

---

## STRATEGIC SCENARIO PLANNING OF THE AGRARIAN SECTOR DEVELOPMENT

**Dr. Valerii Plaksiienko<sup>1</sup>**

**Dr. Inna Nazarenko<sup>2</sup>**

**Dr. Oleksandr Nazarenko<sup>2</sup>**

**Assoc. Prof. PhD. Liudmyla Sokolenko<sup>3</sup>**

<sup>1</sup> Poltava State Agrarian Academy, **Ukraine**

<sup>2</sup> Sumy National Agrarian University, **Ukraine**

<sup>3</sup> Sumy State Pedagogical University, **Ukraine**

### ABSTRACT

The purpose of this article is to present the algorithmization of the scenario planning process, based on cognitive methods of economic and mathematical modeling. The methods are based on the etiological diagnostics of synthesizing economic and non-economic indicators, exponential smoothing of the explanatory factors, and the results of the regression analysis. They will allow constructing multivariate scenarios (realistic, pessimistic, and optimistic) of the agrarian sector of Ukraine's economy. The assessment of such scenarios will provide the identification of the latent risks, indicators of the incentives (disincentives), and objective reasoning of areas development in strategic prospect, considering the variability of the business environment. The authors substantiate that under current conditions the classical methods of management (organizational, administrative, social and psychological) do not provide the proper level for effective strategic managerial decision making. In the cognitive economy, in order to avoid ambivalence of managerial initiatives, the strategic tasks must be set considering economic managerial methods based on the use of information systems (economic and mathematical methods). The researchers found out that implementation of the forecast methods as economic ones transforms a standard managerial approach to the innovation. This will ensure the objective assessment of the current development parameters and the argumentation of strategic tasks based on the consideration of the market mechanisms.

**Keywords:** economic and mathematical modeling, forecast, development, scenario planning, financial result.

### INTRODUCTION

The development of the agrarian sector of Ukraine's economy under the conditions of unpredictability and turbulence is characterized by complexity and uncertainty. It goes without saying that in the modern innovative economy the outline of the enterprise and branches development strategies should be grounded on the reliable information provision. It involves the coherence of the results of diagnosing the potential dangers

and identifying the potential opportunities considering the variability of the business environment. The above-mentioned issue highlights the need for the search and implementation of new tools and methods for managing enterprises in the agrarian sector. In practical terms, their implementation will optimize the structure of resource potential, improve production processes, outline the ways to increase investment attractiveness, identify strategic guidelines that will enhance the potential opportunities to increase the economic development of the agribusiness entities (including the agrarian sector). The process should take place considering the persistent changes in the external environment and latent risks. Therefore, the use of scenario planning as a systematic tool for strategic management becomes possible. This will simulate the optimal approach to the development of the agrarian sector of the country's economy, since its focus will be on identifying the possible alternative scenarios of development, identifying ways to strengthen potential opportunities, optimizing the use of key factors of production, increase of the economic effects of the main activity of the agribusiness entities. In addition, practical application of the mathematical apparatus as an analytical tool for the scenario planning based on the cognitive methods. It will provide an opportunity to make an adaptive prediction of the economic development of the enterprise (industry) making the realistic assessment.

Foreign and domestic scientists, such as M. Baldzhi, H. Bandhold, V. Bardychev, A. Byelousov, S. Brown, V. Heyets, H. Kan, M. Lindgren, G. Mintzberg, S. Popov, J. Rigland, A. Friedman, K. Freeman et al. made fundamental scientific and methodological research of the theoretical substantiation on the relevance of the scenario planning use in the process of strategic management of the enterprise (industry) development.

Despite a considerable amount of the groundings of theoretical and methodological provisions of the scenario planning, it is worth noting that the applied principles of the research subject are randomly presented in the scholarly papers. Accordingly, the need for an in-depth study focused on the algorithmization of the logically sequential stages of the scenario planning arises. The practical implementation will identify managerial decisions that will serve as a fundamental platform for the priority goals and objectives of the strategy aimed at ensuring the sustainable development of the agrarian sector of Ukraine's economy.

**Methods of the research.** This article introduces a set of general scientific and special research methods, such as the method of synthesis and synthesis (in substantiating the theoretical bases of the scenario planning); economic and mathematical (for practical modeling of the performance indicators); adaptive (for the implementation of the exponential smoothing); graphical (for visual illustration of the dynamics of the calculated values); hierarchal (for constructing the scheme of the algorithmic sequence of the scenario modeling), etc.

The purpose of this article is to present the algorithmization of the scenario planning process, based on cognitive methods of economic and mathematical modeling. The methods are based on the etiological diagnostics of synthesizing economic and non-economic indicators, exponential smoothing of the explanatory factors, and the results of the regression analysis. They will allow constructing multivariate scenarios (realistic, pessimistic, and optimistic) of the agrarian sector of Ukraine's economy. The assessment of such scenarios will provide the identification of the latent risks, indicators

of the incentives (disincentives), and objective reasoning of areas development in strategic prospect, considering the variability of the business environment.

**Major results of the study.** The scenario approach is an effective modern method for solving the key management problems. Under the conditions of uncertainty, it allows formulating a development strategy through the presentation of a complex future situation. Its features cannot be forecasted with certainty, though, can lead to the implementation of a particular development option in the future [1]. In practical terms, the current model of managing the agrarian sector of Ukraine's economy does not solve all the existing social and economic problems. Thus, the economic development of agribusiness entities depends on a significant number of factors of the internal and external environment [2].

Classical methods of management (organizational, administrative, social and psychological) do not provide the proper level for making effective strategic managerial decisions. To avoid the ambivalence of managerial initiatives, we believe that in a cognitive economy, the strategic tasks must be set considering the economic managerial methods based on the use of information systems (economic and mathematical methods). As a result, the use of forecast methods as economic ones (e.g., scenario planning with the elements of mathematical modeling) is important. The methods transform a standard managerial approach into an innovative one, which will provide an objective assessment of contemporary development parameters and argumentation of the strategic tasks based on the consideration of the market mechanisms' effects.

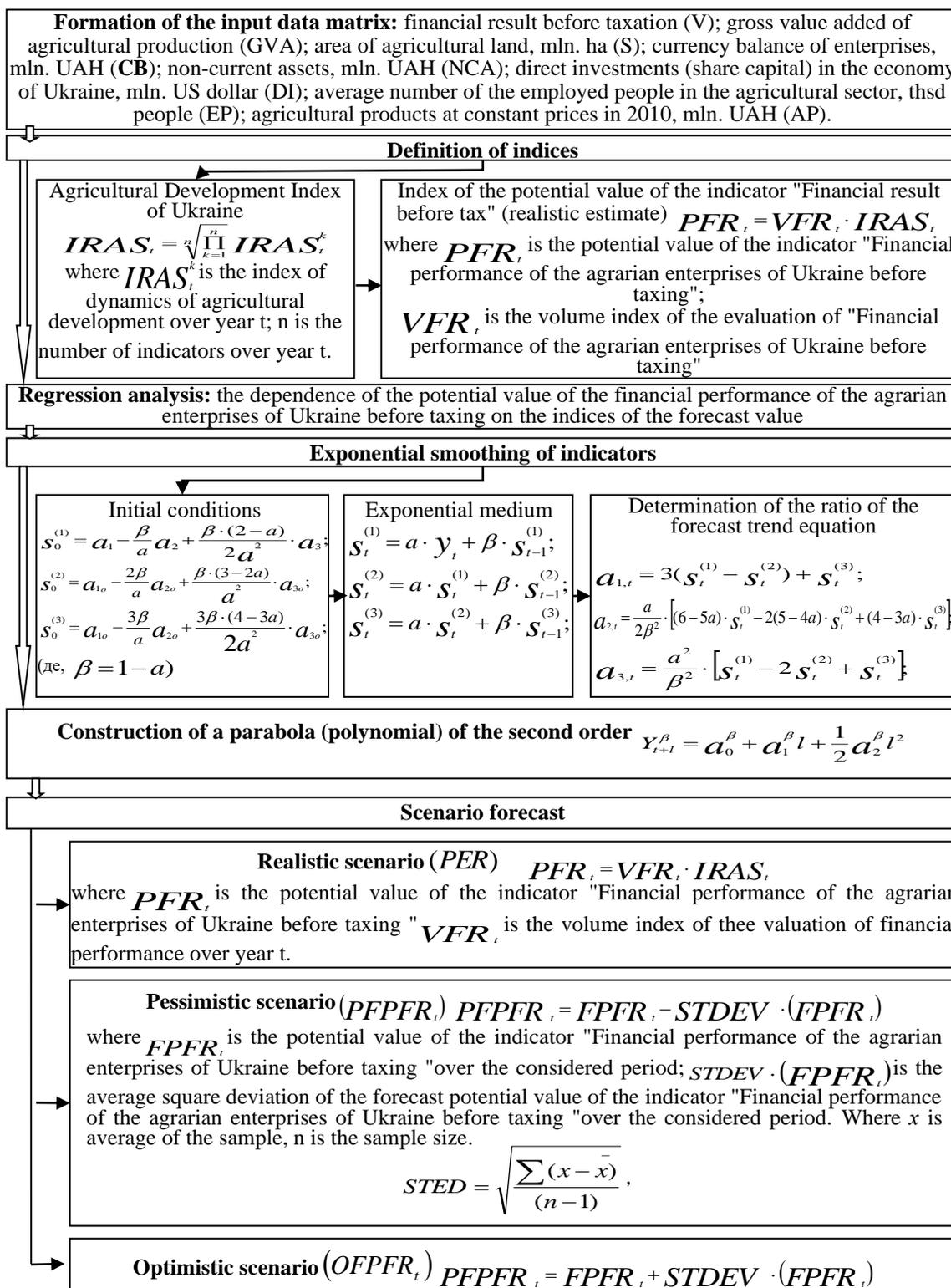
This opinion is consistent with the scientific positions of M. Lindgren and H. Bandhold. That is, scenario planning is an effective tool for mid-term and long-term strategic planning under uncertain conditions. It helps to sharpen the strategies, make the action plans in case of an unexpected development of the events and follow the right direction in important issues. A qualitative set of scenarios must meet the relevant criteria (potential for the decision-making, feasibility, alternativeness, lack of internal contradictions, differentiation, memorability, and the possibility of verification) [3].

Scenario planning of the agrarian sector should be based on the adaptive methods. The adaptive methods of economic and mathematical modeling allow us to construct the self-adjusting models that can consider the result of the forecast made in the previous step.

The adaptive methods provide the implementation of an exponential smoothing [4]. Exponential smoothing is the formalization of the actual learning process, which is the basis for the statistical forecasting. As the prediction models, the higher order polynomials are used, since smoothing the calculations is very simple and the only thing one needs to save is the minimum of historical statistics from one forecast to the next in a file [5]. Considering the forecasting complexity of the economic development of the agrarian sector, the availability of a significant number of destructive factors, respectively, in practical terms, it is advisable to test the method of R. G. Brown and R. F. Mayer. This method is specific for complex processes, since a larger number of polynomial members is included in the model, and the estimation of the coefficients of polynomial members is made by the multiple smoothing [6].

It is worth noting that the parametric structure of the script modeling algorithm consists of a series of successive stages based on the formalized selection of the synthesizing economic and non-economic indicators, the definition of industry development indices,

the construction of a second order polynomial, the conduction of exponential smoothing, the definition of exponential averages, regression analysis, and modeling of the development scenarios (Figure 1).



**Figure 1 - Scheme of an algorithmic sequence of the scenario planning**

\* Source: compiled based on the materials [4].

The aim of the agrarian enterprises is to generate the profit and optimize its size. Thus, for practical testing, we apply the adaptive methods for the scenario planning of the indicator “Financial performance of the agrarian enterprises of Ukraine before taxing” from the gross value added of the agricultural production, agricultural land, currency balance of the enterprises, noncurrent assets, direct investment (equity) in the economy of Ukraine, an average number of the employed population in the agricultural sector, and agricultural products at constant prices in 2016.

Scenario forecast of the agrarian sector of Ukraine will be implemented according to the statistical (economic and noneconomic) data over the period of 2011-2018, respectively, the forecast period for scenarios is determined 2019-2023. Table 1 presents input data to predict the potential value of the indicator “Financial performance of the agrarian enterprises of Ukraine before taxing”.

**Table 1. Input data of the forecast modeling of the potential value of the indicator “Financial performance of the agrarian enterprises of Ukraine before taxing”**

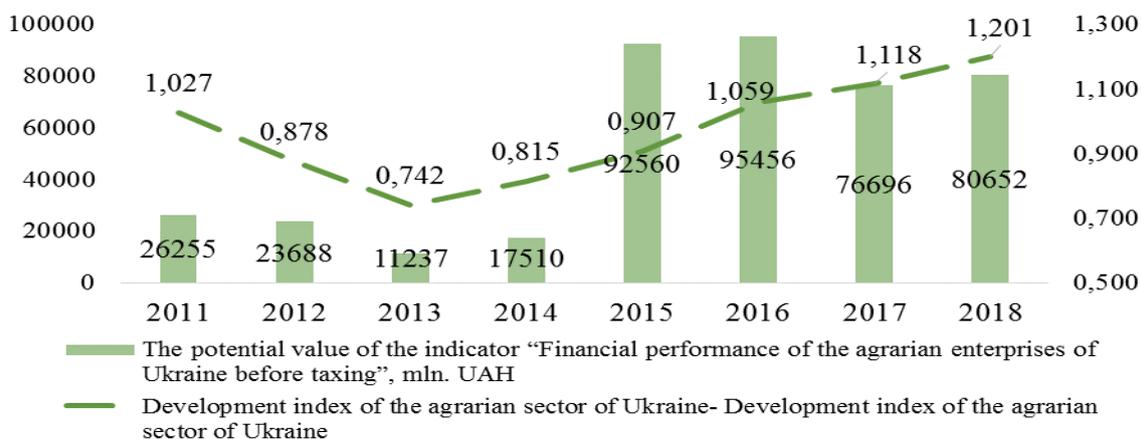
Years	Financial performance of the agrarian enterprises of Ukraine before taxing, mln. UAH	Gross value added of agricultural production, mln. UAH	Area of agricultural land, million hectares	Currency balance of the business entities of the agrarian sector of Ukraine, mln. UAH	Noncurrent assets of the business entities of agrarian sector of the economy of Ukraine, mln. UAH	Direct investment (equity) in the agricultural sector of Ukraine, mln. USD	Average number of employed population in the agrarian sector of Ukraine's economy, thsd. people	Agricultural products at constant prices in 2016, mln. UAH
2011	25566	-	41,6	-	-	720	751	561905
2012	26993	109227	41,6	-	-	725	752	539991
2013	15147	128501	41,5	313033	151833	718	726	613429
2014	21496	161145	41,5	390524	167283	777	733	626925
2015	101996	239806	41,5	685790	205575	617	643	596833
2016	90122	279701	41,5	1533201	264859	502	653	634433
2017	68606	303949	41,5	1466995	335303	586	634	620476
2018	67171	360757	41,5	1633374	399526	579	621	671294

Considering the peculiarity of scenario planning using adaptive methods, it is advisable to evaluate the input factor components for diagnosing the indicators of incentives and disincentives.

Dynamics indices of the factor components are the basis for calculating the agricultural sector development index of Ukraine, which is the basis for calculating the forecast potential value of the indicator “Financial performance of the agrarian enterprises of Ukraine before taxing” (Figure 2).

The calculation of the forecast indicator “Financial performance of the agrarian enterprises of Ukraine before taxing” is done taking into account the dynamics of the production process, therefore, it is necessary to use the year index ( $t$ ) and the square of the year index ( $t^2$ ), which will be the starting intervals of regression.

The construction of a second order parabola (polynomial) is based on the ratios of the regression equation, which are determined using the MS Excel toolkit.



**Figure 2. The results of the forecast modeling of the potential value of the indicator “Financial performance of the agrarian enterprises of Ukraine before taxing”**

The next stage of modeling is the calculation of exponential smoothing indicators (initial conditions, exponential averages, estimates of the trend ratios), which should be considered when implementing intermediate calculations of the regression forecast trend.

The forecast trend equation for each factor component constructed with the help of a second-order parabola (polynomial) using the Brown-Meyer method.

Using the forecast trend equations, predictive values of the factor components and the effective indicator are determined (Table 2).

**Table 2. Dynamics of the forecast values of indicators of assessing the potential value of the financial performance of the agrarian enterprises of Ukraine before taxing from 2019 to 2023**

Year	Financial performance of the agrarian enterprises of Ukraine before taxing mln. UAH	Gross value added of agricultural production, mln. UAH	Agricultural land (square) in the use of agricultural enterprises and citizens, mln. ha	Currency balance of the business entities in the agrarian sector of the Ukrainian economy, mln. UAH	Noncurrent assets of the business entities in the agrarian sector of the Ukrainian economy, mln. UAH	Direct investments (equity) in the agrarian sector of the Ukrainian economy, mln US dollar	Average number of employed population in the agrarian sector of the Ukrainian economy, thousand people	Agricultural products at constant prices in 2016, mln. UAH
2019	68519,5	322675,9	41,5	1510242,7	332506,6	596,8	638,6	524049,8
2020	71428,8	344152,4	41,5	1593920,6	356466,1	594,6	624,8	564392,3
2021	74445,1	367755,8	41,5	1684984,5	383674,8	591,6	609,9	611434,4
2022	77568,4	393486,3	41,5	1783434,4	414132,7	588,0	593,8	665176,0
2023	80798,7	421343,9	41,5	1889270,4	447839,9	583,6	576,7	725617,2

For the modeling the alternative variants of development scenarios it is expedient to determine the final index of economic development of the Ukrainian agrarian sector based on the dynamics of forecast values (Table 2), which will provide the calculation of forecast (potential, realistic) value of the financial performance of the agrarian enterprises of Ukraine before taxing (Figure 3).



**Figure 3. Performance indicators for estimating the potential value of the financial performance of the agrarian enterprises of Ukraine before taxing**

Based on the forecast (potential (realistic) value of the financial performance of the agrarian enterprises of Ukraine before taxing, using the average square deviation for the studied period, optimistic and pessimistic scenarios are modeled (Table 3).

**Table 3. Dynamics of the forecast potential values of the indicator “Financial performance of the agrarian enterprises of Ukraine before taxing”, mln. UAH**

Indicator	Financial performance of the agrarian enterprises of Ukraine before taxing, mln. UAH				
	2019	2020	2021	2022	2023
Pessimistic scenario, mln. UAH	44989	50930	57439	64521	72173
Realistic scenario, mln. UAH	75913	81853	88363	95445	103097
Optimistic scenario, mln. UAH	106837	112777	119287	126369	134021

The results of scenario forecasting of the indicator “Financial performance of the agrarian enterprises of Ukraine before taxing” according to the three scenarios make it possible to state the dynamic increase of the forecast indicator in the long view. Positive influence on this situation is caused by the indicators of the assets currency size of the agrarian business entity of the economy of Ukraine, the non-negotiable assets of agrarian business entities of the Ukrainian economy, agricultural products at constant prices in 2016, and gross value added of the agricultural production, which values tend to increase in the dynamics.

At the same time, when realistic, optimistic, and pessimistic scenarios are implemented, we can observe a reduction in the average number of employed people in the agrarian sector of the Ukrainian economy, direct investment (share capital) in the agrarian sector of Ukraine's economy, agricultural land in use by agricultural enterprises and citizens.

Thus, in the process of financial and economic activity, management personnel must pay particular attention to the formation of the property of agricultural enterprises

(current and noncurrent assets) and increase the production volumes that will altogether have a positive impact on the amount of gross value added.

## CONCLUSION

In terms of international integration of the Ukrainian economy, the issues of changing the direction of the standard management approach to innovation are gaining particular relevance. The cognitive and innovative economy creates a platform for the prevalence of economic methods in the managerial process.

The scenario modeling is the best approach to the planning, since its benefits are the determination and identification of the factors that affect business; handling the financial indicators, not output data, as outcomes for planning; elimination (at least partial) of the hopes that are not based on the reality; testing the reliability and flexibility of the strategy under the adverse conditions; more effective risk and uncertainty management by modeling the scenarios that are not in line with the current trends; a more creative approach; consideration of the opportunities that would otherwise be ignored [7].

Thus, it is expedient for the system of strategic management of an industry (enterprise) to be grounded in the implementation of scenario planning based on the economic and mathematical methods (e.g., adaptive). These methods will allow identifying external and internal risks; substantiate organizational and managerial measures by means of analytical tools (parabolas (polynomials)). Their practical implementation will be achieved by taking multi-dimensional measures to ensure the positive development of the industry (enterprise).

## REFERENCES

- [1] Baldzhy M.D. Application of the scenario approach for carrying out the forecast research at enterprises. Scientific bulletin of Uzhhorod University. series "Economics". Vol. 2 (46). pp. 161–165, 2015.
- [2] Nazarenko, I.; Oriekhova, A. Diagnostics of monetary assets of Ukrainian agribusiness entities: relevance, peculiarities, and the process of algorithm construction. Journal of Environmental Management and Tourism, v. 8, n. 7, pp. 1373-1380, 2018. URL: <https://journals.aserspublishing.eu/jemt/article/view/1773>
- [3] Lindgren M., Bandhold H. Scenario planning: the link between the future and the strategy. M.: CJSC Olympus-Business, 256 p, 2009.
- [4] Lukashin Y.P. Adaptive methods of the short-term forecast of the time series. M.: Finance and statistics, 416 p, 2003.
- [5] Robert G. Brown, Richard F. Meyer and D.A. D'Esopo *Operations Research* Vol. 9, No. 5 (Sep. - Oct., 1961), pp. 673-687 Available from: [https://www.researchgate.net/publication/242930521\\_The\\_Fundamental\\_Theorem\\_of\\_Exponential\\_Smoothing](https://www.researchgate.net/publication/242930521_The_Fundamental_Theorem_of_Exponential_Smoothing) [accessed Oct 07 2019].
- [6] Kosovtseva T.R., Byelyaev V.V. Technologies for processing the economic information. Adaptive forecast methods. Textbook. SPb: Universitet ITMO, 31 p, 2016.
- [7] Davydova O.Y. Scenario modeling is the best approach to planning. Global and national economic problems. vol. 2. pp. 493 – 498, 2014.