Innovative development and competitiveness of agribusiness subjects in the system of ensuring of economic security of the regions of Ukraine

by ***Natalia V. Trusova*[*], *Oksana V. Hryvkivska*[**], ***Tetiana I. Yavorska*[***], *Oleksandr S. Prystemskyi*[****], ***Valentyna N. Kepko*[*****], *Yurii O. Prus*[***]**

Abstract

In the economic system, the development trend is the use of innovative technologies of economic security. The purpose of the study is to comprehensively assess the innovative development of agricultural business in Ukraine within the framework of economic security. The leading research method has become of a modified systematic approach. The article identifies the determinants of economic security of the regions in the agrarian sector of Ukraine. The hidden properties of the influence of the competitiveness of the subjects of agrarian business on the economic security on the formation of well-being in the agricultural sector of the regions in the system of the breeding-reproduction process and their interrelation with the factors-symptoms having latent character are proved. The basis of structural transformations of the system of ensuring of economic security of the regions is developed through an integrated approach to assessing the potential financial opportunities of subjects of the agrarian sector. Complex diagnostics of the level of economic security, sustainability of the development of regions according to the components of the system have been carried out. The research results are of practical importance, since they can contribute to the development of changes in the agricultural sector of the economy.

[*] Department of Finance, Banking and Insurance, Dmytro Motornyi Tavria State Agrotechnological University, 18 B. Khmelnitsky Ave., 72310 Melitopol, Ukraine, e-mail: trusova4878@ubogazici.in

[**] Department of Economics, European University, 42 V. Akademika Hloshkova Ave., 03187 Kyiv, Ukraine

[***] Department of Business, Trade and Exchange Activities, Dmytro Motornyi Tavria State Agrotechnological University, 18 B. Khmelnitsky Ave., 72310 Melitopol, Ukraine

[****] Department of Accounting and Taxation, Kherson State Agrarian University, 23 Stritenska Str., 73006 Kherson, Ukraine

[*****] Department of Business, Trade and Exchange Activities, Bila Tserkva National Agrarian University, 8/1 Soborna Sq., 09100 Bila Tserkva, Ukraine

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Introduction

Integration of Ukraine into the world economic space is connected with the growth of external competitive pressure on the domestic agricultural producers. The decisive trend in the functioning of the economy under the current conditions of development is the innovation paradigm of economic security and its tools, which are determined by the institutional and economic ability of the agribusiness subjects to acquire, retain and expand their resources (Bachev and Tsuji, 2018). This opportunity makes it possible to form models of sustainable development of the agro-industrial complex, which is very important in economic and social terms. At the same time, under the influence of risks, it is weakened and does not provide an adequate level of stability in the production, reproduction, investment, foreign economic and financial levels (Hendrarini et al., 2018). The components of economic security, which must form the general attributes of innovation development, competitiveness, efficiency of production and the strategy of expanding market influence for various subjects, in the absence of their own sources of funding, do not provide the activation of the latest technology with the time and spatial dynamism. This is due to the lack of an adequate number of explicit indicators that would allow to assess the external (institutional and economic conditions of the enterprises), as well as internal factors of the efficiency of the economy (the structure of the property complex and the profitability of the enterprise production).

The study of transformational processes in the agrarian sector, their impact on the economic security of economic entities, well-being and the development of the state as a whole, is concentrated in scientific works H. Balabanov et al. (2004), M. Malik (2007), V. Mesel-Veselyak (2010), I. Leshchyk and H. Pyrih (2013), A.A.R. Ioris (2018), H. Bachev and M. Tsuji (2018), H. Hendrarini et al. (2018). Key questions regarding the optimal mechanism for ensuring economic security of the country and regions in the context of implementing the strategy of innovation development, national stability, sustainable development and strengthening foreign economic security are studied I. Babets (2013), A. Humeniuk (2014), J. Banski and M. Mazur (2016), J. Simonian (2020), H. Adobor (2020). However, the issue of economic security in connection with the actual indicators of the efficiency of economic entities at the regional level, especially large in size,

is not sufficiently investigated. Meanwhile, they are forming the main strategic steps to influence the economic security of the agrosphere and the national security of the country as a whole. Therefore, the increase of economic security of the regions of Ukraine in order to expand the functional capabilities of its indicative components, such as innovation development and competitiveness of agribusiness, is a priority of this research. It should be noted that the process of increasing the economic security of the regions of Ukraine is directly related to the provision of various forms of benefits to society. This study examines how economic security in the agro-industrial sector affects the sustainable well-being of a country.

The most important task of economic security (ES) of the regions is modeling the process of building capacity of economic management and innovative development of agribusiness subjects. O. Yaremenko (2006) points to the importance of using such a tool as indicative modeling, which involves making forecasts that provide innovative development of individual spheres of business and business processes, as well as economic security of economic entities. The first forecast determines the identification of innovative prerequisites for the development of regions to improve financial opportunities in the long run, which guarantees the growth of the competitiveness of agribusiness subjects. At the same time forecast indicators can serve as indicators of aggregate demand for innovation. The formation of competitiveness significantly affects the formation of the welfare of both the sphere of activity and its participants. The resources obtained and the guarantee of economic security help to expand production, attracting even more resources to it. Thus, sustainable development of this area is possible. The second forecast provides the calculation of indicative components in the systemic interconnection of economic security and provides determining the necessary growth rates of forecasted indicators of competitiveness through the integrated indicators of potential financial opportunities and inventive capital of agribusiness subjects.

Materials and methods

In order to assess the level of economic security of regions as a system, in the context of innovative development of agribusiness subjects, a modified system approach is proposed in Equation (1).

$$E_{in} = \frac{\sum_{i=1}^{n} A_i - \sum_{j=1}^{m} B_i}{\sum_{k=1}^{f} S_k} \quad (1)$$

where, E_{iH} – the regional level of economic security (ES) as part of the innovative development of agribusiness subjects; A – aggregate demand for objects of innovations of agribusiness subjects of the region in the system of the ES; $i = 1,\ 2, \ldots,\ n$ (n – number of objects of innovation for which there is a demand); B_i – aggregate supply for objects of innovations of agribusiness subjects of the region in the system of the ES; $i = 1,\ 2, \ldots,\ m$ (m – number of objects of innovation that provide demand); S_k – expenses for implementation of measures to ensure the functionality of the ES system of agribusiness subjects in the region; $k = 1, 2, ..., f$ (f – the number of measures to ensure the ES).

The predicted level of economic security of the regions is estimated by the list of indicators, the totality of which determines the boundary values of the functionality of its components. It is proposed to use a universal methodology for assessing the group of components of the economic security of the regions of Ukraine in a set of indicators, to build a three-model structure of indicators complementing each other. The first model involves comparison of indicators for the ratio of the type "no less than the limit" by the function of this type in Equation (2):

$$y(a,x) = \begin{cases} 2^{(1-\frac{a}{x}}/In\frac{10}{3/}, if\ \frac{x}{a} \geq 1 \\ 2^{-log\ 10/3\frac{a}{x}}, if\ \frac{x}{a} \leq 1 \end{cases} \quad (2)$$

where x – the real value of the indicator; a – the marginal limit of the indicator. In this case, the value $x = a\ (y = 1)$ corresponds to the case of equality of the studied boundary of the indicator; at $x \geq a\ (y \geq 1)$ the value of the indicator above the limit; at $x \leq a\ (y \leq 1)$ – below. The ratio of the type "no more than the limit" is characterized by reversal of normalization. The second model outlines trends in the behavior of indicators in the dynamic trend and determines the level of stability of the region's economic security in the context of increasing the innovative potential of agribusiness subjects in its overall system. There is a division of indicators into "effective" and "costly". For "effective" indicators, a nonlinear transformation is used in Equation (3):

$$y\ (a,x) = x \quad (3)$$

where, x – the value of the output in the current period; a – the value of the indicator in the previous (or base) period. In this case, the value $x = a\ (y = 1)$ means no change; $x \geq a\ (y \geq 1)$ – testifies to the positive dynamics of the behavior of the indicators of the ES; $x \leq a\ (y \leq 1)$ – proves the negative

dynamics of the behavior of the ES indicators in the conditions of suspension of the innovative development of agribusiness subjects.

The reverse valuation is used for "costly" indicators. The use of complex functions allows a wider range of visualization of results for sectors $x \geq 1$ and $x \leq 1$, that is, in cases where the indicator is significantly higher or lower than its limit. The third model establishes the degree of removal of the corresponding indicator from its marginal level. The algorithm of the method involves the formation of a set of indicators; monitoring and evaluation of indicators in their original values; their normalization and generalization into integral indices. The result of this assessment is the behavior of the forecast economic security indexes in the medium term.

The presence of competitive advantages of agribusiness subjects is a guarantee of their high competitiveness, which accompanies modern transformations at all hierarchical links of the market space both in the internal and external environment. This economic category has signs of the hidden properties of the impact on the economic security of regions in such a component of the system as the production-reproduction process, and manifests itself in the form of various factors-symptoms, measured by latent indicators (Terziev and Radeva, 2016; Karabassov *et al.,* 2018).

The first stage of the integrated assessment of the competitiveness of agribusiness subjects in the region is the definition of general provisions for assessing competitiveness. The characteristic factors-symptoms that impact on the assessment of competitiveness are: the level of market competition and the assessment of potential financial development opportunities. This allows to consider it in a complex combination with a group of components of economic security. The second stage is the selection of output indicators through the details of the factors-symptoms. Thus, the assessment of market competition is proposed to be calculated by market share (in %) and the share of sales costs (in %). The assessment of the indicator of potential financial opportunities for agribusiness subjects consists of indicators of profitability (loss), of activity (in %) and return on equity (in %), coefficients of renewal of fixed assets, turnover of receivables (times), maneuverability of working capital, financial independence (autonomy), absolute and rapid liquidity. Estimation of inventive capital indicators is determined by the cost of innovations in production processes, new products, innovations in reproduction processes. The third stage is the standardization of indicators by the aggregate integrated indicator, which identifies the leaders of the agrarian sector of a particular branch of agriculture. A business entity that has the highest value for a comprehensive assessment will occupy the position of the leader, the rest of the entities will be located in the order of their reduction. To calculate the complex assessment of the competitiveness

of the subjects of agribusiness in the system of economic security of the region, a matrix of standardized indicators is used. The average estimate of subjects of agribusiness (K_j) is calculated by the Equation (4):

$$\overline{x} = \frac{P_{ij1}+P_{ij2}+P_{ijm}}{m} \quad (4)$$

where, P_{ij} – indicators of each *j*-th agent of agribusiness; m – number of subjects of agrarian sphere.

Accordingly, the assessment of market competition is calculated as Equation (5), where, X_1 – market share, %; X_2 – share of expenses from sales in the total volume of sales of products, %.

$$K_j = \frac{X_1+X_2}{2} \quad (5)$$

The estimation of potential financial opportunities for the development of agribusiness subjects$K_к$i s calculated as Equation (6):

$$K_К = \frac{K_i + (X_1 + X_2 + X_3 + X_4 + X_5 + X_6 + X_7 + X_8)}{8} \quad (6)$$

where, X_1 – profitability of activity; X_2 – return on equity; X_3 – factor of updating the fixed assets; X_4 – turnover of accounts receivable; X_5 – maneuverability of working capital; X_6 – coefficient of financial independence (autonomy); X_7 – coefficient of absolute liquidity; X_8 – fast liquidity ratio.

In calculating the indicator of potential financial opportunities for the development of agribusiness subjects, the component of inventive capital K_i, which is calculated by the formula Equation (7) is distinguished:

$$K_i = \frac{X_9+X_{10}+X_{11}}{3} \quad (7)$$

where, X_9 – the cost of innovation in production processes; X_{10} – expenses for new goods; X_{11} – the cost of innovation in investment processes.

The fourth stage is a quantitative assessment of the competitiveness of agribusiness subjects in the system of economic security of the region, taking into account the investment capital. To assess the subjects of agrarian business management in order to obtain a verified conclusion on who is the leader in the group, the formula Equation (8) is used:

$$P_{ij} = \frac{F_{ij}}{E_{ij}}. \quad (8)$$

where P_{ij} – indicators of the state of the *j*-th agribusiness subject; F_{ij} – the actual value of the *i*-th indicator; E_{ij} – the best (reference) value from the whole set of output values of the *i*-th indicator. The proposed methodological approach is based on the combination of PESTEL analysis and SWOT analysis.

Results and discussion

Considering safety as the interaction of the system and the environment, the importance of the factors-symptoms of economic security, along with macroeconomic, foreign economic, industrial and other key factors becomes obvious. It should be noted that in each subsystem of the ES there are indicators that act as key ones and most clearly demonstrate the real state of each of these spheres. They are basic to calculate a number of secondary, but significant factors. To assess the regional level of economic security in the context of the innovative development of agribusiness subjects in Ukraine, two groups of indicators were applied. The first group is used to diagnose the dynamic trend of economic security of regions in conjunction with the introduction of innovations for the development of subjects of the agrarian sphere. The second group characterizes the internal resource potential of business entities to increase innovation and the ability to overcome the crisis of lack of internal sources. The so-called "synthetic indicators" are developed for the comprehensive diagnosis of the stability of regional development in order to reflect a number of factors-symptoms of their economic security: the gross regional product, demand for agricultural products, lending, investment, innovation, new technologies, consumer price index, financial opportunities of agribusiness subjects, etc.

The most important of the combination of symptom-factors is the level of innovation development and the indicator of the gross regional product (GRP) per person. The size of the GRP depends on: the level and quality of life of the population, the level of education and health, the possibility of fulfilling social obligations of the region or rural area, the development of culture, art, sports, science. In the EU countries, the value of this indicator exceeds 17.0 thousand dollars. Moreover, the level of innovation.

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culture, art, sports, science. In the EU countries, the value of this indicator exceeds 17.0 thousand dollars. Moreover, the level of innovation development is determined by the marginal boundaries of the indicator per one agribusiness subject as indicative of the efficiency of innovation, respectively, from 2.0 thousand dollars, within the range of 3.0-9.0 thousand dollars and more than 9.0 thousand dollars (Bilotskiy *et al.,* 2017).

The divergence of indicators of innovation impact on the regional level of economic security is much stronger than when considering the GRP indicator per person. Thus, the share of innovative agribusiness subjects in 2012–2018 has a tendency for a sharp negative change in the Kyiv region (from 25.0% to 7.0%). At the same time, 9 out of 22 regions failed to overcome the margins of the indicator of the share of innovative active agribusiness subjects (Karabassov *et al.,* 2016; Sivash *et al.,* 2019).

The negative situation is also outlined by the specific weight of the implemented innovative products in the total volume of sales. The limits of this indicator are lower than sustainable and safe development. Thus, in 2018, significant changes in this indicator are characteristic for Poltava and Dnepropetrovsk regions, respectively, 13% and 0.5%. On average, there were 1.2 thousand innovative-active subjects of agribusiness in 2012, but in 2018 their number decreased to 600 units. Moreover, there was also a decrease in the share of innovations from 20% to 12.2%. With the increase of the latest technological processes in the field of production and reproduction activities (from 2.4 thousand to 3.0 thousand units), the number of innovative products is not in demand in the consumer market, and therefore, on average, per one region it decreased from 2.0 thousand to 1.0 thousand names. This indicates the inappropriate distribution of subsidies sources of the regional budget among the subjects of the agrarian sector and its deficit to provide a multicomponent system of economic security, which should have a well-thought-out strategy for building an innovative component.

The assessment of the regional level of economic security by the components of the system allowed, based on the factors of the symptoms of market competition, the potential financial opportunities, taking into account the indicators of inventory capital of agribusiness subjects, to select 10 subjects of agribusiness in the poultry industry and to propose an integrated indicator of competitiveness on an innovative basis ($_{Icom_{in}}$) by the following Equation (9):

$$Icom_{in} = C_{mc} \times 0.6 + (C_{fo} + C_{ic}) \times 0.4 \quad (9)$$

where C_{mc} – assessment of market competition of the subject of agribusiness; C_{fo} – potential financial opportunities of a subject of

agribusiness; C_{ic} – level of utilization of the investment capital of the subject of agribusiness; 0.6 and 0.4 – weight coefficients of competitiveness assessments. It should be noted that the subjects of the agrarian sphere use innovative technologies in the production and reproduction processes. Therefore, by means of the matrix of the average standardized indicators, the leaders of the agrarian sphere in the poultry industry were identified and their integrated indicators of competitiveness for 2012-2018 were presented (Figure 1). Innovative measures in agribusiness subjects' No. 3 are Hazard Analysis and Critical Control Points (HACCP), which includes risk assessment as well as critical points in order to identify hazards in the production process itself. Strategy of the subject of agribusiness subjects' No. 10 is to preserve the position of the leader of the agricultural market of Ukraine by expanding the business of production of chicken and growing of cereals, as well as strengthening vertical integration.

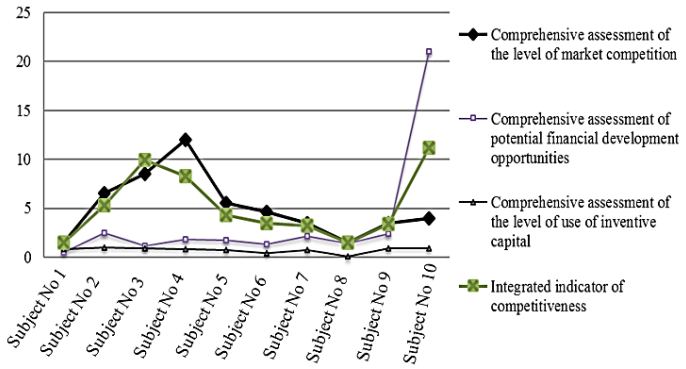

Figure 1 – Integrated indicator of competitiveness of agribusiness subjects in the poultry industry for 2012-2018

Prediction of economic security on the basis of the developed component typology (Table 1) requires the development of a single integrated indicator, which combines a totality of small indicators and characterizes the level of development of each individual region. With the help of the method of multidimensional (taxonomic) forecasting, synthetic quantities that form an integrated level of economic security are aggregated, by constructing a matrix of observations, the dimension of which is. Elements of this matrix are quantitative values of the whole set of selected indicators (x1, x2-x5, x6-x9, x10-x12, x13-x16, x17-x25), which are heterogeneous in quantitative value and units of measurement.

Table 1 – Typology of components of economic security of regions

ES components	*Indicators*
Macroeconomic security	x_1 – gross regional product, bln. UAH; x_2 – gross regional product per person, UAH; x_3 – gross value added (GVA) per person, UAH; x_4 – growth rate of GVA per person; x_5 – consumer price index, %;
Innovative and investment security	x_6 – share of innovatively active subjects of agribusiness in the total number of agribusiness subjects in regions, %; x_7 – share of innovative products in the total volume of sold agricultural products, %; x_8 – fixed capital investments + FDI, bln. UAH; x_9 – financing by venture funds of innovative development of the region, bln. UAH.
Production and reproduction security	X_{10} indices of volumes of agricultural production,%; x_{11} – degree of depreciation of fixed assets in production, %; x_{12} – the degree of wear and tear of fixed assets in the distribution of electricity, gas and water, %
Foreign economic security	x_{13} – export in the regions of Ukraine,% to the total export volume; x_{14} – import in the regions of Ukraine,% to the total import volume; x_{15} – balance of export/import, bln. USD; x_{16} – coefficient of export import coverage;
Financial security of development	X_{17} – level of commodity intervention of subjects of agribusiness in the agrarian market, %; X_{18} – level of potential financial opportunities of development of the subject in agrarian sphere, %; X_{19} – share of financing of inventory capital of the subject of agribusiness in the region, %; X_{20} – share of preferential credit provision of the subject of agribusiness in the agrarian sector, %; X_{21} – share of own sources of financial support, %; X_{22} - share of state financing and support of subjects of agrarian sphere in the region, % X_{23} – share of the tax burden on the subject of agribusiness in the local budget, % X_{24} – share of tax burden of the region in the state budget, %; X_{25} – the share of insurance contracts for manufactured goods of agribusiness entities under forward contracts, %

A preliminary transformation of formulas is conducted into standardized attributes in Equation (10):

$$Z_{ix} = \frac{(k_{ix} - \overline{k}_x)}{S_x} \tag{10}$$

where, i – number of agribusiness subjects in the region; x – indicators of the characteristics of the level of economic security of agribusiness subjects; $\overline{k}_x$ – the arithmetic mean of the corresponding indicator.

The selected indicators are distributed for stimulants (positive effect of influence on the level of economic security of the regions) and disinfestations (negative impact of influence on the level of economic security of the

regions) for constructing the standard represented by the point S_O, with the coordinates $Z_{01}, Z_{02}, \ldots, Z_{0n}$, at that Equation (11):

$$\begin{aligned} Z_{ox} &= \max_i z_{ix}, \text{ if } i \in R \\ Z_{ox} &= \min_i z_{ix}, \text{ if } i \notin R \end{aligned} \tag{11}$$

where Z_{ox} – the calculated coordinates of the indicator benchmark for a separate component in the system of economic security of the region; z_{ix} – the standardized value of the attribute x for the unit i; R – a set of stimulants in Equations (12), (13):

$$\overline{k}_{ix} = \frac{1}{m}\sum z_{ix} \tag{12}$$

$$S_x = \sqrt{\frac{1}{m}\sum(z_{ix} - \overline{k}_x)^2} \tag{13}$$

where m – number of regions; $\overline{k}_x$ – the arithmetic mean value of the sign; S_x – standard deviation of the sign x; Z_{ix} – standardized sign value x for unit i.

The calculated distance between C_{io} and the reference point (S_O) and the arithmetic mean of the distances is as follows in Equations (14), (15):

$$C_{io} = \sqrt{\sum_s (Z_{ix} - Z_{ox})^2}, (i = 1, \ldots, m) \tag{14}$$

$$\overline{C}_o = \frac{1}{m}\sum(C_{io}) \tag{15}$$

The standard deviation of the distances from the reference point (S_O) according to Equation (16) and the distance with the deviations C_{io} according to Equation (17) has the form:

$$S_o = \sqrt{\frac{1}{m}\sum_{i=1}^{m}(C_{io} - \overline{C}_o} \tag{16}$$

$$C_o = \overline{C}_o + 2S_o \tag{17}$$

The final result of the application of the above Equations (10) – (17) is the integrated indicators of the level of economic security of the regions and each of the safety components in Equation (18):

$$I_i = 1 - \frac{C_{io}}{C_o} \tag{18}$$

The predicted interpretation of the calculated integral indicators is as follows: a separate region has a higher level of economic security, when its integral value is closest to one (Figure 2). Thus, the predicted calculations of individual components of the economic security of the regions made it possible to find that the highest indices of macroeconomic, production-reproduction, innovation-investment, for reign economic and financial security development will be recorded in the Odesska, Dnipropetrovska and Zaporizhska regions. This is due to the rapid development of underground activities of agribusiness subjects. At the same time, there is a pronounced uneven development of regions, due to the accumulation of a significant amount of financial resources of agribusiness subjects, which, with a powerful production potential, are obliged to transfer tax payments to the state budget. Such a division reduces the needs and financial possibilities of the reproductive process of the leading regions. At first glance, this situation has a positive impact on the economy, but subsidizing equalization and maintaining the financial stability of weak regions increases the tax burden of donor regions. That is why the revenues of their budgets always prevail over transfer payments.

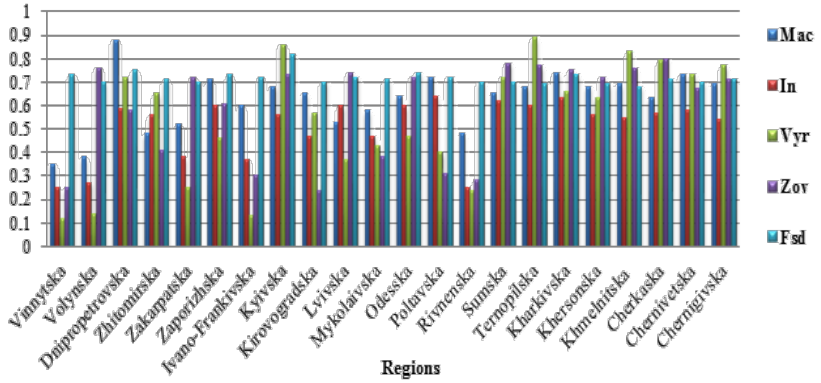

Figure 2 – Forecast indices of components of the regional level of economic security in Ukraine in 2019

In addition, the expected results of settlement components in the system of economic security of the regions of Ukraine have shown that in most cases their integrated indices are lower than the average standardized value. Under such conditions, there is a need to revise the current economic policy of the state, and, first of all, by increasing the autonomy of the regions regarding the differentiation of tax rates and benefits under the main types of taxes in order to ensure the financial stability and independence of local budgets. This

will allow developing its own production base and complying with the relevant economic obligations to form the necessary level of economic security on the basis of innovative development and competitiveness of the agribusiness subjects. At the same time, the scientific and practical interest is the prognostic stability of the level of economic security of the regions at the national level, which is carried out by a comprehensive calculation of this indicator in the dynamic trend of the whole set of indicators (x1, x2-x5, x6-x9, x10-x12, x13-x16, x17-x25) in the long-term period. The calculated integrated level of economic security of Ukraine's regions for 2019-2023 is presented in Figure 3.

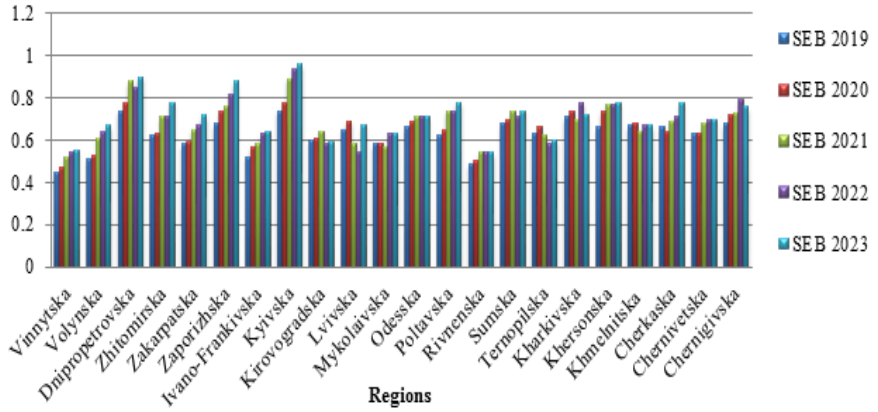

Figure 3 – The projected level of economic security of the regions of Ukraine for 2019-2023

It is established that due to the accumulation of a considerable amount of financial and industrial potential in certain regions, a high level of their economic security is predicted, which characterizes the ability to provide own reproductive expenses. The heterogeneity in the prevalence of individual components of the level of economic security (Mac, In, Vyr, Zov, Fsd) is determined. The effectiveness of state regulation in such conditions will depend on taking into account all possibilities of the regions, namely, the vector of business interests, reproduction processes, scientifically based solution of financial problems. Local authorities should be given a sufficient level of autonomy in terms of selecting areas and means of accumulation of significant volumes of productive, resource and financial potentials.

Conclusion

Innovative progress of the national economy should include the vectors and tools of state innovation policy aimed at stabilizing the economic security of the regions, as well as the revitalization and stimulation of innovative processes, including in the agrarian sector, should be ensured through: transformation of the national economy by concentration of investment resources, increase of their efficiency distribution and use for structural adjustment of the economy; attraction of external lending and foreign investments; exemption from taxation of financial resources of commercial banks, insurance companies and various financial institutions that invest in the innovative development of national subjects of agribusiness; introduction of differentiation of tax rates for agribusiness subjects, taking into account the reduction of rates for long-term financing of innovative projects; the introduction of a system of preferential taxation of profits received from the insurance of innovative development of agribusiness subjects.

At the same time, the financial mechanism for providing innovation, for increasing the level of economic security in the regions should include: own financial support; state financing and support of the agrarian sector; commercial lending to banking institutions; investing in international financial institutions; private foreign investment; financing venture funds. In such possible directions, the subjects of agribusiness need to comprehensively use all sources of financial resources and direct them to ensure effective innovation and increase the level of competitiveness of products. All this is an integral part of the formation of a sustainable well-being of the state, since the innovative progress of the national economy contributes to an increase in quantitative and qualitative terms of material, financial, social and spiritual benefits. Continuous support for the economic security of regions in these vectors directly affects the formation of sustainability.

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