MYKOLAS ROMERIS UNIVERSITY

ISSN 1822-8038 (online)
INTELLECTUAL ECONOMICS
2019, No. 13(2)

SCENARIO MODELING OF FINANCIAL RESOURCES AT THE ENTERPRISE

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DOI: 10.13165/IE-19-13-2-05

Abstract: *It's proved that one of the main factors of effective activity of agrarian enterprises is the effective scenario planning, which would ensure qualitative and most complete modeling of the development options of the enterprise. A focused strategy is a prerequisite for ensuring strong market positions of the company and achieving its high financial performance in the long run. The aim of the work is to study the scenario approach as a method for managing the development of agrarian enterprises. The authors formulated the main uncertainties that have an impact on the future development of agrarian enterprises by using the scenario approach. The developed scenario is the preliminary information on the basis of which further work is performed on forecasting of the main indicators of the production activity of agrarian corporations or the development of an information project option. It enables the presentation of a complex problem, provides a transition to a formal image of the system in the form of charts, tables for conducting expert surveys and other methods of system analysis.*

Keywords: *screenwriting, planning, scenario modeling, analysis, strategy.*

Introduction

Modern reformatory, scientifically grounded methods of managing the finances of business entities provide for the consideration of advanced economic laws of governance, the reasoning system for the formation, distribution and use of funds, a clear system of organization of financial management, the use of economics and mathematical methods and computer technologies (Bakaev L., 2005, Vovk V., 2007).

Scenario planning is an approach to studying and monitoring the dynamic changes in the institutional environment and its likely future impacts on the functioning and further development of a particular economic system (industry) or individual entity.

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The basis of the scenario approach is the selection and analysis of the main driving forces of the subject's development, the goal of which is the most complete identification and identification of both existing tendencies and those that are envisaged in the external and internal environment.

There is no single approach to understanding the essence of scenario modeling in the scientific literature. However, scenario planning is widely used by Western corporations and has a success.

P. Schoemaker (Schoemaker, P., 1995) P. Shoemaker considers script planning as "a rational method of representing probable options in the future, in which they will be able to implement a solution adopted by the organization ...".

According to G. Ringland (Ringland, G., 2008) «The scenario approach is a set of processes that allow you to raise the quality of reasonable assumptions and make it possible to understand what the consequences can be if you risk and act in accordance with these assumptions and make it possible to understand in which cases there is a justifiable risk».

Materials and methods

The toolkit for optimizing financial management is complex and multifaceted.

Mathematical modeling of the financial processes of an enterprise can be presented as a set of tasks, the solution of which should be carried out in several stages (Babenko V., 2017; Davydenko N., Wasilewska N., 2018). It is assumed that the solution is implemented on six levels of a detailed integrated management system (IMS) of business processes. At the upper level, the goal (main targets) of the realized development is formalized (IMS). The next step is to carry out management functions and tasks that can be detailed for each decision maker. In the general case, the task of constructing a management structure in terms of an integrated management system can be represented by the following set of information (< A, B, C, D, F, G, K, W >), where:

A – a set of production goals and achievement of planned profit;

B – a set of tasks implemented by an integrated management system;

C – a set of management functions implemented by an integrated management system;

D – a set of control objects;

F – a set of business processes;

G – a set of people who makes decisions and a hierarchy of management;

K – a set of criteria that provide performance evaluation;

W – a set of alternative options for a management structure implemented by the functions of an integrated management system.

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At this stage, it is also necessary to form the essence of the problem, the preconditions and accepted assumptions. It is necessary to highlight the most important features and properties of the object being modeled, to study its structure and the relationship of its elements, at least in advance to formulate hypotheses that explain its potential behavior and development in time.

This is the stage of formalizing the problem under study, that is, its expression in the form of specific mathematical dependencies. In turn, the construction of the model is divided into several stages. At first, the type of EMM is determined, the possibilities of its application in this problem are studied, a specific list of variables and constraints, parameters and the form of interconnections are specified. If an object has a complex structure, several different-dimensional models are developed. At the same time, each model highlights only individual parts of the object and may be an input for another, etc.

If you use a model that relates to a well-studied class, then the main thing is the substantiated assumption of the use of primary data. There is also a situation where a mathematical structure that was previously unknown was formed in the same way.

At this stage, mathematical analysis of the model is carried out, the general properties of the model are revealed through its possible solutions. In this case, it is important to prove the existence of a solution to the formulated problem. An analytical study shows that not the only solution is what variables can be included in the decision, in what limits they can change, which tendencies of these changes, etc. (Zagorodniy V., Kadievsky V., 2007).

$$q_j^{min} \leq x_j \leq q_j^{max}$$

The third stage of simulation is the most complex one - it is the preparation of the information support of EMM. EMM imposes harsh conditions on the information system, while one must keep in mind not only the creation of information of the required quality but also minimize the cost of forming information arrays.

The third stage consists in transferring the knowledge from the model to the original. As a result, we form a plurality of knowledge about the initial object, while moving from the language of the model to the original language. And this is only possible if the result is consistent with the signs of current (ie, adequacy).

The fourth stage also includes a numerical solution of the economic-mathematical model. The biggest difficulty is the submission of the dimension of the nxm problem, which is usually multivariate, which is the basis for developing scenarios for the further development of financial activity of enterprises.

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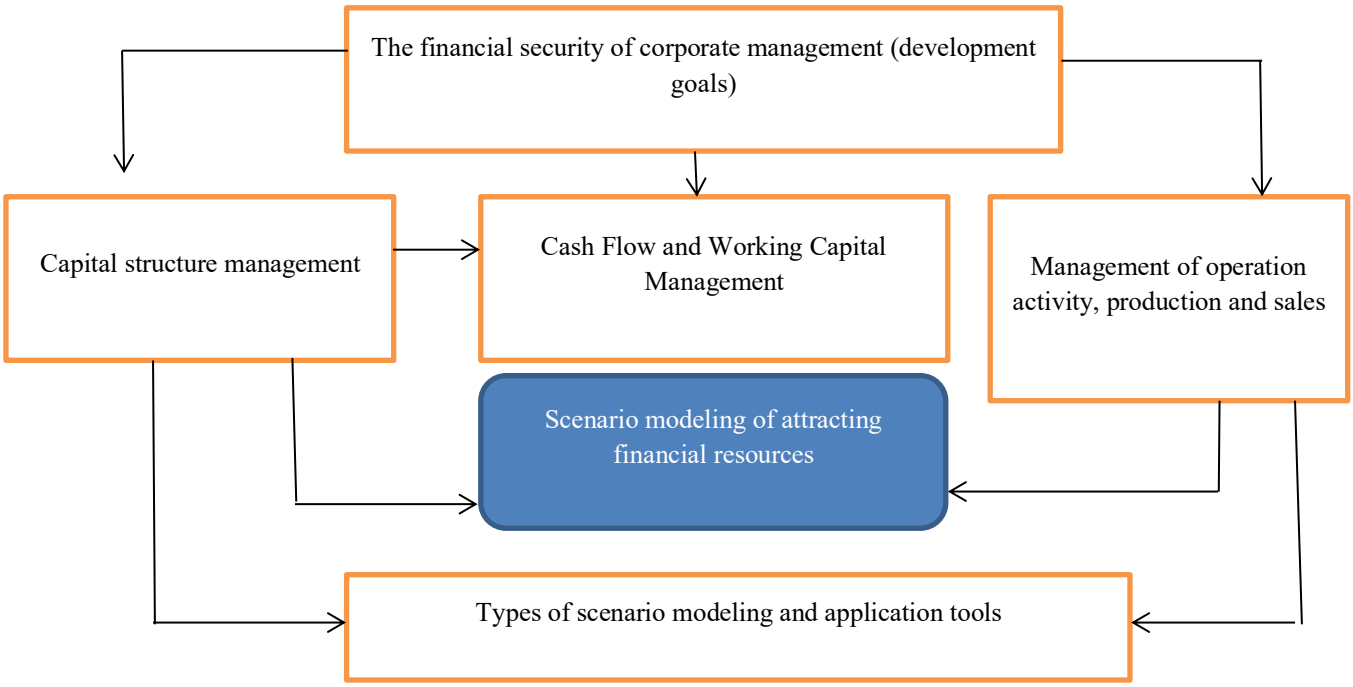

Fig. 1. Interconnection of scenario modeling elements of economic activity of enterprises

*(*created by the author)*

The fifth stage covers the analysis of the obtained numerical results and their application. At this stage, the feasibility and completeness of the modeling results and their application both in practical activity and in order to improve the model itself, as an adequate system of interconnections, the realization of which ensures the goal of development (Fig. 1).

The methodology of forming a financial strategy of an enterprise includes the substantiation and development of such principles of operation of the implementation, which would allow interested parties to effectively solve identified problems. The main principles of modeling the financial strategy of agrarian corporations are to ensure the adopted strategy for their sustainable development and base on the theoretical model of financial strategy, monitor of the organizational structure of the object and changes in it, choose alternative financial strategy alternative from several predicted scenarios.

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P. Schwartz arranged a list of tasks to be solved in the development of scenarios (stages of scenario analysis) (Schwartz P., 1991)

1) Determine the main issue of the study or the required decision;

2) Identify key forces in the local environment;

3) Identify the main driving forces;

4) The highlighted factors ranked by the degree of influence and the associated uncertainty;

5) Selection of scripts development logic;

6) Specify the scenarios;

7) Assess the consequences of their implementation.

Important in shaping the company's financial strategy is the principle of "the ratio of the term of receipt and use of cash", which is very relevant for the agrarian sector, which is characterized by uneven cash flow due to seasonality of production, is taken into account. Thus, a stable state of any economic system is possible only with the timely financing of necessary expenses to ensure effective functioning and further development. The implementation of this premise, which involves the balance of cash flows, is one of the main requirements for financial planning in any agrarian corporation. Accordingly, ensuring the balance of cash flows both in volume and in terms of generation will allow maintaining the financial stability of the entity through the formation of an optimal structure of capital and assets, an adequate level of financing of investment needs at the expense of own and borrowed funds.

Results and discussion

The financial strategy of agrarian corporations determines ways of attracting, accumulating and directing the expenses of financial resources. It is necessary to organize the preparation of the procedure for forming the strategy, up to the interviews with the company's management personnel, etc.

According to G. Hemel (Hamel G, 2000), increasing the sustainability of the economic system requires careful analysis and bold decisions. it involves the development of strategies and the most profound thinking of the problem. That is, in financial planning, there is a problem that has two main aspects that are related to the need:

calculation of indicators of a real financial plan, respectively, it is necessary to apply formal methods and models;

prediction of future states of a changing environment is possible only with the use of informal methods of analysis.

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An important part of the modeling of a financial strategy is the definition and implementation of the sequence of this process. The stages of modeling the financial strategy of the company are as follows:

1. Description of the company as an open dynamic system is carried out with taking into account the influence on it of the factors of external and internal environment. Based on the analysis of the state of the agrarian corporation, one needs to get a picture of the means and opportunities to assess their positive and negative aspects to establish the capacity of the existing financial structure and the direction of its development. It is important to determine the boundaries of the enterprise in various spheres of market economy, analysis of socio-economic (including financial) potential of the enterprise, analysis of the market of products in the area of management, determination of the position (niche) of the enterprise.

2. Definition of strategic goals. It is important to consider different types of strategic goals. Briefly, they can be represented as preserving the existing positions of the company in the former markets in the new economic conditions, increasing the volume of sales of products by changing the proportions between them and changing the geography of markets, the growth of sales of products through the development of new species while preserving the geography of markets, reducing the volume of sales of products for account of the curtailment of the release of some of them.

3. Development of various variants of the financial strategy in accordance with the objectives of the enterprise and taking into account the analysis of its potential, which should result in the desired change in the financial situation of the enterprise.

4. Formation of criteria for choosing options to create regulators to reduce the number of developed alternatives; most often they are in the minimum version of two selection criteria: providing the purpose of modeling and the presence of the lowest transaction costs for the implementation of the option (Vovk V., 2007).

5. Choose the best version of the model script. It is important to methodically substantially create a base for choosing a strategy option. Strategies must be evaluated according to the following criteria: degree of achievement of the goal of the enterprise; economic efficiency (result); reliability of implementation; social and environmental acceptability; technological feasibility.

6. Detailing of the selected variant of the model of financial strategy is carried out by bringing the general model to the level of filling its executors of the development of specific programs and projects. It is important to prioritize tasks within the framework of general strategic development goals.

7. Justifying the financial strategy of enterprises as a software product. At the final stage of the formation of a financial strategy, it takes the form of a mandatory implementation of the organizational and administrative document.

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A characteristic feature of the scenarios is the identification, analysis and, as a consequence, risks management, which can significantly affect the balance of cash flows and lead to a decrease in the efficiency of financial activities of enterprises, their solvency, liquidity, etc.

M. Lindgren and H. Bandhold note that the scenario planning process should be continuous, this will reduce the risk of missed opportunities and costs incurred as the analysis of the most distant future allows you to see a large number of development opportunities and, consequently, increase the efficiency of the company's operations (Lindgren M ., Bandhold H., 2003).

That is, the developed scenario is the initial, preliminary information, on the basis of which it is possible to carry out further work on forecasting of the main indices of the production activity of agrarian enterprises or the development of an information project variant. It enables the presentation of a complex problem, provides a transition to a formal image of the system in the form of charts, tables for conducting expert surveys and other methods of system analysis.

Their achievements are realized on the basis of the economic-mathematical model, which is a reflection of the scenario approach to substantiating the choice of the function of the goal, which has the form (the baseline script and derivatives from it):

The first script (the baseline script). The internal economic aspect; indicator: revenue:

$$F_1(x) = \sum_{j=1}^{n} c_j x_j \ \max, \qquad (1)$$

The second script (the transition period of the region's economy to new conditions). Assessment of the enterprise from the point of view of the consumer; indicator: (consumer satisfaction with a certain type of goods or services):

$$F_2(x) = \sum_{j=1}^{n} b_j x_j \rightarrow max \quad (2)$$

The third script. The financial aspect and suggested indicators were developed by the author: volumes of attracted financial resources taking into account the received profit:

$$F_3(x) = \sum_{j=1}^{n} (c_j x_j - p_j x_j) \rightarrow max, (3)$$

The fourth (perspective development of the enterprise). Taking into account the innovative aspect and suggested indicators were developed by the author: прибутковість інновацій:

$$F_4(x) = \sum_{j=1}^{n} m_j x_j \rightarrow \max \quad (4)$$

The developed economic - mathematical model has restrictions:

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Restrictions on resources:

$$\sum_{j=1}^{n} a_{ij}\, x_j \le A_i \qquad (5)$$

Restrictions on the basis of technical and economic indicators:

$$\sum_{j=1}^{n} y_{rj}\, x_j \ge Y_r \qquad (6)$$

Restrictions on financial resources and volumes of attracted resources:

$$\sum_{j=1}^{n} k_{tj}\, x_j \le K_t, \qquad (7)$$

Restriction on the volume of demand:

$$d_j \le x_j \le D_j \qquad (8)$$

Restriction on Innovation Costs:

$$\sum_{j=1}^{n} v_{lj} x_j \le V_{l\,,} \qquad (9)$$

Restriction on costs to follow product quality:

$$\sum_{j=1}^{n} S_{hj}\, x_j \le S_{h,} \qquad (10)$$

where x_j- optimum desired volume of output of the j-th type, pcs.;

c_j- income from the production of a unit of the j-th type production, UAH.;

b_j- satisfaction of the consumer by j-th type of goods or services;

p_j- production costs of the unit of j-th type production, UAH.;

m_j- share of income per unit of production obtained as a result of the introduction of innovations in the production of j-th type of products, UAH.;

a_{ij}- the norm of the cost of the resource i-th type per unit of j-th type, UAH.;

A_i- the maximum allowable limit on the cost of a resource of a certain type for the production of the whole spectrum of products, UAH.;

y_r- the value of r-th indicator;

Y_r- the minimum value of a certain technical and economic indicator;

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k_j- the amount of working funds (amount of variable costs), necessary for the production of a unit of a particular product, UAH.;

K_t- the maximum amount of working funds available at the disposal of the enterprise, UAH.;

$d_j D_j$- lower and upper limits of production, pcs.;

v_l- innovation costs per unit of production on a certain technological basis or on the goods in general, UAH.;

V_l- the maximum amount of funds allocated for the innovation costs of the l-th type, pcs .;

s_h- expenses for compliance with quality of j-th type of products by h-th technological operation, UAH;

S_h- maximum amount of expenses for compliance with quality, UAH;.

As we see, the economic-mathematical model is characterized by variants (alternatives) of economic actions, the realization of which is supposed in the limitations and concepts of scenario mathematical modeling.

At the same time, variants of the development of the action stipulate the minimum costs of means of production to achieve a certain (set) goal; at these costs of funds or financial resources provide an optimal goal realization.

Such an approach leads to a rational combination of purpose and means (need and opportunity) based on the methodology of scenario modeling. The basic principles of rational actions or behavior based on scenario modeling are principles of minimization or maximization of development, assessment of the state of the functioning of objects and processes. The feature is that in this scenario modeling is carried out not within the same model and transformation of the main indicators a_{ij} b_i c_j, and by transforming the model itself into a type of restriction on sources of funds for capital investments:

$$\sum_{t \epsilon T} a_t z_t + \hat{x} - \bar{\bar{x}} = 0; \quad (11)$$

- profit that can be obtained in each year of the planning period;

$$\frac{T-t}{t} Z_0 + \frac{t}{T} Z_t - Z_t = 0; \quad (12)$$

- the total amount of profit that can be obtained in the planned period:

$$\sum_{j \epsilon I} C_j^T x_j - x^{st} - Z_t = 0; \quad (13)$$

- restrictions on obtaining long-term loans, attracted resources

$$\hat{x} \leq \mathrm{M}; \quad (14)$$

- volumes of gross output, which provides the optimal plan:

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$$\sum_{j\epsilon I} C_j^B x_j - x^B = 0; \quad (15)$$

- volumes of commodity products, which provides the optimal plan:

$$\sum_{j\epsilon I} C_j^T x_j - x^T = 0; \quad (16)$$

The second feature of scenario modeling is that the economic-mathematical model has such restrictions, which contain requirements, the conditions of which change depending on the economic consequences of production activities and the impact of environmental factors on the state of the object of economic activity (statistical or dynamic).

For the analysis of the strategic matrix of correlation dependencies for each of the studied segments (agrarian formations) were calculated: the amount of financial resources Y, received for each of them on the basis of account:

x_1 – liquidity ratio;

x_2 – coefficient of financial stability of agrarian formations.

In this case, linear and polynomial trends were used, and correlation dependencies were constructed using the Statistica6 application package (Figure 2) to determine the covariance between the volumes of financial resources and the liquidity ratios and the financial stability ratios (x_j).

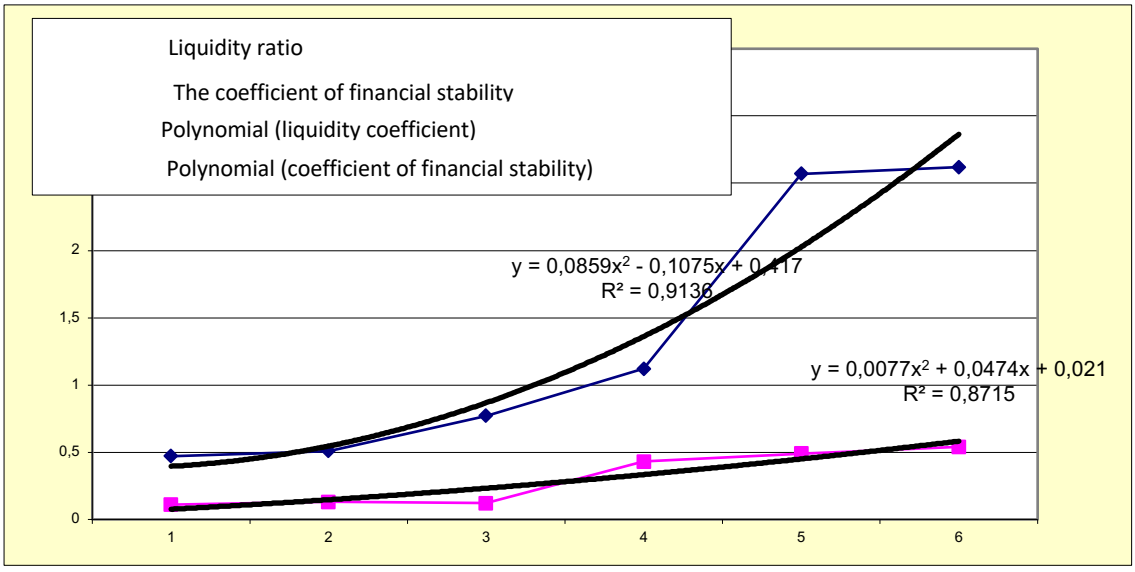

Fig 2. Optimistic forecast of development on the basis of scenario modeling for PJSC "Avangard"

For each of the nine segments (investigated corporate enterprises), two dependency equations are developed. Thus, for PJSC "Avangard" the linear correlation dependence for x1 has the form: y_1 = 04937x_1 – 0,3847, correlation coefficient R^2 = 0,8562, and the determination factor is equal to 0,9263. For x_2 the equation

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has the form $y_2 = 0,1011x_2 – 0,0507$, correlation coefficient $R^2 = 0,861$. The equation of multiple correlation has the form for conditions of linear trend: $y = 0,0859x_2 – 0,1075x_1 + 0,417$, $R^2 = 0,9136$.

For conditions of a polynomial trend, the set of the equation of dependence has the form: $y = 0,0077x_2 + 0,0474x_1 + 0,021$, the correlation coefficient is equal to $R^2 = 0,8715$, the determination coefficient is equal to 0,7595.

The values of correlation coefficients and determination indicate a close relationship between these factors and sufficiently explain the levels of fluctuations of the dependent variable.

Under these conditions, the results of the solution of models of analysis and forecast of indicators of the corporate enterprises work , enterprise management under uncertainty and risk, production potential management models become limited (right-hand sides of the equations) of the coordinating model (optimization of the production program) (fig. 3,4).

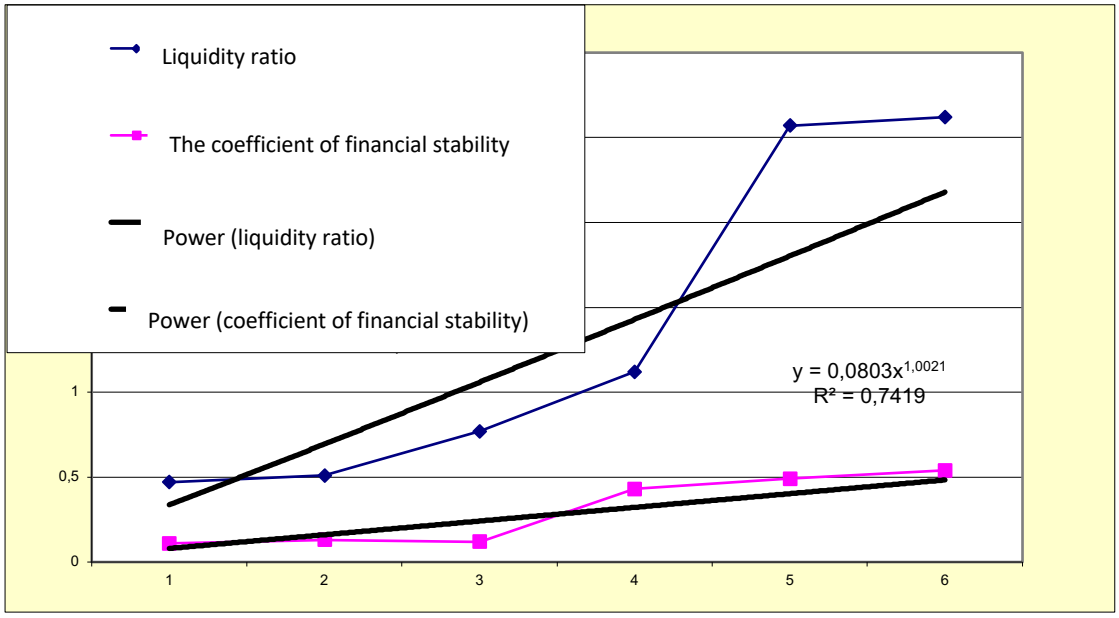

Fig. 3 Moderate development forecast based on scenario modeling for PJSC "Avangard"

As we see, the application of the scenario approach, first of all, allows us to explore the "complex" future. That is, in the planning process there is the possibility of studying existing and future uncertainties, studying and evaluating future opportunities that are potentially present, as well as finding absolutely new; as well as an opportunity to develop a flexible strategy for development, that is, using key success factors and real options of thinking, to create a strategy that will balance the circumstances and the required flexibility of decisions on existing and potential uncertainty; third, to monitor possible deviations from the planned strategy: the use of the early warning system will detect, identify the deviations that have arisen and, as a consequence, make timely corrections to the strategic plans.

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The use of financial planning based on scenario modeling for agrarian corporations will allow:

take into account possible changes in the uneven generation of cash flows in the long run;

identify the levels of uncertainty associated with various aspects of the functioning of the agrarian sector enterprises of the Ukrainian economy and also take into account the possibility of their interaction in the strategic financial plans;

use different combinations of economical and mathematical models and heuristic methods for the best possible account of the experience of functioning and development of agrarian corporations in Ukraine.

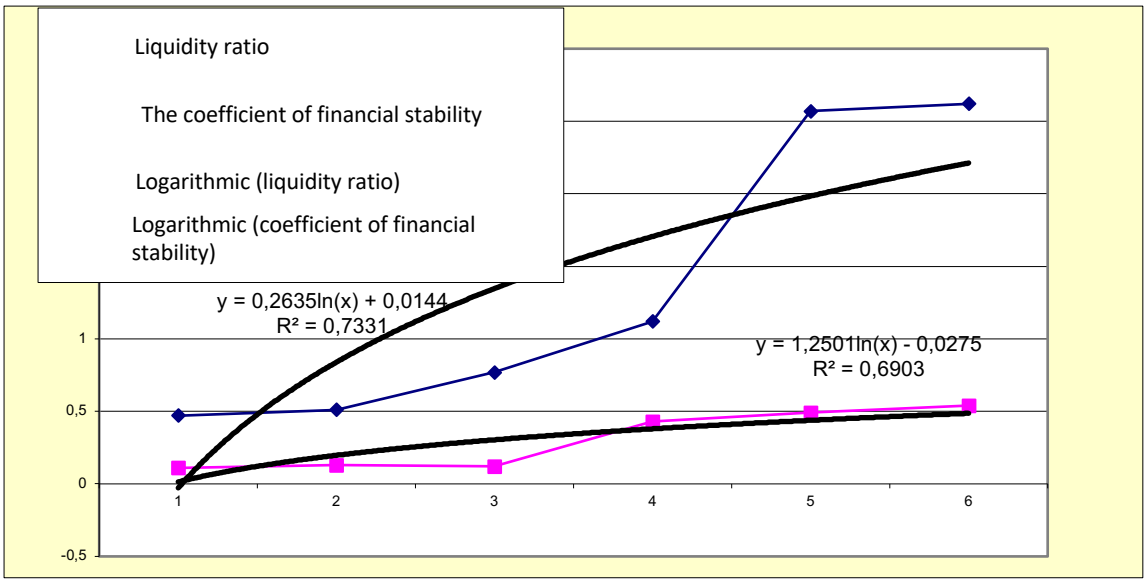

Fig.4 Pessimistic forecast for development on the basis of scenario modeling for PJSC "Avangard"

Conclusion

The results of the forecasting of economic processes lay the foundation for the correct formulation of a particular task in specific financial situations. Unfortunately, most of the traditional methods of forecasting do not correctly consider the theory, patterns and variability of the external conditions of the operation of the prediction object.

Therefore, the purpose of planning and forecasting as a management function is to timely consider and evaluate all internal and external factors that provide favorable conditions for the normal functioning and development of corporate enterprises. This activity is based on the identification and forecasting of consumer demand, the analysis and evaluation of available financial resources and the prospects of economic conditions development.

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One of the leading factors in the successful activity of agrarian units is the implementation of effective scenario planning, which would provide a qualitative and most complete simulation of the options for enterprise development.

The use of scenario modeling will allow the agrarian corporation to address the following financial planning tasks:

estimation of future cash flows by estimating the volumes of available sources of financial resources and directions of their use;

providing production, investment and financial activities with the necessary financial resources;

determination of the directions of efficient use of available capital;

Identification and mobilization of reserves for improving the efficiency of financial activities.

A focused strategy is a prerequisite for ensuring strong market positions of the enterprise and achieving their high financial performance in the long run. Therefore, effective organization of scenario activity as an element of strategic planning is considered as one of the main factors that will improve the financial support of enterprises.

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