

## FORMATION THE SYSTEM FOR ASSESSING THE ECONOMIC SECURITY OF ENTERPRISE IN THE AGRICULTURAL SECTOR

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**Abstract.** The complex of agroindustrial enterprises is an extremely important branch of the national economy of any state. This area determines the level of food security, and can also be one of the powerful incentives for the growth of the entire economic system of the country. This is why it is so important to ensure economic security of agroindustrial enterprise. The purpose of the article is to form the model for assessing the level of economic security of the agroindustrial enterprise. The subject of the study is economic security of the agroindustrial enterprise. It is proved that the effectiveness of anti-crisis measures substantially depends on information support, the formation of which at the proper level is possible when applying the developed model for assessing the level of economic security of the agroindustrial enterprise. The use in the model of quantitative and qualitative indicators can characterize the main parameters of the economic activity of the agroindustrial enterprise and allow to characterize the level of economic security. This model is based on data that were obtained during the assessment by experts who work in agroindustrial enterprises, which may not only be about professionalism, but also take into account the specifics of the studied area. As a result of obtaining one or another value of the integral indicator, the studied agro-industrial enterprise is recognized as requiring no revision of its own strategy for ensuring economic security. The generated model was experimentally applied at ten enterprises in Eastern Europe, in particular in countries such as Poland, the Czech Republic and Ukraine, to test its effectiveness. To define and substantiate our research, we applied the following general research methods: induction and deduction, comparison and systematization, synthesis and analysis, morphological analysis. The following methods are specific for our research: SAW methodology, in our work is designed to form a polyvariate decision-making model for assessing the level of economic security, as well as a method of expert evaluation, which are designed to form a list of necessary for the formation of the above model. The novelty of our research lies in the developed integrated indicator for assessing the level of economic security of agribusiness and its practical application.

**Keywords:** agroindustrial enterprise, economic security, expert survey, financial and economic indicators, model, multi-level algorithm.

**JEL Classification:** N5, O10, P42.

### Introduction

The modern period of the restructuring of the world socio-political and economic structure is characterized by an unprecedented growth of new trends and processes. Among them, one of the leading places belongs to such a phenomenon as integration or the creation of fundamentally new socio-political and socio-economic structures from the micro, mezzo and macro levels of organization

and management from existing ones. Therefore, their study is relevant and timely in the context of agroindustrial complex, because it is the integration factors and processes that allow acquiring new competitive advantages for agribusiness entities, occupying more efficient market niches and positions, and strengthening economic security.

The agroindustrial complex is, in fact, a combination of several sectors of the national economic system, which are aimed at the production or processing of raw materials

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of agricultural origin, as well as the receipt of various types of products from it. The noted set of segments of the economy includes: agriculture itself, represented in a wide variety of industries, which provide for the processing of raw materials, supply farmers with machinery, necessary fertilizers and other resources of industrial origin, as well as transport and logistics companies responsible for supplying products to consumers (Zabrodsky & Kizim, 2000).

The agroindustrial complex is a functional diversified subsystem expressing the interconnectedness, interaction of agriculture and its associated sectors of the economy for the production of agricultural machinery, agricultural products, their processing and sale. The formation of the agroindustrial complex is associated with the transition of agriculture to the machine stage of production, which significantly deepened and expanded the technological and functional ties of agriculture with other sectors of the economy.

The conditions for the functioning of entrepreneurial structures in the agricultural sector have specific features that are not inherent in other sectors of the economy:

- dependence on natural conditions;
- seasonal nature of production;
- the use of specific means of production, which include land, crop and livestock products;
- features of production technology;
- variety of forms of production;
- distinction between city and village;
- sustainability of traditional farming

Traditionally agroindustrial complex divided into three main areas of economic activity, each of which includes individual industries:

- production of capital goods for agriculture;
- agriculture itself;
- processing and sale of finished products.

A production sector based on industries manufacturing agricultural products, including for the processing industry. This includes tractor manufacturing, agricultural machinery, equipment for various areas of livestock, light and food industries, the production of mineral fertilizers and other chemicals of agricultural importance, the production of feed for livestock, microbiological and breeding products for crop production. Also in this area is the agricultural construction industry.

The agricultural sector is the largest subdivision of the agroindustrial complex, which determines the entire spectrum of the country's agrarian activity and its ability to provide for itself. In turn, this area includes such large industries as animal husbandry, crop production, and agriculture. This sphere is formed by the sectors of light, food, automotive industry, means of procurement, storage and sale of products.

The constant development of market relations leads to the fact that modern agro-industrial enterprises are faced with a significant decrease in direct state support for their activities and the need to create conditions for their safe development by their own strength. Stable functioning, growth of the economic potential of any enterprise in

the conditions of market relations largely depends on the availability of a reliable system of economic security. A modern enterprise is in conditions of continuous change in the external and internal environment of its existence. This instability requires constant adaptation from business entities, in particular, the search for new and improvement of already known means of ensuring the system of economic security in order to achieve the economic and social goals of the enterprise. Continuous and optimal provision of economic security is impossible without the existence of a powerful system for determining the level of economic security and factors that have the greatest impact on it.

The purpose of the study is to form a model for assessing the level of economic security of the agroindustrial enterprise. The subject of the study is economic security of the agroindustrial enterprise. Today, a large number of European countries have significant problems with ensuring the economic security, and this is especially felt for the agricultural sector, which is very sensitive to changes in the external environment of functioning. Such potential agricultural lands of the country in which most of the black soil like Poland, the Czech Republic and Ukraine will require the application of effective measures to ensure economic security, however, for this, for starters, it is necessary to establish what its level for the current period. That is why, the development of such an assessment methodology is extremely relevant. Thanks to the practical application of our model, now, organizations in the agro-industrial sector are able effectively apply our model for assessing economic security and timely respond to its changes.

## 1. Literature review

For today, a large number of mathematicians and economists work in the direction of assessing the level of economic security of the enterprise, among which: Aref'eva and Prokhorova (2018), Blank (2005), Goryacheva (2015), Prokhorova (2018), Kovalev (2018), Plastun (2017), Ligonenko (2016), Mandzinovskaya and Shtangret (2018) and others. Despite the sufficient number of studies, unfortunately, it is mainly aimed at assessing the general level of economic security of the enterprise. Today, Parfitt and Barnes (2020) note that the principles of ensuring economic security have changed somewhat in the context of the existence of unstable conditions for the life of economic systems. After the crisis development of the agroindustrial complex, there is a need to study the assessment of the level of economic security.

In the scientific literature (Lasan, 2010), fundamental approaches to the disclosure of certain aspects of ensuring the economic security of enterprises are rather thoroughly considered, however, it should be noted that mechanisms for improving the economic security of the enterprises in the agroindustrial complex of the economy are not well developed, taking into account industry specifics and destructive factors that affect the state of the economic

system. As the analysis shows the economic security of agroindustrial complex largely depends on their financial condition, since the financial subsystem is the dominant functional component of the economic security of any business entity (Entringer et al., 2019). Today, almost single-handedly, scientists (Demchenko, 2017), note that the vast majority of modern methods of bankruptcy forecasting simply can not provide accurate results in today's conditions of enterprise development and business conditions in Eastern Europe.

The problems of the agroindustrial complex have always bothered scientists from all over the world. We can talk about the international nature of this problem. For example, Schmink (2020) investigated the transformational problems of modern agribusiness.

The specifics of managing the agroindustrial complex and the basis of the risks that could adversely affect its development and become a security risk were investigated by Ker (2020), Auci and Barbieri (2020) explored how such a thing as climate change can significantly affect Europe's agroindustrial complex.

In the current conditions of geopolitical transformations in Eastern Europe, there was a need to find new directions of foreign economic activity in both individual sectors and the economy as a whole. Despite the opening of borders for Eastern Europe products on the part of the European Union, it is enough to quickly restore the foreign trade balance of the country only by increasing the production of products that are competitive and in demand in foreign markets (Bazyliuk et al., 2019).

The most active segment of the Eastern Europe economy, whose growth rate, unlike traditional sectors, has not declined even in times of global crisis, is the agroindustrial sector. Today, innovative information technologies are increasingly influencing the socio-economic development of Eastern Europe. In the current situation the domestic agroindustrial sector can be the driver of economic growth in the country, as products and services generated by enterprises in this sector are widely in demand from foreign companies, and their use by domestic enterprises contributes to improving the efficiency of the economy as a whole (Menggang, 2013).

Westgren and Cook (1986) were among the first to study the specifics of planning and forming the development strategy of the agroindustrial complex. In their work, they were the first to form the fundamental principles for further research. In turn, Baker and Leidecker (2001) studied the features of modern planning of the development strategy of the agroindustrial complex, as well as ways to implement this strategy in practice.

Agroindustrial sector is the one of the most active sector of the economy, which does require significant financial and material investments such as industry or other sectors of the economy for its development. At the same time, it has a strong potential, formed primarily by highly qualified personnel and are in high demand from foreign companies. Development of the agroindustrial sector, as a high value-added economy can increase the country's

GDP in the short term and ensure stable foreign exchange earnings (Dzikevičius & Šaranda, 2016).

Agroindustrial enterprise is very important sector of the economy of Eastern Europe, for example, this sector provides a third of the total gross value added in Ukraine. The effective functioning of the agricultural sector ensures food security, the development of foreign and domestic trade, and the improvement of the living standards of the people. Agroindustrial enterprises are forced to operate in conditions of unpredictability and uncertainty. First of all, this is due to the instability of the infrastructure of agricultural markets, the disparity in prices, the dependence of production on natural conditions, which makes it risky. Also essential characteristics of the activities of producers of products is the limited land as the main factor of production, the seasonal nature of production. All this necessitates the formation of economic security of agroindustrial enterprise (Torres et al., 2007).

There are a number of factors that deter investment flow. First of all, this is an unresolved land issue, spontaneity in the processes of rent and sale of land. Thus, the irrational structure of production and intensive technologies in crop production lead to a violation of scientifically proven farming systems, monoculture of agriculture, degradation of farmland. A civilized agricultural market has not yet been created. In addition, the unpredictability of administrative price regulation and export restrictions are considered risk factors (Taylor, 1996). The crisis is not a simple phenomenon and it is provoked by a number of factors, in particular: inefficiency of state management of the industrial economy, lack of effective financial management within the company; high tax rates; neglect of the negative impact of threats and so on.

In the context of the globalization of the economic space, enterprises operating in the field of agriculture and gaining wide economic independence have faced the need for fundamentally new approaches to ensuring economic security (Wu & Meng, 2019), which required a radical transformation of the entire system of protecting the economic interests of these business entities.

As for the strategic development of agroindustrial enterprises, Goldsmith and Gow (2005) note that the formation of powerful mechanisms for ensuring economic security should become the main prerequisites for the formation of a sustainable strategy.

It is very difficult to assess the level of economic security of the agroindustrial enterprise. As Gasanov et al. (2016) have noted, assessing the level of economic security of the agroindustrial enterprise is a certain sequence of managerial efforts that must be carried out in stages. Abdulaziz (2018) considered strategic directions for assessing the level of economic security of the agroindustrial enterprise for processing enterprises through the dynamics of the opportunities and threats of this type of enterprises.

Shynkar et al. (2020) in their work studied the main strategies for determining the level of economic security at enterprises, including assessing the number of threats and factors of the internal and external environment. Golovach

(2018) formed the definition of a strategy for assessing the level of economic security of the agroindustrial enterprise through the formation of a structural-logical scheme for agricultural enterprises.

Sylkin et al. (2018) assessed the impact of threats on security of enterprise, and also assessed the level of this impact on enterprises. However, as part of our study, we focus on agroindustrial enterprise that have not been investigated so far. If we talk exclusively about agroindustrial enterprise, Ershova (2019), has proposed several strategic directions for assessing the level of economic security of the agroindustrial enterprise: a reduction strategy, a limited growth strategy. To date, there is no holistic and practically confirmed method for assessing the level of economic security of the agroindustrial enterprise, the calculation of which would provide information on the need for choosing right management at agroindustrial enterprise, taking into account the specifics of their activities.

## 2. Research model

### 2.1. Methodology for the formation of the stages of assessing the level of economic security of agroindustrial enterprise

In our opinion, the assessment of the level of economic security at the agroindustrial enterprise should be holistic and based on indicators that allow fully reflecting the current economic situation and taking into account the specifics of the industry. For this, it is necessary to attract

relevant experts in the field of agroindustrial enterprise, whose experience and knowledge will allow the formation of the necessary groups of indicators and calculate the integral indicator, the results of which would signal the absence or necessity of the review its own economic security management strategy (Ovchinnikova et al., 2017).

We have identified three main levels for assessing the level of economic security of enterprises in the agro-industrial sector of the economy (Figure 1).

At the first stage of our study, which consisted of review of specialized literature and formation of the list of possible indicators of economic security, we selected 20 indicators. For the purpose of calculation, it is necessary to form a group of indicators that fully reflect the economic condition of the agroindustrial enterprise and determine the current level of economic security: “Desired”, “Acceptable”, “Recommended”, “Allowable”; “Pre-crisis”; “Crisis”. The level of economic security established by us will allow the management of enterprises to better understand when there is a need for the review its own economic security management strategy (Sylkin et al., 2019).

### 2.2. The use of the expert method to determine the main indicators for assessing the economic security of agroindustrial enterprise

To establish the main indicators and their threshold values, at which the threat of the economic crisis at the agroindustrial enterprise, and there is a need for the review its own economic security management strategy, we

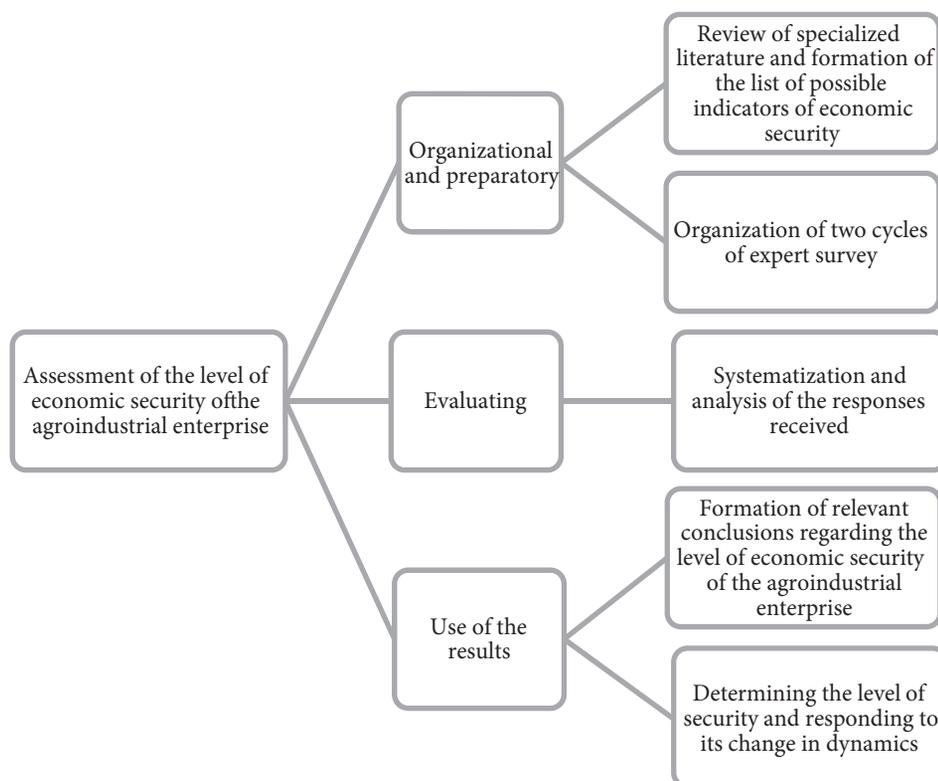


Figure 1. Map of algorithm for assessing the level economic security of the agroindustrial enterprise (source: development by authors)

conducted a survey involving experts working in this field and leading experts in the matter of economic security of the agroindustrial enterprise.

Experts from leading regions in the field of agribusiness in Eastern Europe were selected for the survey. In total, 20 experts from leading agricultural enterprises were selected. The criteria for selecting these reviewers were the following conditions:

- at least 5 years of experience in agricultural enterprises;
- knowledge of experts in the field of our research;
- preliminary participation of experts in scientific research.

All 20 experts are representatives of leading agricultural enterprises from countries such as Ukraine, the Czech Republic and Poland. For communication with experts, direct and remote contact methods were chosen. The frequency of the survey was one-time. To assess the level of economic security of the agroindustrial enterprise, it is necessary to establish the number of indicators, it is better to reflect the economic condition and deterioration of which signal a crisis development. One of the questions for the respondents was to choose indicators of this kind, the values of which, they believe, best reflect the state of economic security of the agroindustrial enterprise. The results made it possible to single out the best of all the economic indicators we listed, and we again sent the respondents a list of economic indicators, we selected according to the results of the survey, in order to obtain their final consent (Menggang, 2013). It is worth noting that all the indicators presented in the questionnaire for the survey of experts are a list formed as a result of summarizing a large number of economic indicators, they were found in scientific works of leading scientists in the field of assessing the level of economic security of the agroindustrial enterprise

(Goldsmith & Gow, 2005; Golovach, 2018; Ker, 2020).

In Figure 2, you can see the list of economic indicators that better reflect the financial condition and level of economic security of the agroindustrial enterprise and whose decline may signal a crisis development, formed after its approval by the respondents.

We have formed a group of “quality indicators”, which include (Podra et al., 2020):

1. Payment discipline. Demonstrates the level and quality of the enterprise fulfilling its obligations to creditors or other persons.
2. The effectiveness of accounting and analytical support. More than once, in the first section it was established how key information support plays in the system of ensuring economic security and anti-crisis management, therefore, assessing the level of effectiveness of accounting and analytical support will assess the level of information support at the enterprise.
3. Interaction with counterparties. Having assessed the level of interaction of the enterprise with contractors, it is possible to more broadly assess the level of economic security, since a negative level of business relations can significantly affect the image and activity of the enterprise and become a serious threat to its development.

Having established and agreed upon the main indicators that will be used to determine the level of economic security at the enterprise, we asked respondents to fill out a table, in which it was necessary to enter indicators in the environment and set their threshold value for subsequent levels of economic safety: “Desired”, “Acceptable”, “Recommended”, “Allowable”, “Pre-crisis”, “Crisis”.

The key place in the levels of economic security that we offer is played by the “Pre-crisis” one, and it is this

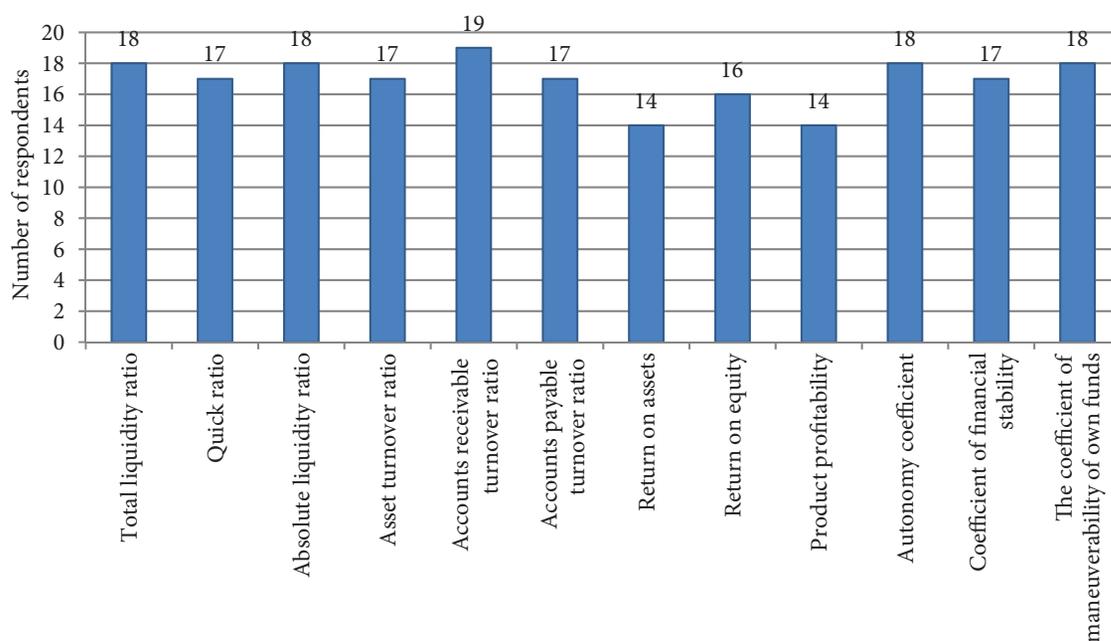


Figure 2. A list of key economic indicators has been compiled that will be used to assess the level the agroindustrial enterprise (source: development by authors)

Table 1. The proportion of current economic indicators to assess the level of economic security at the agroindustrial enterprise (source: development by authors)

Indicator (L)	Weight	Indicator (B)	Weight	Indicator (P)	Weight	Indicator (F)	Weight	Indicator (Q)	Weight
Total liquidity ratio	0.4	Asset turnover ratio	0.5	Return on asserts	0.45	Coefficient of Autonomy	0.5	Payment discipline	0.3
Rapid liquidity ratio	0.4	Receivables turnover ratio	0.25	Return on equity	0.35	Coefficient of financial stability	0.35	The effectiveness of accounting and analytical support	0.4
Absolute liquidity ratio	0.2	Accounts payable turn-over ratio	0.25	Product profitability	0.2	Coefficient of maneuverability of own funds	0.15	Interaction with contractors	0.3

level that should signal a significant threat of the onset of the financial crisis. Thanks to expert judgment, we have determined the proportion of economic indicators separately and groups, which include these indicators. The proportion of economic indicators for assessing the level of economic security of agroindustrial enterprise which was calculated using the methodology of simple additive weighting, is shown in Table 1.

So, according to the results of the expert assessment, research of scientific literature on the subject of other models of assessing economic security, it allowed to collect and use the results of the study to form a model for assessing the level of economic security at the agroindustrial enterprise (Figure 3). In this Figure, lg is this is the integral value for each group of indicators and wi is the specific weight of the indicator, that is, its level of significance for the assessment being carried out, which is determined using expert assessment. Experts determine how important this or that indicator is for the assessment.

Our proposed model for assessing the economic security of the agroindustrial enterprise synthesizes a set of

basic parameters of the economic activity at the agroindustrial enterprise. In order to test in practice our current model for assessing the level of economic security of agroindustrial enterprise, we selected ten enterprises of Eastern Europe agroindustrial region, in particular countries such as Poland, Czech Republic and Ukraine. The reason for choosing these enterprises was that they are representatives of all components of the agro-industrial complex: industries that supply the means of production to agriculture, as well as those engaged in production and technical maintenance of agriculture; agriculture and forestry sectors engaged in bringing agricultural products to the consumer (harvesting, processing, storage, transportation, sale).

A feature of the selected enterprises is that due to the shared features (type of activity, size of the enterprise, etc.) and internal differences (different work experience, different security system, different volumes of profit, etc.), they all allow you to display the area under study at the macro level. An assessment of the level of economic security will be carried out in accordance with the selected economic indicators by experts.

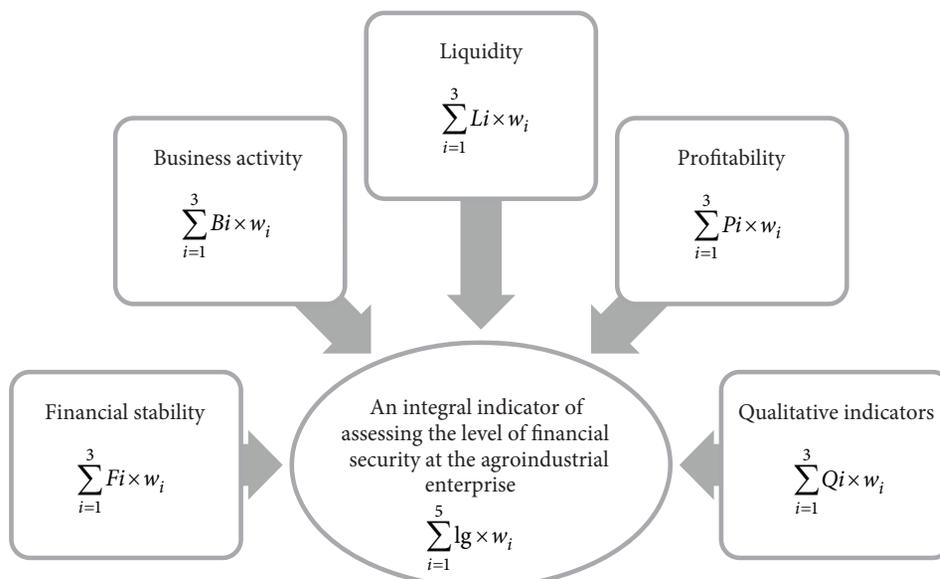


Figure 3. Integral indicator of assessing the level of economic security at the agroindustrial enterprise (source: development by authors)

The results of the study to assess the level of economic security of the agroindustrial enterprise will be demonstrated in the context of the dynamics of the level of security in the following groups:

- the liquidity group;
- the business activity group;
- the financial stability group;
- the profitability group;
- the group quality indicators.

In order to integrate indicators of different origins into one model, it is necessary to bring their value into one measuring unit (from 0 to 1). This conditional value will better reflect the dynamics for each group of indicators.

Of course, if at the general level of the integral indicator for assessing the level of economic security, it can be observed that certain groups of subindicators are decreasing, it is imperative to pay attention to them and, if possible, take a number of measures to improve them.

### 3. Results and discussion

In order to display in detail the dynamics of each group of indicators, we have reflected the results of the calculations in the figures below. Using the above formulas, we have calculated indicators for all the studied groups. The results of the calculation of indicators for the liquidity group for selected agroindustrial enterprise for 2016–2019 shown in Figure 4.

It is also very important to calculate a group of indicators related to business activity. The results of the calculation of indicators for the business activity group for selected agroindustrial enterprise for 2016–2019 shown in Figure 5.

Equally important is the calculation and visual display of the integral indicator for the group of financial stability. The results of the calculation of indicators for the financial stability group for selected agroindustrial enterprise for 2016–2019 shown in Figure 6.

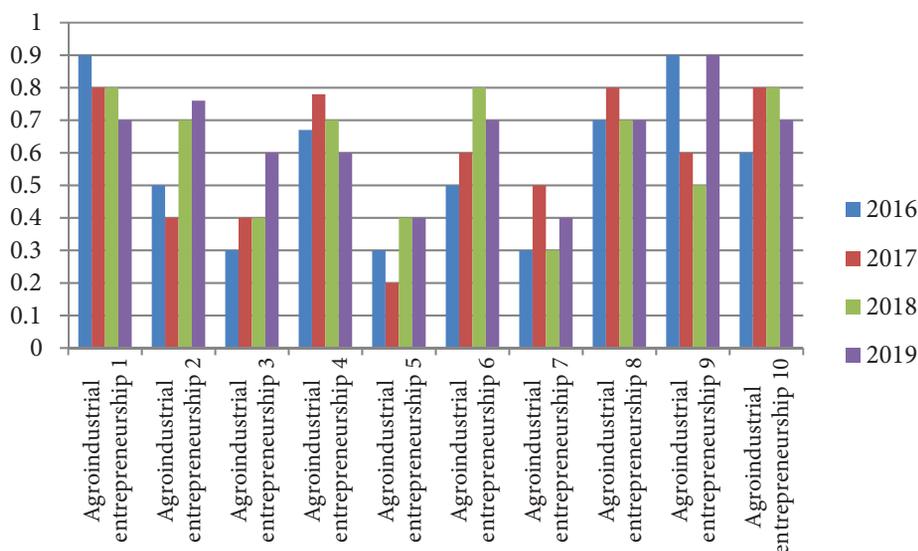


Figure 4. Level of economic security in the liquidity group for selected agroindustrial enterprise (source: development by authors)

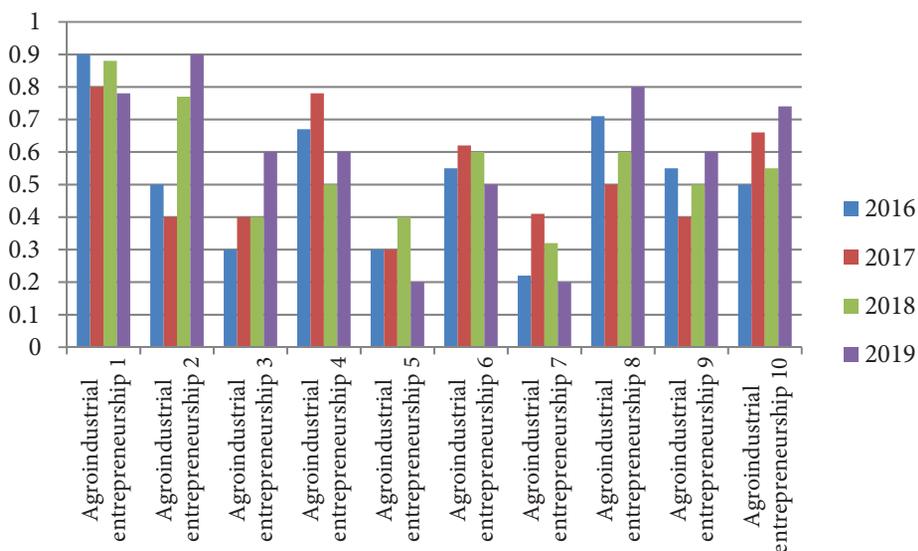


Figure 5. Level of economic security in the business activity group for selected agroindustrial enterprise (source: development by authors)

The problem of profitability of enterprises acquires particular importance in the context of the global financial crisis, which has become a challenge for the economies of many developed countries. The results of the calculation of indicators for the profitability group for selected agroindustrial enterprise for 2016–2019 shown in Figure 7.

The results of the calculation of indicators for the group quality indicators for selected agroindustrial enterprise for 2016–2019 shown in Figure 8.

Calculate the integrated indicator of economic security, taking into account the significance of each group of indicators, and the results of which will allow to see if the enterprise needs to revise its own strategy for ensuring economic security or not (Figure 9).

According to the results of the practical application of our methodology for assessing the economic security of agroindustrial enterprise, it has shown high efficiency

in applying to our choice of 10 agroindustrial enterprises in Eastern Europe. The methodology takes into account the specifics of the agroindustrial complex, which is why we chose the specified financial and economic indicators, which are the most vulnerable and the change in the level of which is most sensitive to changes in the environment, in particular to changes in the level of economic security. Selected agricultural enterprises from 1 to 3 have approximately the same financial and economic indicators from one region of Poland. Subjects for grades 4 through 6 are the same from the Czech Republic. A similar situation is for 7–10 in Ukraine. 3, 5, 7 enterprises require the use of anti-crisis measures, since the level of their economic security for all the studied indicators is below 0.5. According to our methodology, below this threshold value are found enterprises that have signs of crisis, is a threat to economic security.

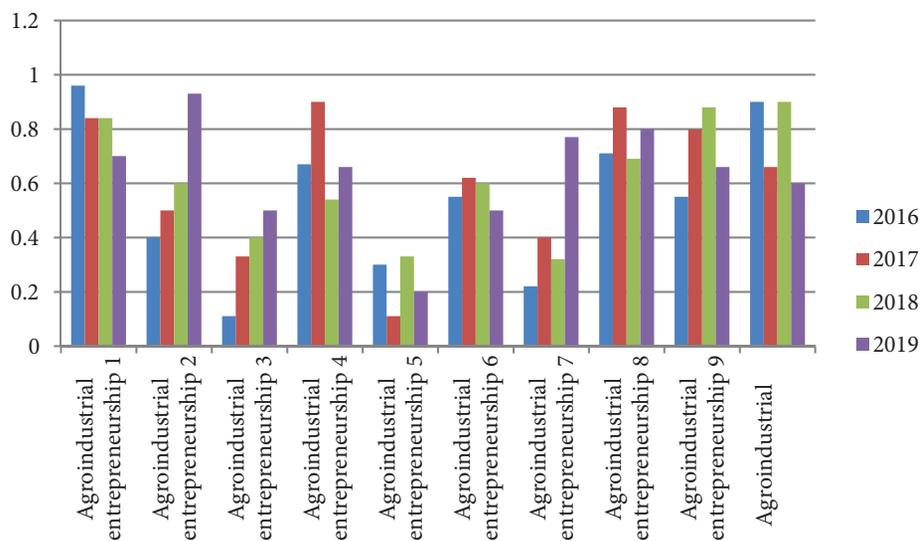


Figure 6. Level of economic security in the financial stability group for selected agroindustrial enterprise (source: development by authors)

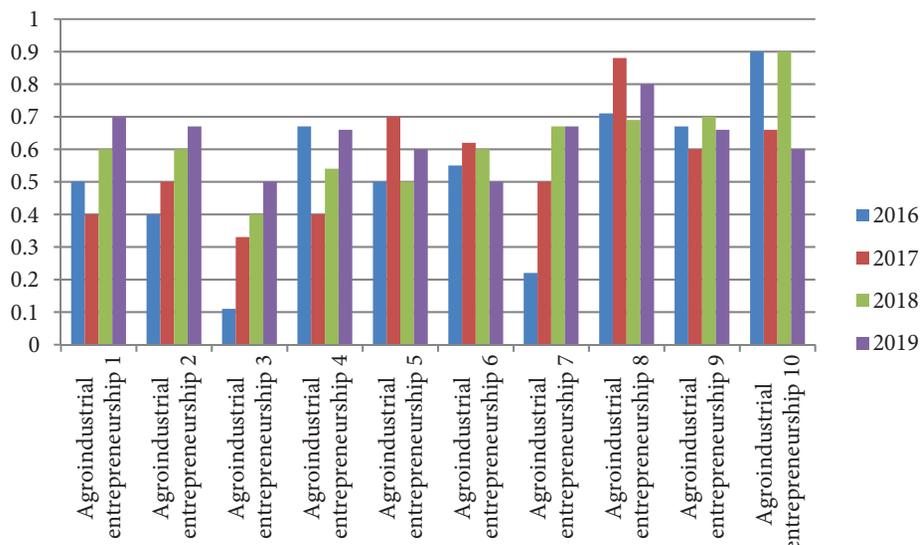


Figure 7. Level of economic security in the profitability group for selected agroindustrial enterprise (source: development by authors)

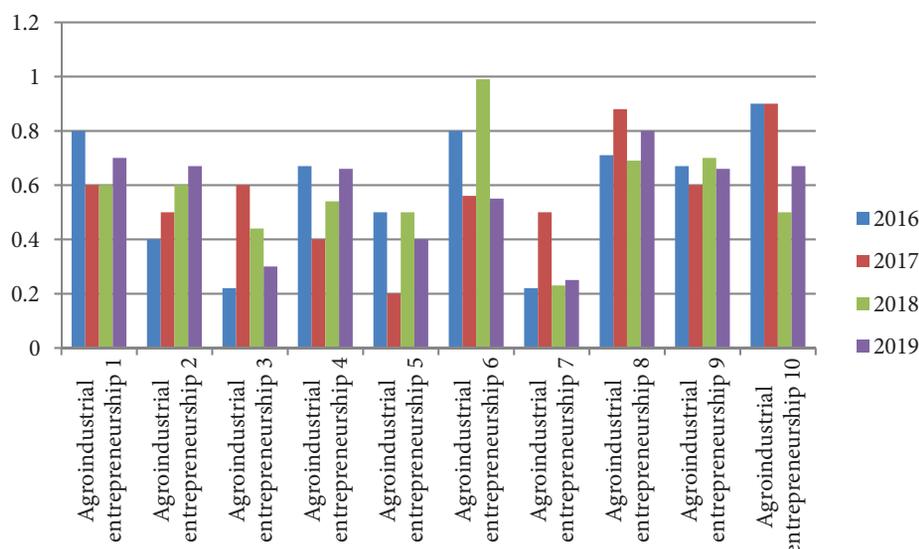


Figure 8. Level of economic security in the group quality indicators for selected agroindustrial enterprise (source: development by authors)

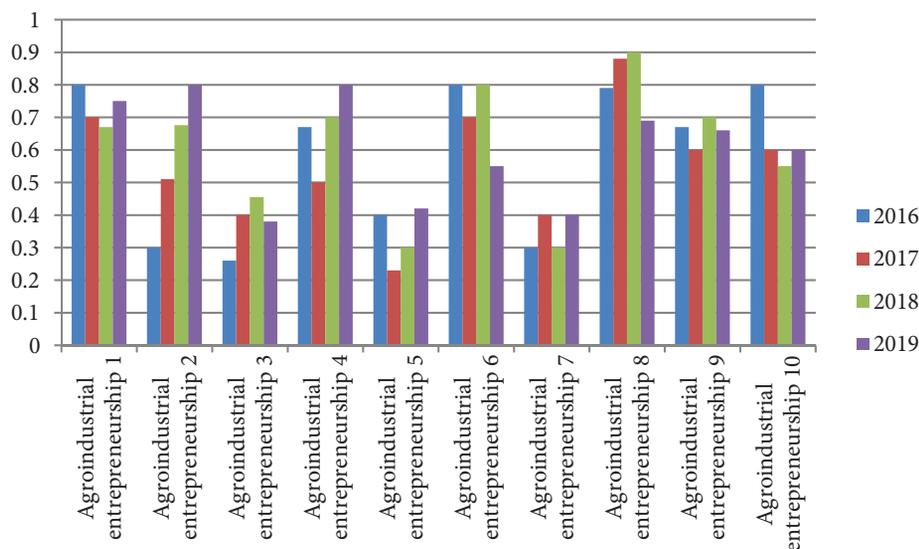


Figure 9. Level of economic security in the all of indicators groups for selected agroindustrial enterprise (source: development by authors)

Thanks to the practical application of our integrated indicator of assessing economic security, we can talk about its effectiveness for institutions in the agricultural sector. Calculating the integral indicator, you can dynamically see what the given indicator of economic security is changing over the years and establish how the company has strengthened or worsened its own security over the years. If, during the period under review, the company received, as a result of calculating the integral indicator, the result is not more than 0.5, we can talk about the lack of economic security and editing its own development strategy and adjusting tactical measures.

Evaluation results may be more informational and controlling for managers. Compared to other studies, our focus is more specifically on the agricultural sector and, in addition to our proposed model for assessing economic

security, our study also provided for the practical application of the assessment model.

It should be noted that in comparison with other scientific studies, we have developed our own methodology for assessing the level of economic security, which allows us to take into account the specifics of enterprises in the agroindustrial sector of Eastern Europe. In addition, it allows you to establish whether the company has crisis signs or not and to protect its own business.

## Conclusions

Thus, summarizing the results of the study, it can be argued that proposed algorithm and a model for assessing the level of economic security allow to most effectively reflecting the need for anti-crisis management at the

agroindustrial enterprise and take into account the specifics of the selected industry. So, the scientific and practical approach that we have formed can create the basis for managing economic security of agroindustrial enterprise and will allow us to identify the signs of crisis development as quickly as possible in order to respond in a timely manner. Not without the help of leading experts and scientists, it was determined which financial indicators should be used in assessing the level of economic security agroindustrial enterprise. Because of the survey, five groups of economic indicators were identified: indicators of liquidity, profitability, financial stability, business activity and quality indicators. After determining these indicators that better reflect the level of economic security, we applied this model to ten agroindustrial enterprise in Eastern Europe and, accordingly, they determined the level of economic security.

It should be noted that future research should be devoted to the practical application of the proposed model for a larger range of enterprises.

### Author contributions

The authors contributed equally.

### Disclosure statement

The authors do not have any conflict of interest.

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