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E-mail: Voitseshyn@gmail.com

UDC 005.334

Zakharenko Natalia
Candidate of Economic Sciences,
Associate Professor Department of Production Economics,
SHEI "Priazovskyi State Technical University"

RESEARCH OF FACTORS OF INFLUENCE ON FINANCIAL AND ECONOMIC RESULTS OF INDUSTRIAL ENTERPRISES ACTIVITY WITH THE PURPOSE OF IMPROVEMENT THE APPROACH OF ANTI-CRISIS MEASURES SYSTEM FORMATION

The article analyzes the most famous and widespread models of foreign and domestic authors predicting the probability of bankruptcy. The availability of adapted models for assessing the state of the enterprise and predicting bankruptcy is determined, which allows identify the factors influencing the financial and economic activity of industrial enterprises. The complexity of the choice of the forecast model is due to the great variety of crisis phenomena and the need to respond to them with the obligatory consideration of the enterprises' own capabilities. Thus, it became necessary, within the framework of the application of anti-crisis management measures at industrial enterprises, to develop an imitative forecast model that takes into account the individual features of enterprise development, which allows obtain reliable results for the formation of anti-crisis measures. In this regard, an imitation predictive model based on the use of statistical data of metallurgical enterprises was proposed. Its testing confirmed the reliability of the results obtained.

Keywords: crisis *management, models of bankruptcy, industrial enterprise, forecasting system, crisis, imitation predictive model.*

ДОСЛІДЖЕННЯ ЧИННИКІВ ВПЛИВУ НА ФІНАНСОВО-ЕКОНОМІЧНІ РЕЗУЛЬТАТИ ДІЯЛЬНОСТІ ПРОМИСЛОВИХ ПІДПРИЄМСТВ ДЛЯ ВДОСКОНАЛЕННЯ СИСТЕМНОГО ФОРМУВАННЯ АНТИКРИЗОВИХ ЗАХОДІВ

Захаренко Н.С.

У статті проаналізовано найвідоміші та поширені моделі зарубіжних і вітчизняних авторів, які прогнозують імовірність банкрутства. Визначено наявність адаптованих моделей для оцінки стану підприємства та прогнозування банкрутства, що дає змогу визначити чинники, які впливають на фінансово-господарську діяльність промислових підприємств. На основі означених моделей побудовано та досліджено стан вибраних промислових підприємств України. Детально розглянуто чинники впливу на зміну показників фінансового стану означених промислових підприємств. Виявлено складність вибору моделі прогнозу, що зумовлено великою різноманітністю кризових явищ і необхідністю відповісти на них з обов'язковим урахуванням власних можливостей підприємств. Однією з основних проблем антикризового управління під час визначення та виявлення чинників впливу на прогнозування майбутньої поведінки є спроможність дослідження причинно-наслідкових взаємозв'язків показників, які спричинили кризову ситуацію, та її механізм антикризового управління підприємством у цих умовах. Для оцінки та отримання достовірних прогнозних даних із метою формування управлінських рішень пропонується використання імітаційної економіко-математичної моделі з локальними індивідуальними блоками оптимізації показників діяльності підприємства. Результативним показником для прийняття рішення в результаті застосування даної імітаційної моделі буде значення фінансово-економічних обґрунтованих параметрів діяльності підприємства, що дасть змогу оцінити ефективність того чи іншого управлінського рішення. Таким чином, у рамках застосування антикризових заходів управління на промислових підприємствах необхідно розробити імітаційну модель прогнозу, що враховує індивідуальні особливості розвитку підприємства та дає змогу отримати достовірні результати для формування антикризових заходів, у зв'язку з чим запропоновано імітаційну прогностичну модель, що базується на використанні статистичних даних металургійних підприємств, її тестування підтвердило достовірність отриманих результатів.

Ключові слова: *антикризове управління, моделі банкрутства, промислове підприємство, система прогнозування, криза, імітаційна прогностична модель.*

ИССЛЕДОВАНИЕ ФАКТОРОВ ВЛИЯНИЯ НА ФИНАНСОВО-ЭКОНОМИЧЕСКИЕ РЕЗУЛЬТАТЫ ДЕЯТЕЛЬНОСТИ ПРОМЫШЛЕННЫХ ПРЕДПРИЯТИЙ ДЛЯ СОВЕРШЕНСТВОВАНИЯ СИСТЕМНОГО ФОРМИРОВАНИЯ АНТИКРИЗИСНЫХ МЕРОПРИЯТИЙ

Захаренко Н.С.

В статье проанализированы известные и распространенные модели зарубежных и отечественных авторов для прогнозирования вероятности банкротства. Определено наличие адаптированных моделей для оценки состояния предприятия и прогнозирования банкротства, что позволяет определить факторы, влияющие на финансово-хозяйственную деятельность промышленных предприятий. Сложность выбора модели прогноза обусловлена большим разнообразием кризисных явлений и необходимостью реагирования на них с учетом собственных возможностей предприятий. Таким образом, в рамках применения антикризисных мер управления на промышленных предприятиях проявляется необходимость разработки имитационной модели прогноза, учитывающей индивидуальные особенности развития предприятия, что позволяет получить достоверные результаты для формирования антикризисных мер. В связи с этим была предложена имитационная прогностическая модель, базирующаяся на использовании статистических данных металлургических предприятий, ее тестирование подтвердило достоверность полученных результатов.

Ключевые *слова: антикризисное управление, модели банкротства, промышленное предприятие, система прогнозирования, кризис, имитационная прогностическая модель.*

Problem statement. Today, Ukraine is in the most difficult conditions of development for all the years of its independence. Manifestation of crisis phenomena from the instability of the financial state of the state to the conduct of hostilities on the territory of industrialized regions. This demonstrates the need to develop and use crisis management for industrial enterprises. The effectiveness of the development and conduct of crisis management of industrial enterprises depends on a number of external and internal factors.

Analysis of recent research and publications. Issues of evaluation of financial and economic results of industrial enterprises are investigated in the works of leading scientists such as A. Matviychuka, A. Tereshchenko, A. Tkachenko, T. Logutovoi, R. Suyfulina, G. Kadykova and others. Research results of financial and economic activities of industrial enterprises are applied in nature. However, the existing studies have reflected not all aspects of improving the approach of anti-crisis measures system formation.

Setting objectives. Research of factors influencing the financial and economic results of industrial enterprises to improve the approach of anti-crisis measure system formation.

Presentation of the main material. The current situation in Ukraine has led to an increase in the number of enterprises that need to develop and implement anti-crisis measures. This requires Ukrainian companies to redirect

cash flows, to seek new additional sources of financing and to use methods of crisis management. So, an enterprise that is in a crisis state, in the period of its adaptation to the existing conditions, often contributes independently to the complication of the situation. At the same time, the time for conducting a complete complex diagnosis of financial and economic activity indicators has already been lost in many cases and, therefore, affects the overall financial and economic activities of the enterprise. Integrated assessment covers the maximum set of interrelated indicators that can reflect the manifestation of certain crisis factors. Therefore, the measures aimed at solving the problem of the fullest and timely analysis involve the use of a number of methods and tools at the enterprise.

As for methods and tools, we can note that their use is quite common. In the world practice there is a large number of developed methods for assessing the financial stability of enterprises, determining the level of solvency, identifying a propensity for crisis phenomena or calculating the probability of bankruptcy of an enterprise. It should be noted that many authors of these methods of diagnosing the likelihood of a financial crisis tend to predict it long before the appearance of any signs. On the other hand, the application of world experience for the model of development of Ukrainian industrial enterprises during the crisis is not optimal due to the influence of such endogenous factors, but they differ significantly from exogenous ones.

The most famous world authors of the main models of bankruptcy forecasting are:

E. Altman presented a Z score model in 1968 built with the help of multiplicative discriminant analysis to predict the probability of bankruptcy of listed companies. In 1983, a model was published for enterprises which shares were not quoted on the exchange [1]. Despite widespread use of the proposed model in the world practice its use is difficult at Ukrainian enterprises. This is due to the development of the Ukrainian stock market, low-quality information base of financial reporting.

G.R. Lis developed and introduced his model of forecasting the bankruptcy of British enterprises in 1972. The disadvantage of using this model for Ukrainian enterprises is the use of the indicator of profit from sales without taking into account the tax component and financial activities.

In 1977 R. Tuffler introduced a four-factor model for forecasting bankruptcy, developed on the basis of a comparative data analysis of bankrupt and solvent enterprises using statistical analysis to construct a discriminant model. The use of this prediction model for Ukrainian enterprises in most cases is impossible, since it was developed by the author to assess the performance of corporations with different capital structures.

In 1978 on the basis of E. Altman's developments Springate proposed his model for predicting bankruptcy of enterprises. Approbation of the results of this model was carried out using data from enterprises in the US and Canada and showed a probability of more than 92% [2]. To calculate the probability of bankruptcy of Ukrainian enterprises, this model is one of the permissible, but with a smaller share of probability forecasts.

In 1984 D. Fulmer introduced a regression nine-factor model for the diagnosis of bankruptcy risk. The advantage of this model is the ability to take into account and evaluate various financial indicators of the enterprise. This model was expected to be used in the banking sector to assess the performance of foreign companies. When using H-score for Ukrainian enterprises, it is recommended to take into account the error for the national currency [3].

They were R.S. Saifulin and G. Kadykov who proposed in 1999 the calculation of the rating number on the basis of the four-factor model for predicting the bankruptcy of enterprises. The universality of this model, in the authors' opinion, lies in the possibility of using analytical indicators for enterprises of any scale of various branches of management [4].

Based on the calculation of the rating number of Saifulin-Kadykov model, a rapid assessment of the three selected metallurgical enterprises of Ukraine.

The performed calculations confirmed the possibility of using the reduced R-model for assessing the financial condition of Ukrainian enterprises. The initial data on the activities of enterprises used in the calculations correspond to the real financial statements of enterprises. Graphic dependencies based on the R-model were constructed. The graphical dependencies are shown in Fig. 1.

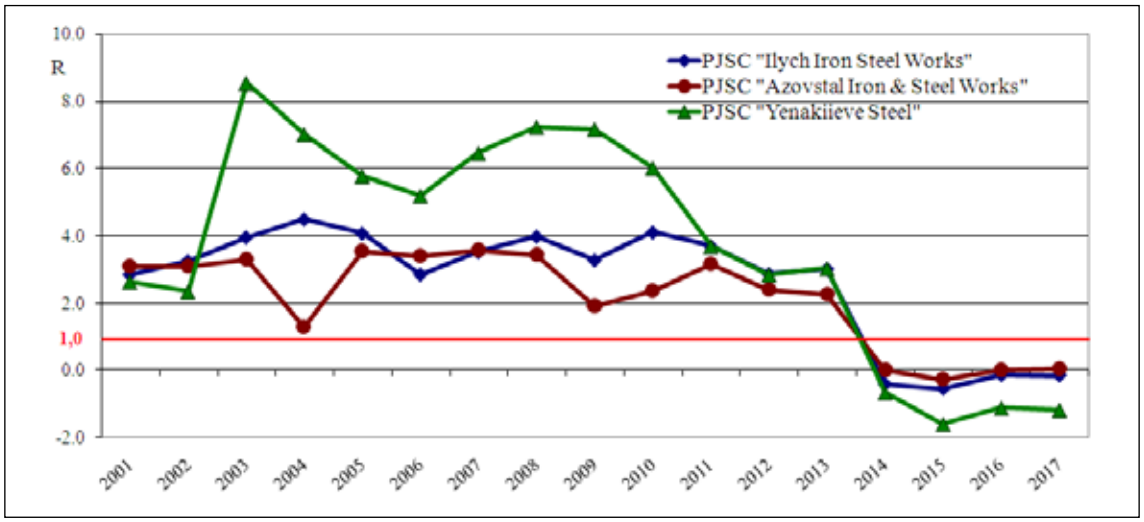

Fig. 1. Dynamics of the rating index of Saifulin-Kadykov's R-model

Source: built on the basis of [5]

The analysis of these dependencies and the ranking index R = 1 allows us to conclude that during 2003-2016 all three metallurgical enterprises were in a satisfactory condition. The results of rapid assessment of the financial condition and the determination of the probability of bankruptcy of these metallurgical enterprises have demonstrated the impact of crisis situations.

To verify the reliability of the obtained financial results of the enterprise and to identify possible bankruptcy of the examined metallurgical enterprises, it is advisable to conduct a number of additional assessments based on other models, the use of which is possible for Ukrainian enterprises.

R-model ISAE (Irkutsk State Academy of Economics) presented in 1997 was developed on the basis of a data synthesis based on thirteen indicators. Based on statistical data processing, a four-factor model was proposed [4].

The use of this R-model is possible for Ukrainian enterprises, as the calculation of the obtained ratio is possible on the basis of financial reporting standards in Ukraine.

The calculation was carried out for above mentioned three metallurgical enterprises of Ukraine on the basis of data on their activities for 2003-2016. The results were compared on the basis of the graphical dependencies (Fig. 2).

The analysis of enterprises' data and the determination of bankruptcy probability with the help of two models presented by scientists and adapted to the conditions of Ukrainian enterprises, showed radically different results. It should be noted that the presented models are complex in the interpretation of the effective indicator, do not take into account the industrial characteristics of the enterprises and have revealed a strong dependence of the accuracy of the results obtained from the initial data.

To obtain an objective assessment of the state of the above mentioned Ukrainian enterprises and to identify the likelihood of their bankruptcy, a similar analysis was conducted on the basis of models proposed by Ukrainian scientists.

In 2003, A.A. Tereshchenko proposed a universal discriminant model for predicting bankruptcy [6-7].

Based on Tereshchenko A. forecasting model of bankruptcy graphic dependencies were constructed to compare the results of the activities of metallurgical enterprises for 2003-2016. (Fig. 3).

In the proposed Tereshchenko A. model the indicator of the change and influence of the company's equity capital on the probability of the company's inclination to bankruptcy was not taken into account, therefore, it does not give a full possible assessment of the enterprise's state.

In 2006 A. Matviychuk proposed a discriminant model for assessing the probability of bankruptcy for Ukrainian enterprises [8].

Using the statistical data of the examined metallurgical enterprises, an assessment of their activities was carried out, the probability of bankruptcy was determined and graphic dependencies were constructed on the basis of Matviychuk A. model of. (Fig. 4).

The above multivariate models testify to the existence of various areas of research of enterprises' financial state with the purpose of predicting the threat of bankruptcy. These researches indicate the possibility of using these models for the purpose of comprehensive assessment of the influence of factors on changes in the financial stability of enterprises. At the same time it was noted that all the indicators of bankruptcy forecasting models presented and calculated showed different values, on the basis of which the relevant conclusions were drawn, although they are partially opposite.

The comparative analysis of the reliability of models has shown that some authors of models use the same or similar relative indicators in determining the effective indicator, but the results obtained are characterized by a high level of unreliability or insignificant differences. The complexity of the choice of anti-crisis management measures in industrial enterprises is due to the great variety of crisis phenomena and the need for prompt response to them with the obligatory consideration of the enterprises' own capabilities.

Thus, there is a need within the framework of applying anti-crisis management measures at industrial enterprises, developing an imitative predictive model that can take into account individual features of enterprise development, which allows obtaining reliable results for the formation of anti-crisis measures.

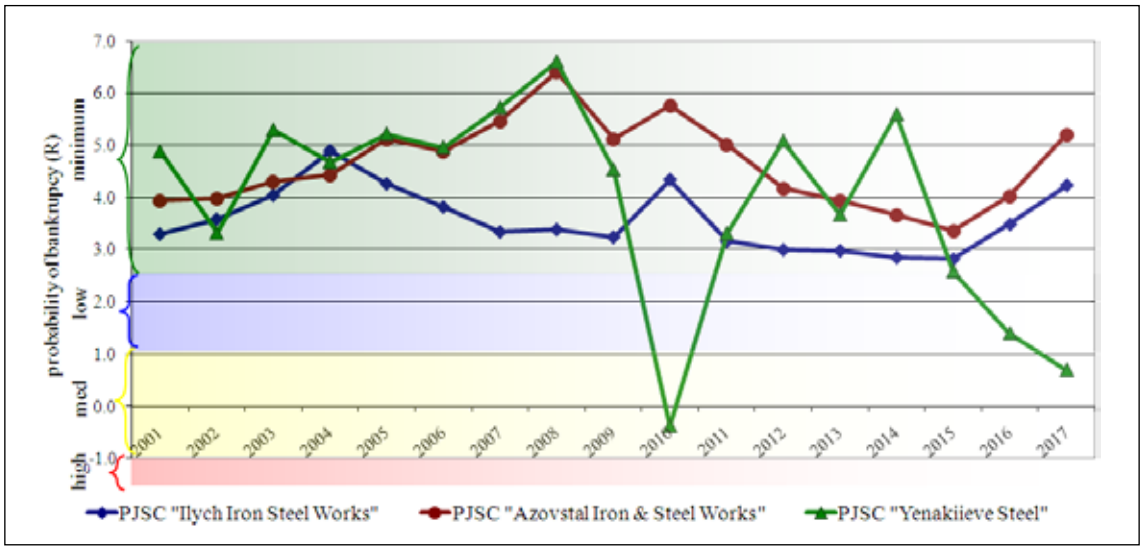

Fig. 2. Dynamics of the rating index of the R-model ISAE

Source: built on the basis of [5]

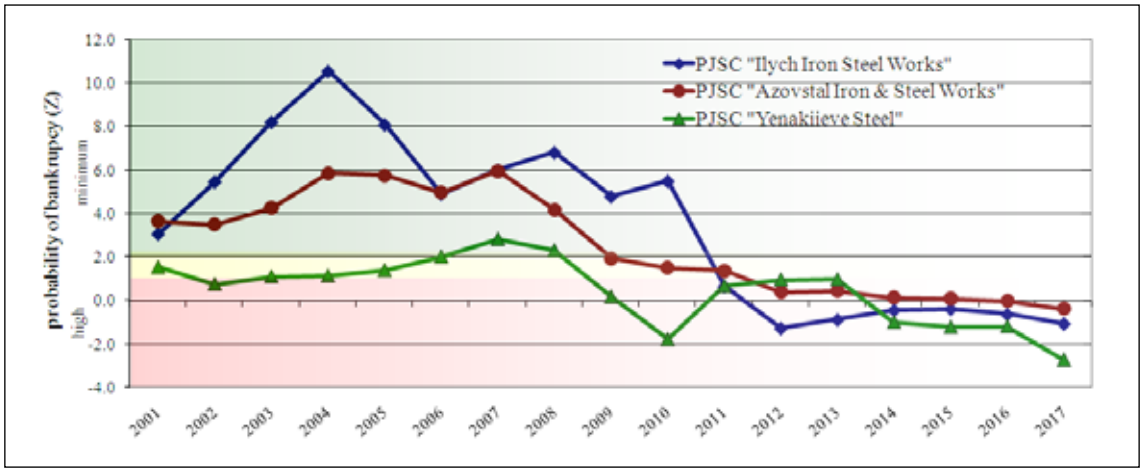

Fig. 3. Dynamics of the rating index of Tereshchenko A. forecasting model of bankruptcy

Source: built on the basis of [5]

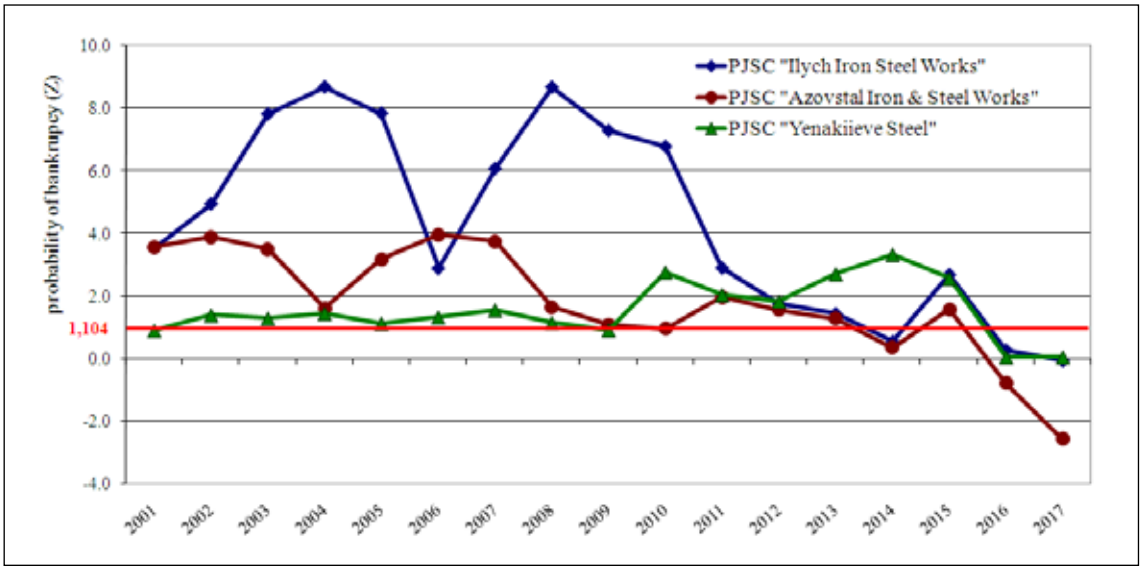

Fig. 4. Dynamics of the rating index of Matviychuk A. forecasting model of bankruptcy

Source: built on the basis of [5]

The analysis of the activities of the above mentioned metallurgical enterprises in Ukraine, the assessment of their performance on the basis of existing forecasting models of bankruptcy and the assessment of the financial condition of the enterprise, preparation of management recommendations for crisis management put forward the following requirements: systemic, flexibility, responsiveness, the ability to take into account various development scenarios, obtaining reliable predictive results. These requirements are satisfied by economic and mathematical modeling on the basis of the method of simulation. It allows to solve a wide range of problems of analysis and management of industrial enterprises. Thus, it is proposed to build an imitation predictive model of crisis management at industrial enterprises.

Simulation predictive modeling of industrial enterprises involves the construction and formalization of complex interrelations of the enterprise's work and the changing elements of its activities in the course of anti-crisis management in different areas: passive and active. The most suitable concept is the system dynamics developed for industrial enterprises by J. Forrester. This concept provides a visualization of cause-effect relationships and makes it possible to classify and rank variables in accordance with their economic content. In case of impossibility to take into account all existing relationships and factors of influence on the enterprise's activity, some indicators were averaged and aggregated. The use of system dynamics method requires the computer program to construct a numerous solution of a differential equations system, and is the basis of the model. For modeling "The Ventana Simulation Environment Vensim" was used. The application of this software is justified by the availability of a free version for the use of research purposes, has a number of built-in necessary functions and supports continuous modeling.

Fig. 5 represents an imitation prediction model of crisis management at an industrial enterprise.

The simulation forecast model, developed on the basis of a flow diagram, allows:

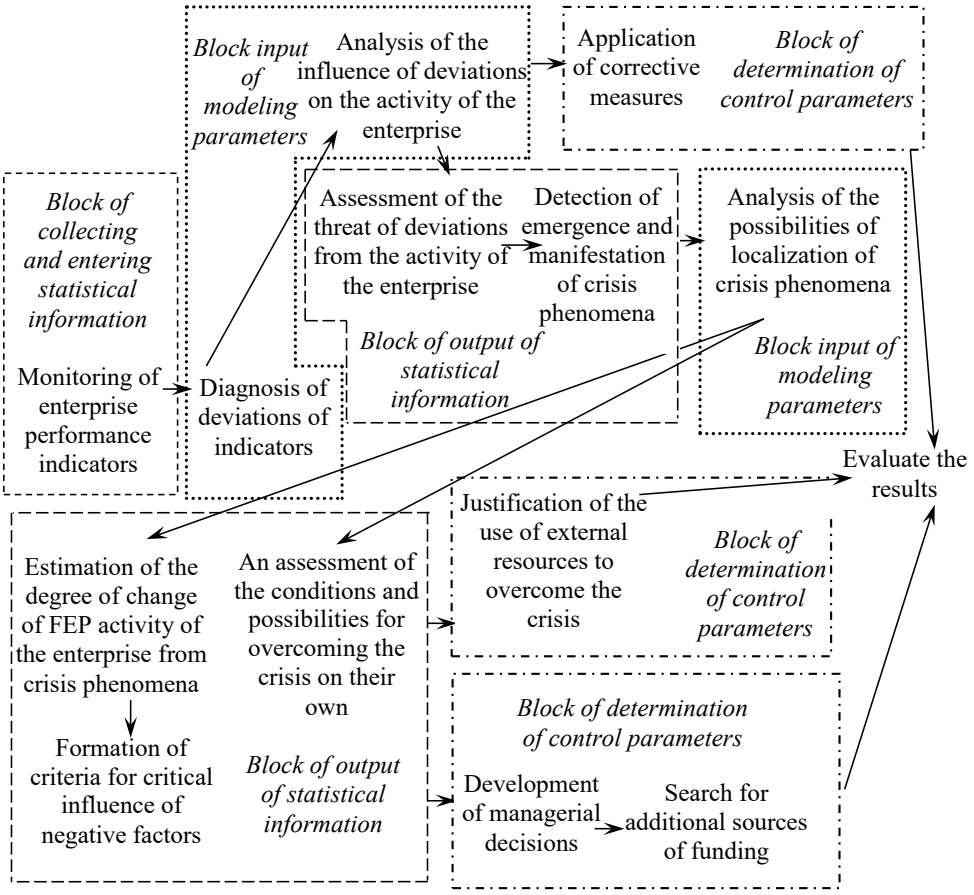

Fig. 5. Imitation predictive model of crisis management at an industrial enterprise

– visually determine the cause-effect relationships between the model variables;

– classify the ways of crisis management and determine the stages of development and implementation of anti-crisis measures;

– forecast the development trend of the enterprise and determine the factors of manifestation of the crisis phenomena.

Conclusions. Currently, the methods of planning the experiment along with the methods of statistics are becoming more widespread. The methods of planning the experiment are applicable to objects that have good reproducibility of the results. We believe that the object has the necessary degree of reproducibility if the differences in the results of the experiments reproduced in intervals will be less or relatively large in magnitude with the experimental error.

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E-mail: zakharenko.natali@gmail.com