26,4	40,6	66,9
Kirovograd	26,3	36,4	20,4	5,2	33,5	50,7	43,7	57,8	49,2	5,4	21,3	28,1	83,4	75,2	62,0	37,5	54,9	94,0
Lugansk	-4,2	11,3	15,3	-1,5	23,3	32,1	-49,4	—	—	—	...	-	49,7	59,9	49,5	36,4	43,2	93,0
Lviv	4,5	8,3	4,3	-10,5	15,9	25,3	56,0	29,2	-3,0	0,2	7,8	44,0	30,9	7,4	0,8	4,9	20,4	22,8
Mykolaiv	20,2	29,0	16,4	10,1	28,5	33,5	33,9	106,4	31,5	-12,4	-4,9	10,1	79,6	63,3	48,2	41,2	44,5	63,8
Odessa	13,6	19,7	-1,9	6,5	27,3	33,4	-15,4	-3,1	-36,8	—	—	-	65,1	42,5	26,1	29,4	41,9	53,3
Poltava	19,7	29,8	15,6	4,5	28,4	79,3	-1,0	9,4	-3,8	11,4	-0,9	20,9	69,2	77,4	43,1	31,7	35,0	107,7
Rivne	10,2	4,6	11,3	3,4	44,9	55,1	5,7	-5,7	32,3	32,3	4,9	32,1	11,0	-8,9	-5,2	-10,8	-6,6	86,7
Sumy	0,4	14,2	19,2	2,9	37,8	53,6	-17,6	21,1	10,1	—	17,5	34,9	37,9	35,2	53,3	34,5	39,5	78,6
Ternopil	12,5	20,8	18,2	3,3	27,2	39,8	20,0	52,7	7,1	-6,6	6,6	47,4	32,8	45,2	25,6	13,0	42,9	65,2
Kharkiv	-4,1	23,1	9,4	-1,2	28,6	37,7	-27,5	18,4	16,1	2,3	26,5	9,6	61,1	69,0	60,8	35,3	29,9	87,3
Kherson	2,5	25,7	7,6	-7,3	19,8	46,9	—	—	—	—	—	-	68,0	37,4	22,2	16,4	22,8	84,1
Khmelnitsky	14,9	21,5	15,9	0,6	40,8	35,4	36,6	32,6	17,3	-0,9	26,6	15,9	33,1	17,2	30,8	-17,9	43,9	82,6
Cherkasy	22,3	29,3	25,4	7,1	31,3	58,7	20,2	78,4	48,8	13,8	44,9	33,8	69,2	55,7	52,8	29,4	49,3	96,4
Chernivtsi	-5,6	12,5	4,9	-4,7	29,7	31,8	25,6	95,7	29,8	-7,5	...	...	27,7	24,6	46,8	27,4	27,8	63,6
Crimea	3,0	24,2	20,5	-3,5	9,9	22,8	51,9	23,8	33,9	3,9	10,6	-2,1	32,4	26,9	53,2	-1,6	3,4	44,6

Source: compiled by the authors on the basis of statistics of the State Statistics Service of Ukraine [151; 152; 153; 154; 155; 156].

Table A.13

**Indicators for assessing crop production in agricultural production in the agricultural sector of the regions
(level of profitability of production of basic crop products in agricultural enterprises)**

	Profitability level of potato production,%						Profitability level of open-source vegetable production,%						Profitability of fruit production,%					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	1,4	28,1	-33,2	...	...	...	60,3	46,4	-10,8	...	...	...	12,4	21,4	24,8	...	...	...
Vinnitsia	63,3	-4,8	-30,9	-2,3	-23,7	-10,2	34,0	22,3	-7,7	-50,6	-13,3	16,7	47,8	24,0	5,9	12,4	-11,2	31,4
Volyn region	104,4	8,5	-10,4	54,8	-25,7	-15,1	32,5	7,4	-34,6	84,2	89,4	55,2	–	87,5	–	11,3	7,1	68,2
Dnipropetrovsk	101,1	44,6	-6,9	37,2	94,4	96,6	31,4	23,2	-6,0	10,0	11,9	37,9	6,1	-0,2	23,0	17,7	24,2	54,8
Donetsk	21,4	6,0	-31,2	-1,0	31,0	-5,8	35,5	16,0	-40,8	-9,0	5,9	129,8	-9,2	40,8	17,2	20,3	2,5	31,3
Zhytomyr	83,3	27,8	7,6	50,0	50,8	12,1	108,1	33,3	127,5	86,7	64,5	112,6	1,0	5,0	6,4	10,3	–	-7,9
Transcarpathian	34,3	28,5	4,3	9,3	-0,8	15,6	3,0	-22,5	6,0	4,2	...	9,4	-11,5	-15,8	3,5	21,4	46,7	35,1
Zaporozhye	3,9	-25,7	-29,7	13,7	112,0	2,9	23,0	-18,3	-14,8	17,7	-1,3	29,5	6,2	2,0	22,9	22,3	0,1	25,4
Iv.-Frankivsk	75,9	21,1	7,2	101,3	440,9	32,9	34,0	16,7	82,0	83,9	284,4	169,2	0,3	15,4	-16,4	-18,0	-4,5	10,3
Kiev	44,9	35,3	-13,2	16,6	13,6	0,9	11,3	18,9	-9,4	6,7	7,1	40,0	-17,9	-20,5	-18,9	-3,8	-43,3	-14,9
Kirovograd	87,8	77,6	-0,9	55,0	203,6	89,4	45,0	11,6	-30,5	7,6	-14,1	56,7	-29,8	-4,5	-6,7	-25,2	-47,6	-59,5
Lugansk	27,9	100,6	14,8	165,4	251,0	-27,1	14,2	-26,9	-29,3	-8,0	...	-26,8	-24,1	0,3	5,0	-3,1	116,9	-14,7
Lviv	41,2	26,1	-39,3	3,4	29,0	0,9	95,9	21,1	12,7	13,2	29,1	181,9	-60,5	-40,6	-81,2	847,5	105,1	213,3
Mykolaiv	13,8	24,3	-30,3	8,3	40,3	-1,7	15,5	26,3	7,3	-2,0	18,9	28,1	24,4	29,4	19,8	12,8	-6,9	13,6
Odessa	68,7	36,0	7,7	73,6	43,7	68,0	16,1	9,5	-9,0	-0,6	23,1	60,7	6,8	7,1	29,9	39,6	-14,1	28,3
Poltava	33,8	-34,0	-66,5	-26,6	-2,4	13,3	-0,2	-13,3	-1,0	14,8	10,9	57,0	-12,6	-36,0	-24,3	-29,4	-43,2	-47,7
Rivne	142,1	71,3	-37,0	6,9	64,0	0,3	37,3	18,0	115,0	26,6	8,3	146,5	-27,6	-10,8	6,4	31,2	-0,4	-9,6
Sumy	17,5	-24,9	-28,5	33,4	13,1	39,4	71,5	53,0	-6,7	75,3	13,8	201,9	20,3	24,1	25,9	39,9	-5,5	20,9
Ternopil	33,5	6,0	-23,3	30,4	-5,2	25,3	68,8	5,1	19,6	20,1	6,9	26,6	-49,7	337,7	93,7	-7,4	-13,1	403,1
Kharkiv	69,7	15,4	-59,9	-11,9	87,3	137,3	87,6	59,3	21,4	20,0	33,4	70,2	-37,8	13,3	-0,1	62,2	24,6	4,0
Kherson	23,0	8,1	-6,0	43,2	51,0	16,9	12,6	-1,6	-9,1	8,3	18,0	41,2	40,2	23,7	-5,2	5,3	31,4	32,0
Khmelnitsky	63,7	3,1	-62,6	10,3	-30,4	10,1	117,5	30,6	35,5	20,1	-23,6	14,8	41,6	40,1	14,6	2,1	-5,3	86,2
Cherkasy	14,4	11,8	-19,9	31,7	63,1	48,4	-7,4	-21,2	-16,8	-5,3	4,3	53,4	-71,4	-4,9	-31,6	-18,4	-46,4	7,0
Chernivtsi	76,6	-7,7	-7,7	-26,6	-78,3	-13,7	36,2	-14,6	-64,7	-25,9	...	...	-66,0	-27,1	-3,5	-12,6	21,7	98,2
Crimea	23,1	16,9	-16,4	15,6	2,7	23,8	183,6	34,8	59,9	5,7	14,7	-35,2	6,3	17,2	-14,7	-25,3	25,8	38,9

Source: compiled by the authors on the basis of statistics of the State Statistics Service of Ukraine [151; 152; 153; 154; 155; 156]

Table A.14

**Indicators for the evaluation of the agricultural processing and storage industries
in the agro-industrial complex of the regions**

	Production of sausage products, thousand tons						Production of unrefined sunflower oil and its fractions (except chemically modified), thousand tons						Production of liquid processed milk (pasteurized, sterilized, homogenized, melted, peptized), thousand tons					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	20,4	20,5	18,3	...	...	...	0,2	0,8	0,3	...	...	...	10,6	8,0	7,7	...	...	...
Vinnitsia	4,9	5,1	5,6	6,0	5,6	5,6	108,8	139,4	168,3	244,0	376,6	351,7	259,9	291,1	319,2	304,3	387,0	350,3
Volyn region	14,8	16,1	15,9	13,6	13,3	10,6	–	...	...	...	...	...	20,2	...	2,3	...	...	...
Dnipropetrovsk	44,0	46,6	47,2	52,3	53,2	55,5	210,0	207,4	237,5	201,8	296,4	288,1	62,2	58,3	54,9	47,1	48,3	44,3
Donetsk	37,6	43,9	45,7	47,8	34,7	27,1	387,7	351,5	388,4	364,2	322,1	153,3	47,7	41,9	40,4	39,5	37,9	6,1
Zhytomyr	8,4	8,3	10,1	10,7	16,0	17,0	0,0	0,2	0,3	0,1	...	0,1	13,0	114,6	130,2	150,6	207,8	183,3
Transcarpathian	...	...	...	...	0,6	0,7	–	–	–	–	–	–	...	...	...	–	–	–
Zaporozhye	11,5	9,9	10,0	11,2	13,2	12,9	427,6	574,4	600,1	444,7	622,8	590,9	20,6	18,7	32,2	35,7	40,3	30,9
Iv.-Frankivsk	2,4	1,9	1,9	1,6	1,3	1,7	...	...	...	...	...	...	5,1	6,0	5,4	4,8	5,2	5,0
Kiev	10,1	8,7	7,9	6,4	6,5	6,0	125,8	102,4	119,5	109,9	119,0	115,1	102,2	107,5	93,8	99,7	115,4	135,6
Kirovograd	18,8	21,2	21,1	20,8	21,6	20,2	353,7	382,7	519,5	669,5	765,7	446,6	...	...	...	0,2	...	...
Lugansk	17,3	18,0	18,6	18,1	8,3	...	64,4	63,1	59,4	72,9	97,4	91,4	9,6	13,2	12,7	19,9	12,5	2,8
Lviv	5,1	5,1	5,2	6,2	7,1	6,4	–	–	...	...	...	–	21,4	30,8	32,8	32,9	24,1	13,2
Mykolaiv	2,4	1,5	1,0	0,9	1,1	1,3	84,9	185,8	327,7	250,3	297,7	255,4	9,2	10,1	13,6	17,3	16,0	10,9
Odessa	7,7	7,4	7,3	7,4	6,9	5,6	375,8	382,0	482,5	335,2	515,4	529,2	16,7	11,9	5,6	4,1	4,0	4,6
Poltava	32,7	36,8	38,5	38,7	41,2	36,9	187,9	208,5	215,4	177,0	232,6	226,4	36,3	36,3	41,3	41,5	39,6	45,4
Rivne	2,9	1,6	1,3	1,1	0,9	0,6	...	...	...	...	...	...	4,5	7,8	5,7	14,9	22,6	8,2
Sumy	1,2	1,2	1,2	1,2	1,3	1,3	3,3	2,2	2,0	0,3	8,7	9,3	19,3	14,8	7,2	...	...	...
Ternopil	1,2	1,3	1,0	1,0	0,8	0,6	0,2	...	...	3,6	5,4	4,0	49,9	26,6	25,4	27,2	27,3	28,6
Kharkiv	20,0	18,1	17,4	18,0	18,7	15,2	347,1	277,0	333,9	244,0	355,7	293,0	35,3	43,9	31,9	31,1	27,5	32,2
Kherson	...	...	...	...	0,1	...	181,2	163,9	202,7	149,1	208,3	201,5	10,9	5,3	6,5	12,2	21,4	13,8
Khmelnitsky	6,0	6,4	6,4	6,8	7,0	4,1	0,1	0,2	0,2	0,2	0,2	0,1	9,8	13,0	8,7	14,1	21,2	15,2
Cherkasy	2,2	2,0	2,0	1,9	1,7	1,9	73,8	77,9	78,7	78,4	85,3	75,1	...	6,6	9,5	20,2	22,2	16,9
Chernivtsi	6,5	6,4	6,3	4,5	3,5	2,4	51,1	50,6	59,3	46,2	66,1	62,9	–	...	...	...	0,2	0,3
Crimea	1,6	1,2	1,2	1,3	1,3	1,3	6,6	6,9	7,3	6,2	15,9	20,1	7,8	5,8	7,4	11,3	13,5	7,5

Source: compiled by authors based on statistics of the State Statistics Service of Ukraine [190]

Table A.15

**Indicators for the evaluation of the agricultural processing and storage industries
in the agro-industrial complex of the regions**

	Production of fatty cheese, thousand tons						Production of yogurt and other fermented or fermented milk and cream, thousand tons						Production of flour, thousand tons					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	1,0	0,3	0,3	...	...	...	7,8	6,0	5,5	...	...	...	144,8	164,3	158,6	...	...	...
Vinnytsia	8,2	7,0	6,6	8,9	11,3	13,2	6,5	6,5	7,0	5,4	8,6	10,3	172,3	177,0	188,0	188,3	195,3	195,8
Volyn region	...	...	...	–	...	–	...	...	1,2	...	...	...	40,9	40,7	33,3	34,2	27,0	32,8
Dnipropetrovsk	0,8	1,1	1,6	2,8	1,8	1,2	62,8	52,0	52,8	55,6	54,4	55,5	160,3	140,2	157,7	143,8	165,5	165,5
Donetsk	1,1	1,2	1,4	1,5	1,4	0,8	47,0	47,6	44,5	42,1	36,7	3,0	262,2	276,4	262,3	265,5	184,2	38,1
Zhytomyr	4,2	4,1	6,6	7,3	8,8	8,4	11,3	16,6	11,0	13,1	12,9	11,8	...	26,3	...	...	...	...
Transcarpathian	...	...	...	...	...	...	...	...	...	...	...	...	26,9	...	19,4	20,4	22,6	19,4
Zaporozhye	13,0	2,1	2,4	0,9	0,6	0,4	13,9	8,9	7,1	6,1	5,7	6,1	79,6	83,7	67,7	87,7	95,7	84,7
Iv.-Frankivsk	4,5	1,9	0,4	0,3	0,3	0,1	3,0	2,9	3,0	3,2	3,4	2,8	53,6	63,0	66,4	60,8	54,5	49,0
Kiev	1,2	1,6	1,8	2,0	2,1	2,2	67,6	71,9	79,9	94,0	91,4	96,7	129,7	116,0	109,9	136,2	141,6	155,2
Kirovograd	1,4	0,7	0,5	0,5	0,3	0,3	...	...	...	...	...	...	34,6	56,6	54,0	61,7	65,8	54,3
Lugansk	1,6	0,5	0,4	0,3	0,3	...	8,2	6,9	7,2	7,6	4,5	0,5	154,7	118,0	173,3	150,9	76,5	10,5
Lviv	0,6	...	0,5	0,3	0,3	...	54,8	51,8	46,3	47,4	34,6	20,7	56,5	50,3	66,0	68,3	67,1	61,9
Mykolaiv	10,1	10,2	11,9	10,2	7,1	5,1	18,6	21,1	23,3	21,6	20,4	20,4	62,3	60,1	39,9	40,3	34,1	45,6
Odessa	2,0	1,4	1,1	0,9	0,8	0,6	4,1	4,3	4,4	4,0	3,7	4,0	109,5	113,4	96,0	111,3	100,7	107,1
Poltava	42,8	42,1	35,3	27,2	16,0	14,6	36,8	35,0	37,5	41,7	40,8	41,4	81,2	82,9	74,6	78,5	80,1	98,0
Rivne	15,3	16,6	14,7	17,7	15,0	18,4	4,1	4,2	4,7	4,9	5,0	4,9	56,7	50,1	44,3	46,7	49,8	47,8
Sumy	19,0	23,2	22,5	25,1	24,8	20,3	5,1	5,6	5,2	...	...	...	100,1	102,4	95,0	84,2	135,4	125,1
Ternopil	6,1	5,1	4,7	4,5	4,4	3,9	10,2	15,5	18,3	19,9	21,5	25,2	67,0	63,7	59,3	60,0	62,8	56,3
Kharkiv	6,5	2,9	0,7	4,8	1,7	0,9	41,4	48,5	50,8	52,6	41,0	39,8	191,4	222,7	270,8	272,5	291,4	324,2
Kherson	11,0	7,2	7,3	5,8	4,3	3,7	33,2	32,8	39,6	48,1	49,9	49,6	101,7	93,1	90,7	86,3	88,4	89,7
Khmelnysky	14,5	8,5	8,5	6,8	4,3	3,2	2,8	1,6	1,7	2,0	2,7	3,6	96,7	90,7	78,0	74,2	77,6	69,8
Cherkasy	22,4	20,2	22,7	23,0	17,1	17,2	7,9	7,8	13,5	...	...	...	156,4	141,4	142,5	137,6	133,2	141,2
Chernivtsi	...	...	0,1	...	...	...	–	...	...	...	0,2	0,3	32,3	26,2	24,3	18,7	...	...
Crimea	16,5	17,5	14,4	14,2	7,7	8,4	5,2	4,1	4,8	5,9	5,7	5,3	44,7	44,5	33,5	33,1	33,8	33,7

Source: compiled by authors based on statistics of the State Statistics Service of Ukraine [190]

Table A.16

**Indicators for the evaluation of the agricultural processing and storage industries
in the agro-industrial complex of the regions**

	Production of bread and bakery products, short-term storage, thousand tons						Production of white crystalline sugar, thousand tons						Manufacture of food products, beverages and tobacco, in% of the previous year					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	61,4	61,1	59,9	...	...	...	-	-	-	-	...	...	99,7	93,8	101,3	...	...	...
Vinnytsia	66,3	65,0	57,1	49,3	45,1	44,0	296,0	439,2	338,3	299,1	430,3	314,9	103,7	100,6	101,7	110,7	121,6	98,6
Volyn region	42,3	39,4	37,3	34,2	33,6	31,3	222,2	256,5	93,2	...	...	...	122,7	101,5	78,0	101,7	110,3	96,1
Dnipropetrovsk	186,7	180,7	177,0	172,9	171,1	167,9	-	-	-	-	-	-	97,9	107,4	107,7	98,2	93,8	106,8
Donetsk	161,6	156,7	147,9	134,7	105,9	49,9	...	47,7	...	...	...	...	109,2	103,7	99,2	102,0	65,4	41,2
Zhytomyr	57,2	57,4	56,4	53,4	48,2	40,5	...	...	...	-	-	-	100,6	105,2	103,9	105,4	111,3	98,5
Transcarpathian	13,6	13,5	13,9	15,6	15,1	12,1	162,5	262,2	201,5	93,6	197,9	154,5	83,4	99,5	91,4	82,4	94,9	83,6
Zaporozhye	74,8	75,0	71,1	67,8	65,0	64,3	...	91,3	69,6	31,3	65,5	...	99,7	100,7	95,6	88,9	101,8	94,8
Iv.-Frankivsk	33,8	35,1	33,5	32,5	30,7	27,7	...	...	...	...	...	...	106,3	98,5	104,3	122,8	106,9	58,1
Kiev	68,5	73,7	72,7	88,8	95,4	113,1	...	-	-	...	...	...	106,2	99,9	94,6	89,5	101,6	93,7
Kirovograd	26,7	26,6	25,4	23,6	20,7	14,0	-	-	...	-	-	-	108,2	114,1	108,6	105,6	115,8	65,2
Lugansk	74,4	68,5	66,0	60,8	30,0	11,7	239,9	442,5	406,6	207,5	257,7	209,6	83,1	91,8	105,0	...	...	...
Lviv	70,9	72,2	65,0	60,5	56,5	50,7	...	...	...	-	-	-	110,5	108,0	109,5	101,5	98,0	93,3
Mykolaiv	36,8	36,4	33,5	30,3	26,7	26,3	...	...	...	-	-	-	114,4	98,5	108,3	96,0	97,5	90,4
Odessa	93,9	90,1	86,3	82,2	78,3	80,8	147,7	208,0	208,9	132,3	271,7	...	114,7	78,7	97,5	87,6	113,8	100,1
Poltava	58,2	54,7	56,1	41,7	37,7	33,6	62,1	130,8	108,1	37,8	119,5	78,5	103,3	101,3	100,3	94,5	110,1	96,7
Rivne	36,3	35,2	30,5	28,5	28,6	28,0	164,3	217,3	233,2	122,0	281,8	167,5	101,4	102,9	90,7	76,1	97,2	113,4
Sumy	61,2	58,5	54,2	50,9	46,0	40,6	147,2	185,6	139,9	...	88,7	...	97,2	93,8	99,5	112,0	95,0	76,8
Ternopil	15,7	15,6	14,4	13,6	12,7	10,0	...	...	-	-	-	-	106,3	107,1	102,2	95,6	114,1	89,6
Kharkiv	131,3	112,4	110,1	96,2	94,8	92,6	...	...	...	...	...	...	93,5	95,4	99,6	87,9	105,9	100,5
Kherson	34,4	36,5	34,9	31,5	29,2	27,2	296,0	439,2	338,3	299,1	430,3	314,9	98,7	87,0	118,0	89,4	115,3	97,6
Khmelnitsky	55,5	61,9	54,3	53,0	56,3	50,4	222,2	256,5	93,2	...	...	...	102,7	101,5	101,2	85,4	131,2	69,0
Cherkasy	64,9	62,4	60,6	51,3	41,1	35,6	-	-	-	-	-	-	123,1	99,1	96,6	92,9	97,1	91,5
Chernivtsi	29,4	27,7	27,4	26,1	25,4	23,2	...	47,7	...	...	...	...	97,5	101,5	95,3	84,6	99,9	93,0
Crimea	50,4	48,0	43,9	39,0	33,9	29,8	...	...	...	-	-	-	102,6	97,4	102,4	88,5	102,7	104,1

Source: compiled by the authors on the basis of statistics of the State Statistics Service of Ukraine [168; 190]

Table A.17

Indicators for the evaluation of the agricultural processing and storage industries in the agro-industrial complex of the regions

	Textile, clothing, leather, leather and other materials,% of previous year					
	2013	2014	2015	2016	2017	2018
Crimea	94,3	64,2	102,4	...	...	...
Vinnitsia	97,2	97,5	83,3	95,9	91,2	100,5
Volyn region	107,4	94,2	87,7	103,3	90,8	115,1
Dnipropetrovsk	141,0	126,0	118,6	111,3	79,7	88,9
Donetsk	100,9	85,0	80,3	74,8	36,0	56,3
Zhytomyr	111,5	100,1	94,2	87,8	98,0	105,0
Transcarpathian	102,1	102,2	82,2	80,0	105,6	96,3
Zaporozhye	116,7	80,4	81,7	97,7	68,2	116,1
Iv.-Frankivsk	96,4	114,9	87,7	93,1	287,0	43,3
Kiev	106,7	104,6	107,2	98,4	90,1	131,7
Kirovograd	105,9	96,9	77,6	98,0	79,0	118,5
Lugansk	129,7	102,4	94,2	...	...	...
Lviv	94,5	112,1	90,8	105,8	104,2	96,5
Mykolaiv	108,6	93,7	68,1	103,7	71,5	82,2
Odessa	109,6	125,8	94,7	98,5	87,2	89,1
Poltava	100,9	94,4	83,5	103,0	97,6	108,7
Rivne	109,8	159,5	106,9	95,5	106,0	102,4
Sumy	117,1	123,9	90,4	93,8	93,2	118,0
Ternopil	87,1	101,5	106,9	84,8	92,3	111,7
Kharkiv	112,8	123,3	98,8	94,4	92,1	89,2
Kherson	81,1	73,6	94,3	80,5	37,5	127,6
Khmelnysky	152,5	106,8	119,9	95,1	85,2	67,3
Cherkasy	124,6	96,9	95,8	99,4	117,2	108,4
Chernivtsi	129,6	96,3	78,9	106,5	98,1	108,4
Crimea	101,1	93,6	90,4	95,7	88,0	84,7

Source: compiled by the authors on the basis of statistics of the State Statistics Service of Ukraine [190; 168]

Table A.18

Indicators for the assessment of the industrial and social infrastructure of agricultural regions

	Commissioning of housing in rural areas, thousand m2 of total area						Capital investment in wholesale and retail trade; repair of motor vehicles and motorcycles,% of total investment in the region						Capital investment in transport, warehousing,% of total investment in the region					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	157	121	201	...	...	...	3,6	1,0	1,3	...	...	...	2,9	2,5	1,7	...	...	...
Vinnytsia	106	107	108	143	88	140	4,7	5,3	3,5	2,4	3,2	3,2	2,3	5,3	4,8	1,8	1,3	4,5
Volyn region	81	89	134	119	117	164	9,2	9,1	4,8	7,2	5,0	3,9	1,7	5,3	3,7	2,0	1,4	1,4
Dnipropetrovsk	45	39	45	67	36	81	10,7	6,4	7,7	6,4	6,5	7,7	9,1	7,2	11,2	8,9	5,5	2,5
Donetsk	40	31	44	65	33	7	3,7	4,2	4,2	6,0	6,1	4,2	9,9	10,6	12,2	6,0	7,3	10,5
Zhytomyr	92	43	55	60	51	73	4,5	5,7	7,5	7,0	9,0	4,2	1,1	1,8	1,6	1,1	2,0	2,8
Transcarpathian	155	163	188	195	205	243	5,0	3,6	5,3	5,9	3,0	2,6	4,6	5,6	5,1	4,0	2,5	9,2
Zaporozhye	37	17	36	46	16	16	43,2	15,4	3,0	3,2	2,3	3,6	0,7	0,6	0,7	0,8	0,8	1,7
Iv.-Frankivsk	278	216	234	339	386	456	2,9	3,0	3,2	2,9	6,5	7,3	4,7	1,8	2,8	3,7	2,9	17,9
Kiev	696	631	710	916	1019	1032	13,4	21,0	19,9	16,9	9,9	15,9	13,0	19,2	13,3	6,9	4,3	1,3
Kirovograd	34	17	38	30	15	31	20,1	28,6	10,6	3,1	5,8	2,8	4,6	4,1	2,1	15,2	4,1	4,7
Lugansk	20	17	30	24	4	4	6,9	6,3	5,8	9,2	2,6	1,3	0,6	1,7	1,5	1,3	3,9	1,3
Lviv	238	197	277	243	307	343	9,7	8,2	8,4	6,4	6,7	7,2	11,1	8,6	7,5	7,6	7,6	6,1
Mykolaiv	14	14	19	13	13	27	26,4	17,9	13,3	6,9	12,1	12,4	16,2	19,2	17,8	17,0	20,1	24,8
Odessa	221	196	241	207	334	102	3,8	5,8	3,9	3,5	5,4	7,0	28,8	20,8	21,4	17,0	26,8	20,0
Poltava	67	50	50	75	45	85	5,6	6,0	15,7	2,0	1,8	2,1	1,8	1,3	5,1	5,6	5,7	6,0
Rivne	100	92	112	121	107	157	4,7	5,4	4,0	2,8	3,6	3,0	4,0	6,0	6,6	4,0	3,6	1,7
Sumy	37	37	44	30	24	25	2,9	2,9	2,2	2,8	1,3	3,7	1,4	3,6	3,2	4,8	5,4	2,2
Ternopil	100	65	141	145	52	180	3,5	5,8	4,0	3,9	3,3	5,1	1,2	3,6	5,7	4,7	16,7	2,2
Kharkiv	83	59	81	62	30	44	10,6	13,8	6,8	5,7	5,4	4,5	18,2	20,8	34,9	9,3	8,0	5,4
Kherson	55	58	73	56	40	32	9,7	9,3	3,8	4,1	4,4	4,4	2,8	1,7	3,0	2,0	2,7	4,3
Khmelnysky	85	48	60	58	40	58	3,2	3,3	3,0	3,1	2,2	2,2	1,1	1,5	3,5	6,9	2,7	1,9
Cherkasy	64	26	33	32	24	45	6,7	7,5	6,6	6,5	14,3	4,0	0,9	1,0	4,5	1,7	4,0	2,1
Chernivtsi	161	76	187	168	88	191	3,1	3,2	2,5	2,2	3,4	2,9	1,8	1,3	0,8	0,8	0,9	1,7
Crimea	57	31	52	50	22	43	6,7	7,5	6,4	4,7	3,3	3,0	6,0	2,2	2,8	4,7	3,5	1,1

Source: compiled by the authors on the basis of statistics of the State Statistics Service of Ukraine [168]

Table A.19

Indicators for the assessment of the industrial and social infrastructure of agricultural regions

	Capital investment in temporary accommodation and catering,% of total regional investment						Capital investment in information and telecommunications,% of total regional investment						Capital investment in education,% of total regional investment					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	9,1	3,8	2,9	...	...	...	0,4	0,1	0,1	...	...	...	1,4	0,7	0,2	...	...	...
Vinnitsia	0,5	0,1	0,2	0,6	0,1	0,1	0,7	0,5	0,5	0,5	0,4	0,5	0,8	1,0	0,7	0,8	0,7	1,3
Volyn region	0,3	0,5	0,1	0,3	0,1	0,1	0,1	0,1	0,1	0,1	0,2	0,0	1,5	0,4	0,4	0,4	0,4	0,5
Dnipropetrovsk	0,2	0,2	0,2	0,4	0,2	0,2	0,5	0,7	0,7	0,3	0,2	0,4	0,5	0,2	0,1	0,1	0,1	0,2
Donetsk	0,5	1,4	1,3	0,6	0,3	0,1	0,7	0,2	0,1	1,2	3,7	8,2	1,1	0,2	0,1	0,1	0,3	0,6
Zhytomyr	0,3	0,2	0,4	0,1	0,3	0,1	0,3	0,2	0,5	0,4	0,4	0,5	1,0	0,9	0,8	0,6	0,8	0,4
Transcarpathian	0,7	0,4	0,8	0,5	0,8	0,9	0,1	0,4	0,2	0,1	0,1	0,2	1,1	0,9	0,9	1,2	1,3	1,3
Zaporozhye	0,2	3,4	0,2	0,2	0,2	1,6	0,2	0,2	0,4	0,2	0,1	0,2	0,3	0,3	0,3	0,3	0,2	0,6
Iv.-Frankivsk	0,6	0,9	1,6	0,4	0,4	0,1	0,1	0,3	0,3	0,2	0,1	0,1	0,9	0,7	0,3	0,4	0,2	0,2
Kiev	0,4	0,8	0,7	0,2	0,4	0,2	0,1	0,1	0,1	0,2	0,3	0,1	1,2	1,2	0,2	0,1	0,0	0,1
Kirovograd	0,3	0,1	0,4	0,1	0,0	0,0	0,2	0,2	0,3	0,1	0,1	0,1	0,8	0,3	0,2	0,3	0,2	0,2
Lugansk	0,1	0,1	0,2	0,1	0,0	0,1	0,3	0,3	0,3	0,2	0,1	0,1	0,9	0,5	0,5	0,2	0,0	2,4
Lviv	0,8	1,0	1,4	2,4	2,7	1,6	1,2	1,1	1,4	0,8	1,2	1,0	1,2	0,9	1,0	0,6	0,6	0,8
Mykolaiv	0,7	0,2	0,6	0,4	0,7	0,2	0,2	0,2	0,2	0,3	0,2	0,2	0,5	0,4	0,4	0,3	0,4	0,3
Odessa	2,1	0,7	0,4	0,7	2,2	1,9	3,8	1,4	2,6	4,3	3,9	2,8	2,5	0,9	0,3	0,4	0,4	0,9
Poltava	0,1	0,1	0,1	0,1	0,0	0,1	0,1	0,2	0,1	0,2	0,1	0,3	0,6	0,4	0,3	0,2	0,2	0,3
Rivne	0,1	0,8	0,3	0,1	0,2	0,1	0,2	0,2	0,3	0,5	0,3	0,1	2,6	1,2	1,1	1,2	1,2	0,7
Sumy	0,2	0,2	0,1	0,1	0,3	0,0	0,3	0,3	0,3	0,3	0,2	0,2	8,6	7,5	4,8	0,8	0,7	1,5
Ternopil	0,1	0,2	0,3	0,1	0,2	0,0	0,1	0,1	0,5	0,5	1,1	0,5	1,2	1,4	0,7	0,6	0,9	0,8
Kharkiv	0,4	0,1	0,2	0,3	2,3	0,7	0,9	3,8	0,9	0,8	1,4	1,4	2,4	3,4	1,1	1,7	2,0	2,3
Kherson	0,9	0,6	0,3	0,9	0,1	0,4	0,3	0,2	0,6	0,2	0,2	0,1	1,6	1,3	0,8	0,5	0,5	0,8
Khmelnitsky	0,1	0,2	0,1	0,1	0,1	0,1	0,2	0,2	0,2	0,1	0,1	0,1	0,8	0,8	0,5	0,5	0,3	0,7
Cherkasy	0,3	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,1	0,2	0,1	1,1	0,7	0,4	0,6	0,5	0,7
Chernivtsi	0,4	0,3	0,2	0,4	2,7	0,3	0,3	0,2	0,4	0,1	0,2	0,2	1,7	2,6	0,6	0,6	0,2	1,1
Crimea	0,3	0,2	0,4	0,6	0,4	0,2	0,3	0,2	0,2	0,1	0,3	0,2	0,7	0,6	0,5	0,2	0,2	0,3

Source: compiled by the authors on the basis of statistics of the State Statistics Service of Ukraine [86; 172; 190; 210]

Table A.20

Indicators for the assessment of the industrial and social infrastructure of agricultural regions

	Capital investment in health and social assistance,% of total regional investment						Capital investment in professional, scientific and technical activities,% of total investment in the region						Retail trade, except of motor vehicles and motorcycles, mln. UAH					
	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018	2013	2014	2015	2016	2017	2018
Crimea	5,2	1,7	2,0	...	...	...	9,3	5,6	1,2	...	...	...	6135	8803	9996	1...	...	...
Vinnytsia	1,1	0,8	1,0	1,1	1,2	1,3	0,3	0,8	1,1	1,5	1,9	1,8	3239	4583	4791	5099	7055	8525
Volyn region	1,6	1,5	2,1	1,5	0,9	0,9	0,3	0,2	0,3	0,3	0,2	0,1	2571	3416	4089	4487	5239	6678
Dnipropetrovsk	1,6	1,1	1,3	1,0	0,4	0,6	0,5	0,8	1,1	0,5	0,7	0,5	17719	22680	25937	27909	35003	40295
Donetsk	0,5	0,6	0,8	0,9	0,5	2,1	6,7	11,2	9,4	0,8	0,6	0,8	16209	20383	22914	28039	21468	12081
Zhytomyr	1,0	1,5	2,7	1,9	1,4	1,3	0,6	1,7	0,8	0,9	0,3	0,1	3324	4209	4746	5619	6564	7971
Transcarpathian	2,8	1,9	1,6	2,7	1,7	1,8	4,1	1,6	1,5	0,8	0,6	0,2	3023	3594	3792	4975	7605	8577
Zaporozhye	0,5	0,5	0,8	0,5	0,7	1,6	3,0	3,6	2,2	2,4	1,6	3,9	7444	9362	10690	11888	14442	16693
Iv.-Frankivsk	3,8	3,5	0,9	0,5	0,4	0,7	0,4	0,3	0,2	0,2	0,5	0,3	3092	3990	4301	5281	6152	6937
Kiev	0,4	0,9	0,1	0,1	0,1	0,2	0,5	0,2	0,2	0,3	0,2	0,2	9085	11413	13623	16825	18313	23764
Kirovograd	1,0	0,8	1,4	0,6	0,4	3,6	0,4	0,2	0,2	0,4	0,4	0,2	2744	3509	4258	4670	5680	6751
Lugansk	2,5	2,0	1,6	0,7	0,4	3,7	3,6	2,4	1,9	0,6	0,7	0,9	6261	7740	9486	11306	6264	2586
Lviv	3,3	2,4	2,6	0,7	0,7	1,1	12,5	27,8	18,8	1,7	1,1	1,9	10136	11973	12270	13308	18026	21397
Mykolaiv	1,1	0,5	1,0	0,5	0,5	0,8	0,5	0,5	0,5	0,2	0,6	0,8	3872	4467	4860	5932	6359	7910
Odessa	1,0	0,9	1,1	0,8	1,4	1,4	0,8	1,3	1,2	2,0	2,3	1,4	13380	16294	18306	20976	23909	29724
Poltava	0,9	0,6	1,0	0,8	0,7	0,9	0,4	0,6	0,5	1,0	0,8	1,4	4207	5631	6403	6469	8474	10319
Rivne	1,1	1,1	1,5	0,4	0,6	0,9	0,3	0,3	0,2	0,2	0,1	0,2	2949	3643	4017	4722	5802	7165
Sumy	0,9	0,6	0,8	0,8	1,1	1,5	0,6	0,3	0,5	0,5	0,4	0,9	2181	3252	3818	4127	5231	6431
Ternopil	0,8	0,3	0,8	0,6	0,4	0,6	0,8	0,9	1,2	2,2	3,1	2,9	2199	2677	2655	3269	3836	4757
Kharkiv	1,3	0,3	0,7	1,2	1,2	1,5	1,5	1,6	1,2	2,7	1,5	2,2	13354	17236	17999	19554	24084	29926
Kherson	1,0	0,6	0,8	1,1	0,8	0,9	1,0	5,7	2,4	1,7	1,8	1,0	3326	4309	4889	5399	6284	7478
Khmelnitsky	1,4	1,3	1,1	0,8	0,9	1,7	0,2	0,5	0,8	0,4	0,4	0,3	3025	3465	3735	5084	6145	6901
Cherkasy	1,8	1,1	1,9	0,7	1,1	1,4	1,5	1,0	0,7	0,8	0,7	0,4	3441	4361	4795	5686	6345	8032
Chernivtsi	1,5	1,8	1,3	0,7	1,1	1,5	0,3	0,2	0,3	0,2	0,2	0,4	2672	3275	3150	3203	3870	4969
Crimea	1,1	0,9	0,6	0,7	0,5	0,9	0,2	0,2	0,1	0,1	0,4	0,1	2910	3589	4066	4608	5902	7061

Source: compiled by the authors on the basis of statistics of the State Statistics Service of Ukraine [86; 172; 190; 210].

Appendix B**Calculations for the developed methodological approach of evaluation of organizational and economic mechanism of agro-industrial regions development****Kyiv region**

Calculations are carried out according to the proposed calculation steps (see fig. 3.1). Rationing certain indicators using the method of mathematical expectations for and sphere of AIC (II)-industries that produce means of production for agriculture and other industries that provide service to agriculture. From the data given in the Add B, choose the valuation indicators for assessing the development of agriculture in Kyiv region in accordance with the proposed stages of the assessment of the agro-industrial regions development (see fig. 3.1). We are rationing these indicators with formulas 3.2-3.3 see Table. B.1.

Table B.1

Indicators for assessing the sphere of industries producing means of production for agriculture and other industries providing service to agriculture in Kyiv region

	2013	2014	2015	2016	2017	2018
1	2	3	4	5	6	7
Indicator	Capital investments in agriculture, hunting and the provision of related services,% to the total volume of investments in the region (x_1)					
Value	8,7	7,9	7,1	7,3	8,1	11,5
Normalized value	1,032	0,937	0,842	0,866	0,960	1,364
Indicator	Innovatively Active Enterprises, total, units (x_2)					
Value	38	44	68	66	44	39
Normalized value	0,763	0,883	1,365	1,324	0,883	0,783
Indicator	Purchase of agricultural enterprises of new agricultural machinery, pcs. (x_3)					
Value	965	947	983	1027	637	830
Normalized value	1,074	1,054	1,094	1,143	0,709	0,924
Indicator	Availability of tractors, combines and agricultural machinery, agricultural enterprises, year-end, pcs. (x_4)					
Value	11817	11011	11733	11640	11001	11060
Normalized value	1,039	0,968	1,031	1,023	0,967	0,972
Indicator	Sale of agricultural fodder enterprises, thousand quintals (x_5)					
Value	149,7	170,7	128,6	2481,4	2458,5	2571,0
Normalized value	0,113	0,129	0,097	1,87	1,853	1,938
Indicator	Purchase of agricultural enterprises of energy materials mln. m ³ (x_6)					
Value	257,0	101,4	125,6	131,5	116,5	101,4
Normalized value	1,850	0,730	0,904	0,947	0,839	0,730
Indicator	Sale of agricultural enterprises of petroleum products, thousand (x_7).					
Value	124,05	97,9	150,2	108,8	111,9	105,2
Normalized value	1,066	0,841	1,291	0,935	0,962	0,904

Continuation of Table B.1

1	2	3	4	5	6	7
Indicator	Purchase of agricultural enterprises of mineral fertilizers, thousand quintals (x_8)					
Value	2009,7	2468,5	2950,9	2875,9	3006,1	4362,0
Normalized value	0,682	0,838	1,002	0,976	1,021	1,481
Indicator	Purchase agricultural enterprises plant protection products, thousand tons (x_9)					
Value	593,0	474,0	592,0	598,5	542,2	695,7
Normalized value	1,018	0,814	1,016	1,027	0,931	1,194
Indicator	Purchase agricultural enterprises plant protection products, thousand liters (x_{10})					
Value	2623,1	2425,3	3940,9	3006,3	3604,1	3752,5
Normalized value	0,813	0,752	1,222	0,932	1,117	1,163

Source: compiled and calculated by the authors

We check the correlation between the estimators by the formula 3.4.

$$r_1 = \begin{pmatrix} 1 & -0.678 & -0.337 & -0.415 & 0.389 & -0.063 & -0.382 & 0.693 & 0.665 & 0.207 \\ -0.678 & 1 & 0.494 & 0.501 & -0.029 & -0.25 & 0.519 & -0.054 & -0.01 & 0.313 \\ -0.337 & 0.494 & 1 & 0.694 & -0.505 & 0.291 & 0.255 & -0.364 & 0.021 & -0.401 \\ -0.415 & 0.501 & 0.694 & 1 & -0.411 & 0.686 & 0.695 & -0.47 & 0.218 & -0.069 \\ 0.389 & -0.029 & -0.505 & -0.411 & 1 & -0.42 & -0.464 & 0.667 & 0.457 & 0.396 \\ -0.063 & -0.25 & 0.291 & 0.686 & -0.42 & 1 & 0.312 & -0.628 & 0.08 & -0.415 \\ -0.382 & 0.519 & 0.255 & 0.695 & -0.464 & 0.312 & 1 & -0.186 & 0.176 & 0.483 \\ 0.693 & -0.054 & -0.364 & -0.47 & 0.667 & -0.628 & -0.186 & 1 & 0.689 & 0.697 \\ 0.665 & -0.01 & 0.021 & 0.218 & 0.457 & 0.08 & 0.176 & 0.689 & 1 & 0.557 \\ 0.207 & 0.313 & -0.401 & -0.069 & 0.396 & -0.415 & 0.483 & 0.697 & 0.557 & 1 \end{pmatrix}$$

The results of the calculations confirm that the estimated indices x_1 - x_{10} are functionally independent, since all elements of the R_1 matrix are relative to the diagonal $| < 0.7$.

Since multiple regressions have no signs of multicollinearity and siderativeness in relationships between valuation indicators (), we go to the definition of the most influential indicators of the sectors that produce means of production for agriculture and other industries providing servicing of agriculture in Kyiv region.

We find index of branches that produce means of production for agriculture and other industries providing service of agriculture of Kiev Region (I_1), taking into account the calculation error:

$$I_1 := (0.2118 \ 0.25 \ 0.192 \ 0.19 \ 0.245 \ 0.25)^T \quad IIM = 0.2231$$

$$K2 := \left[(X1^T \cdot X1)^{-1} \cdot X1^T \right]^T \cdot I1$$

$$K2^T = \begin{pmatrix} 0.223 & 0.086 & -0.077 & -0.019 & 0.16 & 2.292 \times 10^{-3} & -0.054 & 0.01 & -0.044 & -0.076 & 0.011 \end{pmatrix}$$

$$I1p := K2_0 + K2_1 \cdot x1 + K2_2 \cdot x2 + K2_3 \cdot x3 + K2_4 \cdot x4 + K2_5 \cdot x5 + K2_6 \cdot x6 + K2_7 \cdot x7 + K2_8 \cdot x8 + K2_9 \cdot x9 + K2_{10} \cdot x10$$

$$In1p^T = (0.09 \ 0.089 \ 0.068 \ 0.087 \ 0.097 \ 0.121)$$

Coefficients of impact of estimation indices $x1 - x10$ spheres, which produce means of production for agriculture and other branches, which provide servicing of agriculture of Kiev region in the order of reduction of influence the following:

$$x4, x1, x2, x9, x6, x8, x3, x10, x7, x5.$$

The greatest influence on the index of $I1$ of Kyiv region has показник $x4$ – availability of tractors, combines and agricultural machinery in agricultural enterprises at the end of the year.

In the same algorithm, the values of indexes of other spheres of APK of Kiev region are calculated. When determining the agricultural sector index, we divide the indices on livestock and plant indexes. After rationing estimates ($x11-x15$) we check the correlation relationship and get the following matrix:

$$r2 = \begin{pmatrix} 1 & 0.556 & 0.699 & -0.13 & -0.131 \\ 0.556 & 1 & 0.294 & 0.643 & -0.312 \\ 0.699 & 0.294 & 1 & -0.067 & 0.516 \\ -0.13 & 0.643 & -0.067 & 1 & -0.298 \\ -0.131 & -0.312 & 0.516 & -0.298 & 1 \end{pmatrix}$$

Since signs of multicollinearity and siderativeness in relations between valuations are not found, we determine the index of agriculture (livestock).

Coefficients of the impact of evaluation indices $x11-x15$ spheres of Agriculture (livestock) of Kiev region in the order of reduction of influence the following:

$$x12, x14, x11, x13, x15.$$

The biggest influence on index $I2$ of Kiev region has показник $x12$ – milk production.

After rationing estimates (x_{16} - x_{23}) we check the correlation relations and get the following matrix:

Since signs of multicollinearity and siderativeness in relations between valuation are not found, the agricultural index (crop) is determined:

Coefficients of the impact of estimation indices x_{16} - x_{23} spheres of Agriculture (crop) of Kyiv region in the order of reduction of influence the following:

$x_{18}, x_{17}, x_{21}, x_{22}, x_{16}, x_{23}, x_{20}, x_{19}$.

$$r_5 = \begin{pmatrix} 1 & 0.58 & 0.66 & -0.634 & 0.061 & 0.503 & 0.347 & -0.113 & 0.604 & -0.229 \\ 0.58 & 1 & -0.045 & -0.636 & -0.374 & -0.202 & -0.506 & -0.209 & 0.061 & 0.159 \\ 0.66 & -0.045 & 1 & 0.062 & 0.39 & 0.483 & 0.698 & 0.215 & 0.407 & 0.133 \\ -0.634 & -0.636 & 0.062 & 1 & -0.121 & -0.477 & 0.123 & 0.649 & -0.531 & 0.538 \\ 0.061 & -0.374 & 0.39 & -0.121 & 1 & 0.683 & 0.351 & -0.541 & 0.283 & -0.059 \\ 0.503 & -0.202 & 0.483 & -0.477 & 0.683 & 1 & 0.549 & -0.546 & 0.534 & -0.55 \\ 0.347 & -0.506 & 0.698 & 0.123 & 0.351 & 0.549 & 1 & 0.366 & 0.694 & -0.442 \\ -0.113 & -0.209 & 0.215 & 0.649 & -0.541 & -0.546 & 0.366 & 1 & 0.017 & 0.193 \\ 0.604 & 0.061 & 0.407 & -0.531 & 0.283 & 0.534 & 0.694 & 0.017 & 1 & -0.696 \\ -0.229 & 0.159 & 0.133 & 0.538 & -0.059 & -0.55 & -0.442 & 0.193 & -0.696 & 1 \end{pmatrix}$$

The biggest influence on index I3 of Kiev region has показник x_{18} – production of sunflower.

As signs of multicollinearity and siderativeness in links between livestock and agricultural farming are not found, we expect the agricultural sector index in Kyiv region:

As the agricultural sector index is divided in the calculations for livestock and plant indexes, we determine their impact rate.

The largest influence on the agricultural sector Index has an index of agriculture in Kyiv region.

We proceed to rationing estimation indicators (x_{24} - x_{33}) Sphere of industry for processing and preservation of agricultural products, check correlation relations and get the following matrix: As signs of multicollinearity and Siderativeness in the relations between the valuation is not found, determine the sphere index of industries on processing and preservation of agricultural products.

Coefficients of impact of estimation indices x_{24} - x_{33} spheres of industries on processing and preservation of agricultural products of Kiev region in order of reduction of influence the following:

$x_{25}, x_{31}, x_{33}, x_{24}, x_{30}, x_{27}, x_{32}, x_{26}, x_{28}, x_{29}$.

$$r_4 = \begin{pmatrix} 1 & 0.059 & 0.692 & 0.274 & -0.302 & -0.686 & 0.565 & 0.102 & 0.612 & 0.376 \\ 0.059 & 1 & -0.109 & -0.446 & 0.508 & 0.575 & 0.225 & -0.119 & 0.077 & 0.512 \\ 0.692 & -0.109 & 1 & 0.578 & 0.169 & -0.579 & 0.067 & 0.685 & 0.684 & 0.034 \\ 0.274 & -0.446 & 0.578 & 1 & 0.142 & -0.304 & -0.537 & 0.662 & 0.406 & 0.013 \\ -0.302 & 0.508 & 0.169 & 0.142 & 1 & 0.697 & -0.625 & 0.685 & -0.154 & 0.35 \\ -0.686 & 0.575 & -0.579 & -0.304 & 0.697 & 1 & -0.513 & 0.033 & -0.571 & 0.33 \\ 0.565 & 0.225 & 0.067 & -0.537 & -0.625 & -0.513 & 1 & -0.634 & 0.371 & -0.039 \\ 0.102 & -0.119 & 0.685 & 0.662 & 0.685 & 0.033 & -0.634 & 1 & 0.114 & 0.177 \\ 0.612 & 0.077 & 0.684 & 0.406 & -0.154 & -0.571 & 0.371 & 0.114 & 1 & -0.255 \\ 0.376 & 0.512 & 0.034 & 0.013 & 0.35 & 0.33 & -0.039 & 0.177 & -0.255 & 1 \end{pmatrix}$$

The greatest influence on the index I4 of Kiev region has the indicator x_{25} – production of milk of liquid treated (pasteurized, sterilized, homogenized, melted, peptide).

We norms the estimated indicators (x_{34} - x_{43}) of the sphere of production and social infrastructure, check the correlation links and get the following matrix:

Since signs of multicollinearity and siderativeness in relations between valuation are not found, we determine the index of production and social infrastructure.

Coefficients of impact of estimation indices x_{34} - x_{43} in the sphere of industrial and social infrastructure of Kyiv region in the order of reduction of influence the following:

$x_{43}, x_{42}, x_{38}, x_{37}, x_{39}, x_{41}, x_{36}, x_{35}, x_{40}, x_{34}$.

The biggest influence on the index of I5 of Kyiv region has показник x_{43} – capital investments in information and telecommunications.

After finding indexes of four agricultural spheres we determine the integral index of agro-industrial complex of Kiev region, but before that we determine the presence of correlation relations between indexes.

$$rp5 := \begin{pmatrix} \text{corr}(I1, I1) & \text{corr}(I1, I2) & \text{corr}(I1, I3) & \text{corr}(I1, I4) \\ \text{corr}(I2, I1) & \text{corr}(I2, I2) & \text{corr}(I2, I3) & \text{corr}(I2, I4) \\ \text{corr}(I3, I1) & \text{corr}(I3, I2) & \text{corr}(I3, I3) & \text{corr}(I3, I4) \\ \text{corr}(I4, I1) & \text{corr}(I4, I2) & \text{corr}(I4, I3) & \text{corr}(I4, I4) \end{pmatrix} \quad rp5 = \begin{pmatrix} 1 & -0.026 & -0.573 & -0.048 \\ -0.026 & 1 & -0.529 & 0.148 \\ -0.573 & -0.529 & 1 & -0.372 \\ -0.048 & 0.148 & -0.372 & 1 \end{pmatrix}$$

$$|rp5| = 0.264$$

$$I^T = (0.832 \ 0.625 \ 0.804 \ 0.615 \ 0.798 \ 0.772)$$

$$I_p := K1_0 + K1_1 \cdot I1 + K1_2 \cdot I2 + K1_3 \cdot I3 + K1_4 \cdot I4$$

$$I_p^T = (0.778 \ 0.585 \ 0.752 \ 0.575 \ 0.747 \ 0.722)$$

Coefficients of the impact of indexes of agro-industrial complex of Kyiv region in descending order of the following: I1,-spheres producing means of production for agriculture and other industries providing maintenance of agriculture; I3,-spheres of industries on processing and preservation of agricultural products; I2,-spheres of agriculture; 4.-the sphere of industrial and social infrastructure.

Thus, the calculations carried out make it possible to determine the average integrated index of AIC Kyiv region in the period studied, namely $I_s = 0.693$.

To determine the development of AGRICULTURE define the dynamics factor:

$$kD_i = \sqrt{\left(\frac{Ii_1}{ri_1}\right)^2 + \left(\frac{Ii_2}{ri_2}\right)^2 + \left(\frac{Ii_3}{ri_3}\right)^2 + \left(\frac{Ii_4}{ri_4}\right)^2 + \left(\frac{Ii_5}{ri_5}\right)^2 + \left(\frac{Ii_6}{ri_6}\right)^2}$$

The dynamics coefficient calculations showed a high level of agriculture in Kyiv region.

In accordance with the proposed methodological approach to assessing the development of agricultural regions, we will build an forecast for 2031 considering the impact of evaluation indicators on the development of each of the agricultural sectors in the region.

**Calculations for the developed methodological approach of evaluation of
organizational and economic mechanism of agro-industrial regions development
Chernihiv region**

Calculations are carried out according to the proposed calculation steps (see fig. 3.1). Rationing certain indicators using the method of mathematical expectations for and sphere of AIC (II)-industries that produce means of production for agriculture and other industries that provide maintenance of agriculture. From the data given in Appendix B, select the valuation indicators for assessing the development of agriculture in Chernihiv region in accordance with the proposed stages of the evaluation of the agro-industrial complex development (see fig. 3.1). We are rationing these indicators with formulas 2.2-2.3. We check the correlation relationships between the evaluational parameters by the formula 3.4.

$$r1 = \begin{pmatrix} 1 & 0.091 & 0.307 & -0.456 & 0.217 & -0.582 & 0.209 & 0.358 & 4.969 \times 10^{-3} & -0.095 \\ 0.091 & 1 & 0.568 & 0.528 & -0.61 & 0.207 & 0.048 & -0.467 & -0.171 & -0.119 \\ 0.307 & 0.568 & 1 & 0.682 & -0.609 & 0.161 & 0.216 & -0.368 & -0.641 & -0.666 \\ -0.456 & 0.528 & 0.682 & 1 & -0.636 & 0.684 & -0.053 & -0.633 & -0.677 & -0.445 \\ 0.217 & -0.61 & -0.609 & -0.636 & 1 & 0.031 & -0.066 & 0.681 & 0.164 & 0.69 \\ -0.582 & 0.207 & 0.161 & 0.684 & 0.031 & 1 & 0.081 & -0.082 & -0.408 & 0.287 \\ 0.209 & 0.048 & 0.216 & -0.053 & -0.066 & 0.081 & 1 & 0.665 & 0.425 & 0.202 \\ 0.358 & -0.467 & -0.368 & -0.633 & 0.681 & -0.082 & 0.665 & 1 & 0.543 & 0.632 \\ 4.969 \times 10^{-3} & -0.171 & -0.641 & -0.677 & 0.164 & -0.408 & 0.425 & 0.543 & 1 & 0.537 \\ -0.095 & -0.119 & -0.666 & -0.445 & 0.69 & 0.287 & 0.202 & 0.632 & 0.537 & 1 \end{pmatrix}$$

The results of the calculations confirm that the estimated indices x1-X10 are functionally independent, since all elements of the R1 matrix are relative to the diagonal $| < 0.7$.

Since multiple regressions have no signs of multicollinearity and siderativeness in relationships between valuation indicators ($|r1| \neq 0$), we go to the definition of the most influential indicators of the sectors producing means of production for agriculture and other industries providing maintenance of agriculture in Chernihiv region.

We find an index of branches that produce means of production for agriculture and other industries providing service of agriculture of Chernihiv region (I1), taking into account the error of calculations.

$$K2 := \left[(X1^T \cdot X1)^{-1} \cdot X1^T \right]^T \cdot I1$$

$$K2^T = (0.139 \quad 3.118 \times 10^{-4} \quad 0.128 \quad -0.14 \quad 0.158 \quad 0.029 \quad 0.054 \quad -0.142 \quad -0.21 \quad 0.077 \quad 0.046)$$

Coefficients of the impact of estimation indices x1-x10spheres, which produce means of production for agriculture and other branches, which ensure maintenance of agriculture of Chernihiv region in the order of reduction of influence Following:

$$x_8, x_4, x_7, x_3, x_2, x_9, x_6, x_{10}, x_5, x_1,$$

The greatest influence on the index of I1chernihiv region has показникx8 – purchase of mineral fertilizers.

In the same algorithm, values of indices of other spheres of AGRICULTURE of Chernihiv region are calculated. When determining the agricultural sector index, we divide the indices on livestock and plant indexes. After rationing estimates (X11-x15) We check the correlation relationship and get the following matrix:

$$r2 = \begin{pmatrix} 1 & -0.221 & -0.08 & 0.438 & -0.655 \\ -0.221 & 1 & -0.667 & 0.599 & -0.062 \\ -0.08 & -0.667 & 1 & -0.428 & 0.181 \\ 0.438 & 0.599 & -0.428 & 1 & -0.676 \\ -0.655 & -0.062 & 0.181 & -0.676 & 1 \end{pmatrix}$$

$$I1 := (0.24 \quad 0.20 \quad 0.083 \quad 0.083 \quad 0.074 \quad 0.155)^T \quad I1p^T = (0.22 \quad 0.183 \quad 0.076 \quad 0.076 \quad 0.068 \quad 0.142)$$

Since there are no signs of multicollinearity and simulativity in the relationship between the estimated indicators, we determine the index of agriculture (animal husbandry):

$$\text{In1} := (0.124 \ 0.09 \ 0.08 \ 0.0874940 \ 0.06 \ 0.125)^T$$

$$\text{In1M} = 0.09442$$

$$\text{K2}^T = (0.094 \ -0.024 \ -0.272 \ -0.335 \ 0.612 \ 0.019)$$

$$\text{In1p}^T = (0.12 \ 0.087 \ 0.077 \ 0.085 \ 0.058 \ 0.121)$$

Coefficients of influence of estimation indicators of $x11$ - $x15$ sphere of agriculture (animal husbandry) of Chernihiv region in the order of decrease of influence the following

$$x_{14}, x_{13}, x_{12}, x_{11}, x_{15}.$$

The greatest influence on the index of I2 of Chernihiv region has indicator $x14$ – prices for livestock products.

After rationing of valuation indicators ($x16$ - $x23$) spheres of agriculture (crop) we check the correlation relations and get the following matrix:

$$r3 = \begin{pmatrix} 1 & -0.359 & 0.681 & 0.335 & 0.436 & 0.445 & 0.297 & -0.206 \\ -0.359 & 1 & -0.562 & 0.565 & 0.181 & -0.541 & 0.212 & 0.103 \\ 0.681 & -0.562 & 1 & -0.171 & 0.467 & 0.692 & 0.639 & 0.082 \\ 0.335 & 0.565 & -0.171 & 1 & 0.682 & -0.594 & 0.129 & -0.552 \\ 0.436 & 0.181 & 0.467 & 0.682 & 1 & -0.221 & 0.6 & -0.439 \\ 0.445 & -0.541 & 0.692 & -0.594 & -0.221 & 1 & 0.285 & 0.658 \\ 0.297 & 0.212 & 0.639 & 0.129 & 0.6 & 0.285 & 1 & 0.169 \\ -0.206 & 0.103 & 0.082 & -0.552 & -0.439 & 0.658 & 0.169 & 1 \end{pmatrix}$$

Since signs of multicollinearity and siderativeness in relations between valuation are not found, the agricultural index (crop) is determined:

Coefficients of impact of estimation indices $x16$ - $x23$ spheres of Agriculture (crop) of Chernihiv region in the order of reduction of influence are the following:

$$x_{16}, x_{20}, x_{22}, x_{17}, x_{18}, x_{19}, x_{23}, x_{21}.$$

The biggest influence on index I3 of Chernihiv region has indices $x16$ – production of grain and leguminous crops.

$$\text{In2} := (0.0855 \ 0.044 \ 0.110 \ 0.11 \ 0.08 \ 0.122)^T$$

$$\text{K2}^T = \begin{pmatrix} 0.092 & -0.145 & -0.036 & 0.022 & 9.434 \times 10^{-3} & 0.102 & -6.979 \times 10^{-4} & 0.04 & 8.286 \times 10^{-3} \end{pmatrix}$$

$$\text{In2M} = 0.092$$

$$\text{In2p}^T = (0.082 \ 0.042 \ 0.106 \ 0.106 \ 0.077 \ 0.117)$$

As signs of multicollinearity and siderativeness in links between livestock and agricultural farming are not found, we expect the agricultural sector index in Chernihiv region.

As the agricultural sector index is divided in the calculations for livestock and plant indexes, we determine their impact rate.

The most influential in the agricultural sector Index is the index of livestock agriculture in Chernihiv region.

We proceed to rationing estimates (x24-x33) Sphere of industry for processing and preservation of agricultural products, check correlation relations and get the next matrix:

$$r4 = \begin{pmatrix} 1 & 0.062 & 0.148 & 0.472 & 0.056 & 0.311 & 0.666 & 0.667 & 0.193 & 0.693 \\ 0.062 & 1 & -0.585 & 0.135 & -0.597 & -0.113 & -0.387 & 0.683 & -0.226 & 0.074 \\ 0.148 & -0.585 & 1 & -0.67 & 0.668 & 0.667 & 0.266 & -0.365 & -0.377 & 0.61 \\ 0.472 & 0.135 & -0.67 & 1 & -0.239 & -0.383 & 0.468 & 0.41 & 0.695 & -0.289 \\ 0.056 & -0.597 & 0.668 & -0.239 & 1 & 0.602 & 0.667 & -0.607 & -0.019 & 0.085 \\ 0.311 & -0.113 & 0.667 & -0.383 & 0.602 & 1 & 0.335 & -0.156 & 7.18 \times 10^{-3} & 0.557 \\ 0.666 & -0.387 & 0.266 & 0.468 & 0.667 & 0.335 & 1 & 0.013 & 0.316 & 0.217 \\ 0.667 & 0.683 & -0.365 & 0.41 & -0.607 & -0.156 & 0.013 & 1 & -0.112 & 0.505 \\ 0.193 & -0.226 & -0.377 & 0.695 & -0.019 & 7.18 \times 10^{-3} & 0.316 & -0.112 & 1 & -0.392 \\ 0.693 & 0.074 & 0.61 & -0.289 & 0.085 & 0.557 & 0.217 & 0.505 & -0.392 & 1 \end{pmatrix}$$

$$\text{I3} := (0.13 \ 0.12 \ 0.08 \ 0.14 \ 0.011 \ 0.17)^T$$

$$\text{K2}^T = (0.109 \ 0.038 \ -0.069 \ 0.092 \ -0.025 \ 0.068 \ -0.36 \ 0.062 \ 0.138 \ -0.032 \ 0.088)$$

$$\text{I3p}^T = (0.12 \ 0.11 \ 0.074 \ 0.129 \ 0.01 \ 0.156)$$

Since signs of multicollinearity and siderativeness in communication between

valuation indicators are not found, we define the index of industries on processing and preservation of agricultural products.

Coefficients of impact of estimation indices x_{24} - x_{33} spheres of industries on processing and preservation of agricultural products of Chernihiv region in order of reduction of influence the following:

$$x_{29}, x_{31}, x_{26}, x_{33}, x_{25}, x_{28}, x_{30}, x_{24}, x_{32}, x_{27}.$$

The greatest influence on the index I_4 chernihiv region has показник x_{29} – production of bread and bakery products of short-term storage.

We norms the estimated indicators (x_{34} - x_{43}) of the sphere of production and social infrastructure, check the correlation links and get the following matrix:

$$r_5 = \begin{pmatrix} 1 & -0.072 & -0.498 & -0.698 & 0.524 & -0.613 & 0.645 & 0.207 & 0.144 & 0.37 \\ -0.072 & 1 & -0.666 & 0.084 & -0.255 & -0.056 & -0.32 & -0.693 & 0.173 & 0.687 \\ -0.498 & -0.666 & 1 & 0.193 & 0.027 & 0.634 & -0.45 & 0.504 & -0.106 & -0.645 \\ -0.698 & 0.084 & 0.193 & 1 & -0.689 & -0.079 & -0.371 & -0.325 & -0.616 & -0.026 \\ 0.524 & -0.255 & 0.027 & -0.689 & 1 & -0.101 & 0.06 & -0.064 & -0.088 & -0.391 \\ -0.613 & -0.056 & 0.634 & -0.079 & -0.101 & 1 & -0.562 & 0.283 & 0.52 & -0.349 \\ 0.645 & -0.32 & -0.45 & -0.371 & 0.06 & -0.562 & 1 & 0.37 & 0.198 & 0.094 \\ 0.207 & -0.693 & 0.504 & -0.325 & -0.064 & 0.283 & 0.37 & 1 & 0.459 & -0.133 \\ 0.144 & 0.173 & -0.106 & -0.616 & -0.088 & 0.52 & 0.198 & 0.459 & 1 & 0.259 \\ 0.37 & 0.687 & -0.645 & -0.026 & -0.391 & -0.349 & 0.094 & -0.133 & 0.259 & 1 \end{pmatrix}$$

$$rp_5 = \begin{pmatrix} 1 & 0.155 & 0.51 & 0.385 \\ 0.155 & 1 & 0.698 & -0.578 \\ 0.51 & 0.698 & 1 & 0.15 \\ 0.385 & -0.578 & 0.15 & 1 \end{pmatrix}$$

$$rp_5 := \begin{pmatrix} \text{corr}(I_1, I_1) & \text{corr}(I_1, I_2) & \text{corr}(I_1, I_3) & \text{corr}(I_1, I_4) \\ \text{corr}(I_2, I_1) & \text{corr}(I_2, I_2) & \text{corr}(I_2, I_3) & \text{corr}(I_2, I_4) \\ \text{corr}(I_3, I_1) & \text{corr}(I_3, I_2) & \text{corr}(I_3, I_3) & \text{corr}(I_3, I_4) \\ \text{corr}(I_4, I_1) & \text{corr}(I_4, I_2) & \text{corr}(I_4, I_3) & \text{corr}(I_4, I_4) \end{pmatrix}$$

Since signs of multicollinearity and siderativeness in relations between valuation are not found, we determine the index of production and social infrastructure.

Coefficients of impact of estimation indices x_{34} - x_{43} in the sphere of industrial and social infrastructure of Chernihiv region in order of reduction of influence the following:

$$x_{38}, x_{43}, x_{40}, x_{41}, x_{36}, x_{35}, x_{39}, x_{37}, x_{42}, x_{34}.$$

The greatest influence on the index of the Chernihiv region has показникх38 – capital investment in the wholesale trade and repair of vehicles and motorcycles.

After the finding of indexes of four agricultural spheres we determine the integral index of agricultural development in Chernihiv region, but before that we determine the presence of correlation relations between indexes.

Coefficients of the impact of indexes of agricultural sector of Chernihiv region in descending order of influence: I_2 – spheres of agriculture; I_1 – spheres of production means for agriculture and other industries providing maintenance of agriculture; I_3 – spheres of industries on processing and preservation of agricultural products; I_4 – The sphere of industrial and social infrastructure.

$$I^T = (0.536 \ 0.615 \ 0.328 \ 0.415 \ 0.209 \ 0.533)$$

$$K_1^T = \begin{pmatrix} 1.332 \times 10^{-14} & 1 & 1 & 1 & 1 \end{pmatrix}$$

$$IM = 0.439$$

$$I_p := K_1^T \cdot I_1 + K_1^T \cdot I_2 + K_1^T \cdot I_3 + K_1^T \cdot I_4$$

$$I_p^T = (0.495 \ 0.567 \ 0.303 \ 0.383 \ 0.193 \ 0.492)$$

Therefore, the calculations made it possible to determine the average integrated index of agricultural industry of Chernihiv region for the period under study, namely $I_s = 0.406$.

To determine the development of the agro-industrial complex we determine the dynamics factor:

$$kD_i = \sqrt{\left(\frac{Ii_1}{ri_1}\right)^2 + \left(\frac{Ii_2}{ri_2}\right)^2 + \left(\frac{Ii_3}{ri_3}\right)^2 + \left(\frac{Ii_4}{ri_4}\right)^2 + \left(\frac{Ii_5}{ri_5}\right)^2 + \left(\frac{Ii_6}{ri_6}\right)^2}$$

In accordance with the proposed methodological approach to the assessment of the development of the agro-industrial complex of the regions, we will make a forecast by 2031, taking into account the impact of the evaluation indicators on the development of each of the agro-industrial complexes of the region.

**Calculations for the developed methodological approach of evaluation of
organizational and economic mechanism of agro-industrial regions development
Sumy region**

Calculations are carried out according to the proposed calculation steps (see fig. 3.1). Rationing certain indicators using the method of mathematical expectations for and sphere of AIC (II)-industries that produce means of production for agriculture and other industries that provide maintenance of agriculture. From the data given in Appendix B, select Valuation indicators for evaluation of agricultural development of Sumy region in accordance with the proposed stages of the assessment of the agro-industrial regions development (see fig. 3.1). We are rationing these indicators with formulas 3.2-3.3. We check the correlation relationships between the evaluational parameters by the formula 3.4.

$$r1 = \begin{pmatrix} 1 & 0.086 & -0.081 & -0.671 & 0.649 & -0.696 & 0.685 & 0.479 & 0.5 & 0.434 \\ 0.086 & 1 & 0.688 & 0.03 & 0.275 & -0.206 & -0.185 & -0.364 & 0.427 & 0.237 \\ -0.081 & 0.688 & 1 & -0.184 & -0.35 & 0.052 & -0.288 & -0.327 & 0.164 & 0.237 \\ -0.671 & 0.03 & -0.184 & 1 & -0.182 & 0.635 & -0.034 & -0.319 & -0.069 & -0.597 \\ 0.649 & 0.275 & -0.35 & -0.182 & 1 & -0.392 & 0.416 & 0.497 & 0.697 & 0.498 \\ -0.696 & -0.206 & 0.052 & 0.635 & -0.392 & 1 & -0.174 & 0.187 & 0.106 & -0.039 \\ 0.685 & -0.185 & -0.288 & -0.034 & 0.416 & -0.174 & 1 & 0.483 & 0.488 & -0.03 \\ 0.479 & -0.364 & -0.327 & -0.319 & 0.497 & 0.187 & 0.483 & 1 & 0.645 & 0.687 \\ 0.5 & 0.427 & 0.164 & -0.069 & 0.697 & 0.106 & 0.488 & 0.645 & 1 & 0.676 \\ 0.434 & 0.237 & 0.237 & -0.597 & 0.498 & -0.039 & -0.03 & 0.687 & 0.676 & 1 \end{pmatrix}$$

The results of the calculations confirm that the estimated indices $x1-x10$ are functionally independent, since all elements of the R1 matrix are relative to the diagonal $| < 0.7$.

Since multiple regressions have no signs of multicollinearity and siderativeness in relationships between valuation indicators ($|r1| \neq 0$), we go to the definition of the most influential indicators of the sectors producing means of production for agriculture and other industries providing maintenance of agriculture of Sumy region.

We find index of branches that produce means of production for agriculture and other industries providing service of agriculture of Sumy region (I1), taking into account error of calculations.

$$K2^T = (0.11 \quad -0.044 \quad -0.04 \quad -0.013 \quad 0.235 \quad 0.057 \quad -7.809 \times 10^{-5} \quad 0.197 \quad -0.078 \quad -0.089 \quad -0.226)$$

$$K2 := \left[(X1^T \cdot X1)^{-1} \cdot X1^T \right]^T \cdot I1$$

Coefficients of impact of estimation indices $x1 - x10$ spheres, which produce means of production for agriculture and other branches, which ensure maintenance of agriculture of Sumy region in the order of reduction of influence the following:

$$x4, x10, x7, x9, x8, x1, x5, x2, x6, x3.$$

The biggest influence on the index of I1 Sumy region has indices $x4$ – presence of tractors, combines and equipment in agricultural enterprises.

In the same algorithm the values of indexes of other spheres of agriculture of Sumy region are calculated. When determining the agricultural sector index, we divide the indices on livestock and plant indexes. After rationing estimates ($x11-x15$) we check the correlation relationship and get the following matrix:

$$x4, x10, x7, x9, x8, x1, x5, x2, x6, x3.$$

$$r2 = \begin{pmatrix} 1 & -0.19 & 0.697 & 0.685 & 0.426 \\ -0.19 & 1 & -0.305 & 0.344 & -0.699 \\ 0.697 & -0.305 & 1 & 0.654 & 0.395 \\ 0.685 & 0.344 & 0.654 & 1 & 0.195 \\ 0.426 & -0.699 & 0.395 & 0.195 & 1 \end{pmatrix}$$

$$I1p^T = (0.056 \quad 0.074 \quad 0.168 \quad 0.149 \quad 0.13 \quad 0.039)$$

$$I1M = 0.1104$$

$$K2^T = (0.098 \quad -0.168 \quad -1.549 \quad -0.322 \quad 2.034 \quad 5.703 \times 10^{-3})$$

$$I1M = 0.0979$$

$$I1 := (0.17 \quad 0.05347 \quad 0.09 \quad 0.09 \quad 0.0661 \quad 0.118)^T$$

$$I1p^T = (0.16 \quad 0.05 \quad 0.085 \quad 0.085 \quad 0.062 \quad 0.111)$$

$$I1 := (0.06 \quad 0.08 \quad 0.18 \quad 0.16 \quad 0.140 \quad 0.04240)^T$$

$$I1p := K2_0 + K2_1 \cdot x1 + K2_2 \cdot x2 + K2_3 \cdot x3 + K2_4 \cdot x4 + K2_5 \cdot x5 + K2_6 \cdot x6 + K2_7 \cdot x7 + K2_8 \cdot x8 + K2_9 \cdot x9 + K2_{10} \cdot x10$$

Since signs of multicollinearity and siderativeness in relations between valuation are not found, we determine the index of agriculture (livestock).

$$x_{14}, x_{12}, x_{13}, x_{11}, x_{15}.$$

Coefficients of impact of estimation indices x_{11} - x_{15} spheres of Agriculture (livestock) of Sumy region in the order of reduction of influence the following:

The greatest influence on the index of I2 Sumy region is the indicator of x_{14} – prices for livestock products.

After rationing of valuation indicators (x_{16} - x_{23}) spheres of agriculture (crop) we check the correlation relations and get the following matrix:

$$r_3 = \begin{pmatrix} 1 & -0.053 & 0.458 & 0.437 & 0.346 & -0.424 & 0.626 & 0.244 \\ -0.053 & 1 & -0.452 & -0.067 & 0.281 & -0.572 & -0.425 & -0.338 \\ 0.458 & -0.452 & 1 & -0.081 & 0.348 & 0.353 & 0.673 & 0.685 \\ 0.437 & -0.067 & -0.081 & 1 & 0.619 & 0.072 & 0.679 & -0.126 \\ 0.346 & 0.281 & 0.348 & 0.619 & 1 & 0.162 & 0.69 & 0.118 \\ -0.424 & -0.572 & 0.353 & 0.072 & 0.162 & 1 & 0.368 & 0.522 \\ 0.626 & -0.425 & 0.673 & 0.679 & 0.69 & 0.368 & 1 & 0.436 \\ 0.244 & -0.338 & 0.685 & -0.126 & 0.118 & 0.522 & 0.436 & 1 \end{pmatrix}$$

Since signs of multicollinearity and siderativeness in relations between valuation are not found, the agricultural index (crop) is determined:

$$\ln_2 := (0.0855 \ 0.034 \ 0.110 \ 0.10 \ 0.049 \ 0.122)^T \quad \ln_2 M = 0.083$$

$$K_2^T = \begin{pmatrix} 0.083 & 0.067 & -0.015 & 0.056 & -8.183 \times 10^{-3} & -0.016 & 0.048 & -0.136 & 4.6 \times 10^{-3} \end{pmatrix}$$

Coefficients of the impact of estimation indices x_{16} - x_{23} spheres of Agriculture (crop) of Sumy region in the order of reduction of influence the following:

$$x_{22}, x_{16}, x_{18}, x_{21}, x_{20}, x_{17}, x_{19}, x_{23}.$$

The greatest influence on the index I3 of Sumy region has the indicator x_{22} – prices for crop production.

As signs of multicollinearity and siderativeness in relationships between livestock and agricultural farming are not found, we expect the agricultural sector index of Sumy region.

As the agricultural sector index is divided in the calculations for livestock and plant indexes, we determine their impact rate.

The most influential in the agricultural sector Index is the index of livestock farming of Sumy region

We proceed to rationing estimates (X24-x 33) sphere of industries on processing and preservation of agricultural products, check correlation relations and get the following matrix:

$$r_4 = \begin{pmatrix} 1 & 0.578 & -0.688 & 0.47 & -0.036 & 0.421 & 0.021 & -0.298 & -0.502 & 0.351 \\ 0.578 & 1 & -0.407 & -0.031 & 0.126 & 0.676 & 0.556 & 0.51 & -0.358 & 0.497 \\ -0.688 & -0.407 & 1 & -0.136 & 0.168 & -0.434 & -0.52 & 0.318 & 0.626 & -0.606 \\ 0.47 & -0.031 & -0.136 & 1 & 0.674 & -0.548 & -0.192 & -0.674 & -0.691 & 0.094 \\ -0.036 & 0.126 & 0.168 & 0.674 & 1 & -0.637 & 0.261 & -0.192 & -0.649 & 0.347 \\ 0.421 & 0.676 & -0.434 & -0.548 & -0.637 & 1 & 0.29 & 0.582 & 0.194 & 0.095 \\ 0.021 & 0.556 & -0.52 & -0.192 & 0.261 & 0.29 & 1 & 0.321 & -0.554 & 0.694 \\ -0.298 & 0.51 & 0.318 & -0.674 & -0.192 & 0.582 & 0.321 & 1 & 0.43 & -0.137 \\ -0.502 & -0.358 & 0.626 & -0.691 & -0.649 & 0.194 & -0.554 & 0.43 & 1 & -0.63 \\ 0.351 & 0.497 & -0.606 & 0.094 & 0.347 & 0.095 & 0.694 & -0.137 & -0.63 & 1 \end{pmatrix}$$

$$I_3 := (0.010 \ 0.00 \ 0.00 \ 0.010 \ 0.00 \ 0.245)^T$$

$$I_3M = 0.04$$

$$K_2^T = (0.036 \ 0.091 \ -0.11 \ -0.106 \ 0.037 \ -0.053 \ 0.012 \ 0.049 \ -0.219 \ 6.085 \times 10^{-4} \ 0.307)$$

$$I_3p^T = (8.775 \times 10^{-3} \ 4.969 \times 10^{-15} \ 0 \ 8.775 \times 10^{-3} \ 3.361 \times 10^{-15} \ 0.215)$$

Since signs of multicollinearity and siderativeness in communication between valuation indicators are not found, we define the index of industries on processing and preservation of agricultural products.

Coefficients of impact of estimation indices x24-x 33 spheres of industries on processing and preservation of agricultural products of Sumy region in the order of reduction of influence the following:

$$x_{33}, x_{31}, x_{25}, x_{26}, x_{24}, x_{28}, x_{30}, x_{27}, x_{29}, x_{32}.$$

The greatest influence on the index of I4sumy region has показникx33 – the textile production, the production of clothes, leather, leather goods and from other materials.

We norms the estimated indicators (x 34-X 43) of the sphere of production and social infrastructure, check the correlation links and get the following matrix:

$$r5 = \begin{pmatrix} 1 & -0.25 & -0.033 & -0.684 & 0.213 & 0.151 & -0.242 & 0.663 & -0.63 & 0.625 \\ -0.25 & 1 & -0.592 & 0.325 & 0.638 & -0.603 & 0.688 & -0.329 & -0.592 & 0.143 \\ -0.033 & -0.592 & 1 & 0.33 & -0.053 & -0.03 & -0.25 & 0.202 & 0.507 & -0.184 \\ -0.684 & 0.325 & 0.33 & 1 & 0.124 & -0.157 & 0.69 & -0.619 & 0.317 & -0.333 \\ 0.213 & 0.638 & -0.053 & 0.124 & 1 & -0.695 & 0.434 & -0.015 & -0.67 & 0.629 \\ 0.151 & -0.603 & -0.03 & -0.157 & -0.695 & 1 & -0.065 & -0.247 & 0.369 & 0.06 \\ -0.242 & 0.688 & -0.25 & 0.69 & 0.434 & -0.065 & 1 & -0.653 & -0.331 & 0.236 \\ 0.663 & -0.329 & 0.202 & -0.619 & -0.015 & -0.247 & -0.653 & 1 & -0.316 & -0.054 \\ -0.63 & -0.592 & 0.507 & 0.317 & -0.67 & 0.369 & -0.331 & -0.316 & 1 & -0.602 \\ 0.625 & 0.143 & -0.184 & -0.333 & 0.629 & 0.06 & 0.236 & -0.054 & -0.602 & 1 \end{pmatrix}$$

$$I_p := K1_0 + K1_1 \cdot I1 + K1_2 \cdot I2 + K1_3 \cdot I3 + K1_4 \cdot I4$$

$$|rp5| = 0.022$$

$$I_p^T = (0.358 \ 0.15 \ 0.435 \ 0.418 \ 0.246 \ 0.429)$$

$$I^T = (0.392 \ 0.165 \ 0.477 \ 0.458 \ 0.269 \ 0.471)$$

Since signs of multicollinearity and siderativeness in relations between valuation are not found, we determine the index of production and social infrastructure.

Coefficients of impact of estimation indices x 34-x 43 of the sphere of production and social infrastructure of Sumy region in the order of reduction of influence the following:

$$x_{37}, x_{41}, x_{35}, x_{40}, x_{42}, x_{36}, x_{34}, x_{39}, x_{43}, x_{38}.$$

The greatest influence on the index of I5 Sumy region is the indicator of x37 – retail trade, except for trade in motor vehicles and motorcycles.

After the finding of indexes of four agricultural spheres we determine the integral index of agricultural development of Sumy region, but before that we determine the presence of correlation relations between indexes.

$$rp5 := \begin{pmatrix} \text{corr}(I1, I1) & \text{corr}(I1, I2) & \text{corr}(I1, I3) & \text{corr}(I1, I4) \\ \text{corr}(I2, I1) & \text{corr}(I2, I2) & \text{corr}(I2, I3) & \text{corr}(I2, I4) \\ \text{corr}(I3, I1) & \text{corr}(I3, I2) & \text{corr}(I3, I3) & \text{corr}(I3, I4) \\ \text{corr}(I4, I1) & \text{corr}(I4, I2) & \text{corr}(I4, I3) & \text{corr}(I4, I4) \end{pmatrix}$$

$$rp5 = \begin{pmatrix} 1 & -0.264 & -0.593 & 0.667 \\ -0.264 & 1 & 0.461 & 0.373 \\ -0.593 & 0.461 & 1 & -0.538 \\ 0.667 & 0.373 & -0.538 & 1 \end{pmatrix}$$

Coefficients of impact of indexes of agricultural sector of Sumy region in the order of reduction of influence the following: I2,-spheres of agriculture; I1,-spheres of production means for agriculture and other industries providing maintenance of agriculture; I4.-Areas of production and social infrastructure; I3,-spheres of industries on processing and preservation of agricultural products.

Thus, the calculations conducted make it possible to determine the average integrated index of AIC APK in Sumy region for the period studied, namely $I_s = 0.339$.

To determine the development of agriculture define the dynamics factor:

$$kD_i = \sqrt{\left(\frac{Ii_1}{ri_1}\right)^2 + \left(\frac{Ii_2}{ri_2}\right)^2 + \left(\frac{Ii_3}{ri_3}\right)^2 + \left(\frac{Ii_4}{ri_4}\right)^2 + \left(\frac{Ii_5}{ri_5}\right)^2 + \left(\frac{Ii_6}{ri_6}\right)^2}$$

The dynamics coefficient calculations showed low level of agricultural development of Sumy region.

In accordance with the proposed methodological approach to assessing the development of AIC regions, we will build an forecast for 2031 considering the impact of evaluation indicators on the development of each of the agricultural sectors in the region.

**Calculations for the developed methodological approach of evaluation of
organizational and economic mechanism of agro-industrial regions development
Kharkiv region**

Calculations are carried out according to the proposed calculation steps (see fig. 3.1). Rationing certain indicators using the method of mathematical expectations for and sphere of AIC (II)-industries that produce means of production for agriculture and other industries that provide maintenance of agriculture. From the data in the appendix would choose the valuation indicators for the evaluation of the agricultural development in Kharkiv region in accordance with the proposed stages of the assessment of the agro-industrial regions development (see Fig. 3.1). We conduct rationing of these indicators with formulas 3.2.-3.3. We check the correlation relationships between the evaluational parameters by the formula 3.4.

$$r1 = \begin{pmatrix} 1 & -0.434 & -0.343 & -0.185 & 0.662 & 0.078 & -0.471 & 0.603 & -0.357 & -0.048 \\ -0.434 & 1 & 0.67 & 0.614 & 0.113 & -0.323 & -0.296 & -0.211 & 0.199 & 0.673 \\ -0.343 & 0.67 & 1 & 0.667 & -0.21 & 0.483 & -0.127 & -0.697 & -0.221 & 0.128 \\ -0.185 & 0.614 & 0.667 & 1 & 0.243 & 0.181 & -0.405 & -0.487 & -0.31 & 0.622 \\ 0.662 & 0.113 & -0.21 & 0.243 & 1 & -0.379 & -0.394 & 0.698 & 0.138 & 0.457 \\ 0.078 & -0.323 & 0.483 & 0.181 & -0.379 & 1 & 0.151 & -0.658 & -0.557 & -0.585 \\ -0.471 & -0.296 & -0.127 & -0.405 & -0.394 & 0.151 & 1 & -0.107 & 0.655 & -0.695 \\ 0.603 & -0.211 & -0.697 & -0.487 & 0.698 & -0.658 & -0.107 & 1 & 0.421 & 0.118 \\ -0.357 & 0.199 & -0.221 & -0.31 & 0.138 & -0.557 & 0.655 & 0.421 & 1 & -0.091 \\ -0.048 & 0.673 & 0.128 & 0.622 & 0.457 & -0.585 & -0.695 & 0.118 & -0.091 & 1 \end{pmatrix}$$

The results of the calculations confirm that the estimated indices x1-X10 are functionally independent, since all elements of the R1 matrix are relative to the diagonal $| < 0.7$.

Since multiple regressions have no signs of multicollinearity and siderativeness in relationships between valuation indicators ($|r1| \neq 0$), we go to the definition of the most influential indicators of the sectors producing means of production for agriculture and other industries providing maintenance of agriculture of Kharkiv region.

We find an index of branches that produce means of production for agriculture and other industries providing service of agriculture of Kharkov region (I1), taking into account the error of calculations.

$$I1p := K2_0 + K2_1 \cdot x1 + K2_2 \cdot x2 + K2_3 \cdot x3 + K2_4 \cdot x4 + K2_5 \cdot x5 + K2_6 \cdot x6 + K2_7 \cdot x7 + K2_8 \cdot x8 + K2_9 \cdot x9 + K2_{10} \cdot x10$$

$$K2 := \left[(X1^T \cdot X1)^{-1} \cdot X1^T \right]^T \cdot I1$$

Coefficients of impact of estimation indices $x1 - x10$ spheres, which produce means of production for agriculture and other branches, which provide servicing of agriculture of Kharkov region in the order of reduction of influence the following:

$$x1, x10, x2, x4, x7, x3, x5, x6, x9, x8.$$

The greatest influence on the index of I1 of Kharkiv region has the indicator X1 – Capital investments in agriculture, hunting and provision of related services.

In the same algorithm, the values of indexes of other spheres of agriculture of Kharkiv region are calculated. When determining the agricultural sector index, we divide the indices on livestock and plant indexes. After rationing estimates (X11-x15) we check the correlation relationship and get the following matrix:

$$r2 = \begin{pmatrix} 1 & 0.624 & -0.633 & 0.402 & 0.15 \\ 0.624 & 1 & -0.368 & 0.51 & 0.237 \\ -0.633 & -0.368 & 1 & 0.326 & -0.698 \\ 0.402 & 0.51 & 0.326 & 1 & -0.407 \\ 0.15 & 0.237 & -0.698 & -0.407 & 1 \end{pmatrix}$$

Since signs of multicollinearity and siderativeness in relations between valuation are not found, we determine the index of agriculture (livestock).

Coefficients of the impact of evaluation indices $x11-X15$ spheres of Agriculture (livestock) of Kharkiv region in the order of reduction of influence the following:

$$x14, x11, x12, x13, x15.$$

The greatest influence on the index of I2 of Kharkiv region has indices $x14$ – prices for livestock products.

After rationing of valuation indicators (X16-x23) spheres of agriculture (crop) We check the correlation relations and get the following matrix:

$$r_3 = \begin{pmatrix} 1 & 0.116 & 0.695 & 0.625 & -0.499 & 0.513 & 0.506 & 0.418 \\ 0.116 & 1 & -0.229 & 0.186 & -0.35 & -0.63 & -0.472 & 0.302 \\ 0.695 & -0.229 & 1 & 0.514 & -0.369 & 0.635 & 0.554 & 0.661 \\ 0.625 & 0.186 & 0.514 & 1 & 0.166 & 0.297 & -0.224 & 0.689 \\ -0.499 & -0.35 & -0.369 & 0.166 & 1 & -0.198 & -0.516 & -0.014 \\ 0.513 & -0.63 & 0.635 & 0.297 & -0.198 & 1 & 0.515 & -0.064 \\ 0.506 & -0.472 & 0.554 & -0.224 & -0.516 & 0.515 & 1 & -0.058 \\ 0.418 & 0.302 & 0.661 & 0.689 & -0.014 & -0.064 & -0.058 & 1 \end{pmatrix}$$

Since signs of multicollinearity and siderativeness in communication between valuation are not found, the agricultural index (crop) is determined.

$$\text{In}_2 := (0.1249 \ 0.125 \ 0.010 \ 0.125 \ 0.125 \ 0.0640)^T \quad \text{In}_2^T = (0.125 \ 0.125 \ 0.01 \ 0.125 \ 0.125 \ 0.064)$$

Coefficients of impact of estimation indices x16-x23 spheres of agricultural (crop) of Kharkiv region in the order of reduction of influence are the following:

$$x_{22}, x_{21}, x_{16}, x_{18}, , x_{20}, x_{17}, x_{19}, x_{23}.$$

The greatest influence on the index of I3 of Kharkiv region has indices x18 – prices for crop production.

As signs of multicollinearity and siderativeness in relationships between livestock and agricultural farming are not found, we expect the agricultural sector index of the Kharkiv region.

As the agricultural sector index is divided in the calculations for livestock and plant indexes, we determine their impact rate.

The most influential in the agricultural sector Index is the index of livestock agriculture of the Kharkiv region

We proceed to rationing estimates (X24-x 33) sphere of industries on processing and preservation of agricultural products, check correlation relations and get the following matrix:

$$r4 = \begin{pmatrix} 1 & 0.115 & 0.698 & 0.385 & -0.265 & 0.616 & -0.032 & 0.041 & -0.439 & 0.342 \\ 0.115 & 1 & 0.239 & -0.329 & -0.672 & 0.044 & -2.391 \times 10^{-3} & 0.207 & -0.471 & 0.593 \\ 0.698 & 0.239 & 1 & -0.22 & -0.107 & 0.501 & 0.637 & 0.134 & -0.614 & 0.043 \\ 0.385 & -0.329 & -0.22 & 1 & 0.358 & 0.53 & -0.416 & -0.566 & 0.204 & 0.14 \\ -0.265 & -0.672 & -0.107 & 0.358 & 1 & 0.223 & 0.442 & -0.688 & 0.386 & -0.67 \\ 0.616 & 0.044 & 0.501 & 0.53 & 0.223 & 1 & 0.324 & -0.139 & -0.643 & 0.426 \\ -0.032 & -2.391 \times 10^{-3} & 0.637 & -0.416 & 0.442 & 0.324 & 1 & -0.071 & -0.391 & -0.343 \\ 0.041 & 0.207 & 0.134 & -0.566 & -0.688 & -0.139 & -0.071 & 1 & -0.572 & 0.511 \\ -0.439 & -0.471 & -0.614 & 0.204 & 0.386 & -0.643 & -0.391 & -0.572 & 1 & -0.698 \\ 0.342 & 0.593 & 0.043 & 0.14 & -0.67 & 0.426 & -0.343 & 0.511 & -0.698 & 1 \end{pmatrix}$$

$$rp5 := \begin{pmatrix} \text{corr}(I1, I1) & \text{corr}(I1, I2) & \text{corr}(I1, I3) & \text{corr}(I1, I4) \\ \text{corr}(I2, I1) & \text{corr}(I2, I2) & \text{corr}(I2, I3) & \text{corr}(I2, I4) \\ \text{corr}(I3, I1) & \text{corr}(I3, I2) & \text{corr}(I3, I3) & \text{corr}(I3, I4) \\ \text{corr}(I4, I1) & \text{corr}(I4, I2) & \text{corr}(I4, I3) & \text{corr}(I4, I4) \end{pmatrix}$$

$$|rp5| = 0.326$$

$$Ip^T = (0.541 \ 0.837 \ 0.549 \ 0.732 \ 0.794 \ 0.589)$$

$$I^T = (0.588 \ 0.909 \ 0.596 \ 0.796 \ 0.863 \ 0.64)$$

Since signs of multicollinearity and siderativeness in communication between valuation indicators are not found, we define the index of industries on processing and preservation of agricultural products.

Coefficients of impact of estimation indices x24-x 33 spheres of industries on processing and preservation of agricultural products of Kharkiv region in order of reduction of influence the following:

$$x_{29}, x_{32}, x_{25}, x_{31}, x_{33}, x_{28}, x_{27}, x_{24}, x_{26}, x_{30}.$$

The greatest influence on the index I4 of Kharkiv region has the indicator x29 – production of bread and bakery products of short-term storage.

We norms the estimated indicators (x 34-X 43) of the sphere of production and social infrastructure, check the correlation links and get the following matrix:

$$r5 = \begin{pmatrix} 1 & 0.029 & 0.032 & 0.025 & 0.693 & -0.095 & -0.328 & -0.324 & -0.298 & 0.694 \\ 0.029 & 1 & 0.17 & 0.463 & -0.385 & -0.158 & 0.411 & 0.016 & -0.654 & 0.158 \\ 0.032 & 0.17 & 1 & 0.676 & -0.625 & 0.698 & 0.367 & -0.313 & -0.57 & 0.484 \\ 0.025 & 0.463 & 0.676 & 1 & -0.565 & 0.089 & 0.591 & -0.196 & -0.545 & 0.617 \\ 0.693 & -0.385 & -0.625 & -0.565 & 1 & -0.449 & -0.66 & 0.022 & 0.364 & 0.168 \\ -0.095 & -0.158 & 0.698 & 0.089 & -0.449 & 1 & 0.39 & -0.623 & -0.489 & -0.114 \\ -0.328 & 0.411 & 0.367 & 0.591 & -0.66 & 0.39 & 1 & -0.621 & -0.674 & -0.153 \\ -0.324 & 0.016 & -0.313 & -0.196 & 0.022 & -0.623 & -0.621 & 1 & 0.695 & -0.042 \\ -0.298 & -0.654 & -0.57 & -0.545 & 0.364 & -0.489 & -0.674 & 0.695 & 1 & -0.282 \\ 0.694 & 0.158 & 0.484 & 0.617 & 0.168 & -0.114 & -0.153 & -0.042 & -0.282 & 1 \end{pmatrix}$$

$$rp5 = \begin{pmatrix} 1 & 0.192 & -0.213 & -0.041 \\ 0.192 & 1 & 0.576 & -0.497 \\ -0.213 & 0.576 & 1 & -0.02 \\ -0.041 & -0.497 & -0.02 & 1 \end{pmatrix}$$

$$I_p := K1_0 + K1_1 \cdot I1 + K1_2 \cdot I2 + K1_3 \cdot I3 + K1_4 \cdot I4$$

Since signs of multicollinearity and siderativeness in relations between valuations are not found, we determine the index of production and social infrastructure.

Coefficients of impact of estimation indices x 34-x 43 of the sphere of industrial and social infrastructure of Kharkiv region in the order of reduction of influence the following:

$x_{40}, x_{38}, x_{42}, x_{35}, x_{37}, x_{34}, x_{41}, x_{39}, x_{36}, x_{43}$.

The greatest influence on the index of I5 of Kharkiv region has the indicator x40 – capital investments in health care and provision of social assistance.

After finding indexes of four agricultural spheres we determine the integral index of agricultural development of Kharkiv region, but before that we determine the presence of correlation relations between indexes.

Coefficients of the impact of indexes of agricultural sectors of Kharkiv region in descending order of influence the following: I2,-spheres of agriculture; I1,-spheres of production means for agriculture and other industries providing maintenance of agriculture; I3,-spheres of industries on processing and preservation of agricultural products; 4.-The sphere of industrial and social infrastructure.

Thus, the calculations carried out make it possible to determine the average integrated index of agro-industrial complex of Kharkiv region in the period studied, namely $I_s = 0.678$.

To determine the development of agriculture define the dynamics factor:

$$kD_i = \sqrt{\left(\frac{Ii_1}{ri_1}\right)^2 + \left(\frac{Ii_2}{ri_2}\right)^2 + \left(\frac{Ii_3}{ri_3}\right)^2 + \left(\frac{Ii_4}{ri_4}\right)^2 + \left(\frac{Ii_5}{ri_5}\right)^2 + \left(\frac{Ii_6}{ri_6}\right)^2}$$

The dynamics coefficient calculations showed a high level of agricultural development of Kharkiv region.

In accordance with the proposed methodological approach to assessing the development of AIC regions, we will build an forecast for 2031 considering the impact of evaluation indicators on the development of each of the agricultural sectors in the region.

**The most influential indicators of investment are determined by the results
of the proposed methodological approach to assessing the development
of agriculture in the regions**

Regions	The most influential investment indicators	
Vinnitsia region	x_{34}	Capital investment in education, % of total regional investment
Volyn region	x_{43}	Capital investment in information and telecommunications, % of total regional investment
Dnipropetrovsk region	x_{39}	Capital investment in temporary accommodation and catering, % of total regional investment
Donetsk region	x_{43}	Capital investment in information and telecommunications, % of total regional investment
Zhytomyr region	x_{42}	Capital investment in transport, warehousing, % of total investment in the region
Transcarpathian region	x_{39}	Capital investment in temporary accommodation and catering, % of total regional investment
Zaporozhye region	x_{43}	Capital investment in information and telecommunications, % of total regional investment
Ivano-Frankivsk region	x_{35}	Capital investment in professional, scientific and technical activities, % of total investment in the region
Kiev region	x_{43}	Capital investment in information and telecommunications, % of total regional investment
Kirovograd region	x_{35}	Capital investment in professional, scientific and technical activities, % of total investment in the region
Lugansk region	x_{39}	Capital investment in temporary accommodation and catering, % of total regional investment
Lviv region	x_{34}	Capital investment in education, % of total regional investment
Mykolaiv region	x_{43}	Capital investment in information and telecommunications, % of total regional investment
Odessa region	x_{39}	Capital investment in temporary accommodation and catering, % of total regional investment
Poltava	x_{35}	Capital investment in professional, scientific and technical activities, % of total investment in the region
Rivne region	x_{34}	Capital investment in education, % of total regional investment
Sumy region	x_{35}	Capital investment in professional, scientific and technical activities, % of total investment in the region
Ternopil region	x_{40}	Capital investment in health and social assistance, % of total regional investment
Kharkiv region	x_{40}	Capital investment in health and social assistance, % of total regional investment
Kherson region	x_{39}	Capital investment in temporary accommodation and catering, % of total regional investment
Khmelnitsky region	x_{34}	Capital investment in education, % of total regional investment
Cherkasy region	x_{35}	Capital investment in professional, scientific and technical activities, % of total investment in the region
Chernivtsi region	x_{35}	Capital investment in professional, scientific and technical activities, % of total investment in the region
Chernihiv region	x_{38}	Capital investment in transport, warehousing, postal and courier activities, % of total regional investment

Source: the most influential metrics are the calculations.

NOTES