http://doi.org/10.35784/iapgos.3249 *received: 6.11.2022 | revised: 3.12.2022 | accepted: 15.12.2022 | available online: 30.12.2022*

FORECASTING BUSINESS PROCESSES IN THE MANAGEMENT SYSTEM OF THE CORPORATION

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Abstract. *One of the key issues in corporate management is business process management. That is why the greatest interest for company analysts is the issue of effective forecasting of business processes. In today's digitalization of the economy, integration and automation of business processes have become the main priorities for achieving efficiency and effectiveness of companies, and especially for effective management decisions. This problem can be solved with the help of integrated systems, which are tools for effective management decisions, modeling and optimization of business processes. The article provides an analytical review of known forecasting methods and identifies the features of their application, analyzes the advantages and disadvantages that will take them into account in modeling the company and promote economic development, competitiveness and optimize business processes.*

Keywords: corporation, management, forecasting, business process, integrated system, making effective management decisions

PROGNOZOWANIE PROCESÓW BIZNESOWYCH W SYSTEMIE ZARZĄDZANIA KORPORACJĄ

Streszczenie. *Jednym z kluczowych zagadnień w zarządzaniu przedsiębiorstwem jest zarządzanie procesami biznesowymi. Dlatego też największym zainteresowaniem analityków firmowych jest kwestia skutecznego prognozowania procesów biznesowych. W dobie dzisiejszej cyfryzacji gospodarki integracja i automatyzacja procesów biznesowych stały się głównymi priorytetami dla osiągnięcia sprawności i efektywności przedsiębiorstw, a przede wszystkim dla skutecznych decyzji zarządczych. Problem ten można rozwiązać za pomocą systemów zintegrowanych, które są narzędziami do podejmowania skutecznych decyzji zarządczych, modelowania i optymalizacji procesów biznesowych. W artykule dokonano analitycznego przeglądu znanych metod prognozowania i wskazano cechy ich zastosowania, przeanalizowano zalety i wady, które pozwolą uwzględnić je w modelowaniu przedsiębiorstwa i wspierać rozwój gospodarczy, konkurencyjność oraz optymalizować procesy biznesowe.*

Słowa kluczowe: korporacja, zarządzanie, prognozowanie, proces biznesowy, zintegrowany system, podejmowanie efektywnych decyzji zarządczych

Introduction

The mechanism of effective corporate governance will expand the opportunities for investing in business, increase the productivity and competitiveness of companies. The course of the world economy (including the Ukrainian one) on digitalization will help to rethink traditional ways in organizing business and allow realizing the advantages of modern information technologies. Today's functioning of companies is due to the special attention given to management processes. And one of the main warehouse management processes is business processes. For this very reason, the greatest interest for analyst companies is to become the basis for effective management of business processes, based on their forecasts. In addition, in the business environment, there is an increase in the role of victory and the promotion of modern methods to improve these business processes.

Nutrition for the development of corporate governance in the rest of the world is widely discussed in the international and domestic business environment. Researched nutrition, which is related to corporate governance and system optimization [4, 6–8], dedicated their scientific practice to such universities, as Ross S., Westerfield R., Jordan B., Van Horne D., Ihnatyeva I. A., Hafonova O. I., Mostenska T. L., Novak V. O. [14, 21, 25, 28] etc. Previous methods of forecasting in management companies were used by the following scientists: Vanderput N., Wilson J., Meskon M., Hanke J., Mitelhammer R., Bakanov M. I., Fisenko M. A. and insh [13, 20]. This practice is the basis for the development and implementation of new direct and flexible methods for modeling the economic activity of companies based on effective forecasting methods [5, 12, 16, 24].

Creating an effective and efficient corporate governance system is a multifaceted management system, which consists of operating in a reliable legal field, development of investment processes, implementation of corporate governance standards, use of positive experience of the world, their concepts and technologies, implementation of integrated management systems and others.

1. Formulation of the problem

One of the key problems in corporate management is business process management, where forecasting is an integral part [11, 13]. In today's economy, forecasting the financial performance of companies is a rather complex process. At the same time, the experience of countries with developed economies shows the need for financial planning in companies and corporations, as the effectiveness of economic activity depends primarily on management strategy. A well-designed strategy avoids significant miscalculations and associated costs. This is achieved by being able not only to assess the current financial and economic condition of the company, but also to predict the future taking into account the state of the market, business activity of partners, competition and more.

Every business leader wants to make their company more efficient and profitable. A manager who thinks about the future will strive to improve his business. And modeling and forecasting business processes is one of the effective tools to improve the business management system and its indicators.

A company's business process is a set of related actions and functions that are necessary to produce a certain result that has value for external or internal consumers. The approach of business process modeling is the basis of process management of the company, when all the tasks and activities of the organization are presented in the form of a set of different processes, related and interacting with each other [13, 31]. Many experts consider this approach to be the most effective in organizing the company's activities. When we single out individual processes in the company's activities, we can achieve more efficient performance of work, as we can appoint a person responsible for the work of this process, we can plan the result and monitor the entire path to its achievement. We can also, based on this, build the most optimal system of motivation for employees working on a particular process, and thus achieve greater productivity.

The study of this problem has shown that insufficient attention is paid to the question of reasonable choice of the most optimal methods of forecasting the company's activities, which requires further research.

The purpose of the article is to study and substantiate the choice of the most optimal method for forecasting the company's activities.

2. Theoretical research

In the classical approach, all business processes can be divided into three types: basic (operational), management and supporting (or auxiliary). The main processes are those that directly bring the company a profit. These are the functions that are aimed at creating products or services of the company. Auxiliary or supportive are those that support the main business processes, make it possible to implement them. Business management processes are functions that are responsible for the management and development of the entire organization, and this includes, first of all, strategic management. Also, in order to highlight the company's business processes, you need to know that they can be of several levels, regardless of type. This is usually the upper level and lower. Top-level processes – the company's activities are described as a „top view", without going into detail. A more detailed description of the activity takes place at the lower level. The description of business processes at the first stage should be carried out on a „as is" basis. And only then, after analyzing the „bottlenecks" and identifying all the problems, apply the principle of „as it should be" or „as it should be" to the described business processes. Each dedicated business process must have the result and the input resources needed to obtain that result. Each process has its own supplier and consumer who is interested in obtaining (exit the business process). In addition, each business process has its own manager or owner – a manager who has the authority to optimize, change the business process and others. Implementing a process approach in a company can make business more transparent and predictable, manageable, controlled. When the company's processes are formalized and prescribed, the influence of the human factor decreases. Formalization and engineering of business processes form a systematic approach to process management in terms of their maximum efficiency [7, 15, 26].

A classic corporation is three levels of management, a hierarchy of decisions, regulations and procedures, accounting cycles, basic functions – accounting and control, analytics – a fact plan.

Digital corporation is a flat structure, decentralization of decisions, flexible business processes, real-time situational management, basic functions – analysis based on data (dynamic planning, sliding forecasting). The transition in corporate business process management to integrated systems is the first step towards digitalization of the company. If we consider digitalization in full, we are talking about the introduction of artificial intelligence technologies, digital money, blockchain, smart spaces, cloud technologies and others [14, 21, 27]. In the future, digital management technologies will be developed as hybrid solutions in which artificial intelligence does not replace humans, but is a partner system to reduce uncertainty and increase the effectiveness of decisions. Functions of corporate governance with components of artificial intelligence (shown in Fig. 1). Implementing forecasting tools in an integrated corporate governance system can make business more predictable, manageable and controlled.

Business Process Management – allows companies to model, forecast, automate, execute, control, measure and optimize business activities. Integrated systems of companies that allow modeling, forecasting and optimizing business processes are a tool for making effective management decisions. That is why the issues of effective management in the company are closely related to integrated management systems.

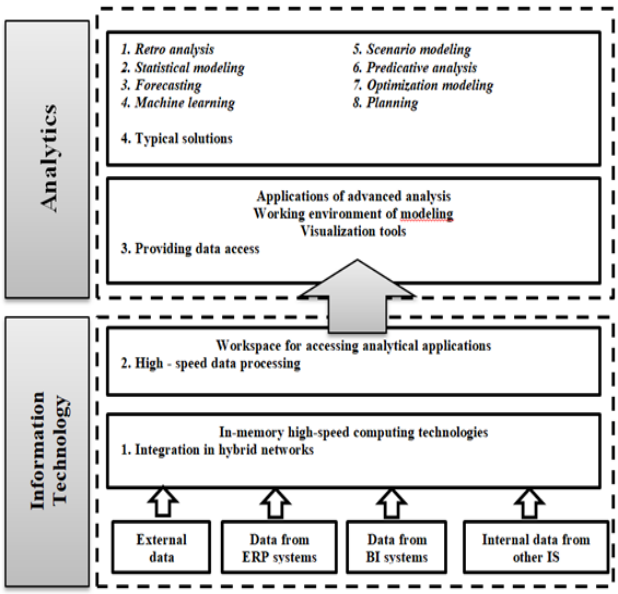

Fig. 1. Corporate governance functions with artificial intelligence components [9]

Forecasting is a necessary component of analytical modeling of business processes. In many cases, the forecasting of economic activity of the company occurs in conditions of uncertainty or chance. Therefore, to increase the efficiency of forecasting, management should identify (at the preparatory stage) those forecasting methods, the use of which is most appropriate under the given conditions. In this regard, it is important to study the known methods of forecasting, identify their advantages and disadvantages, as well as the features of application to solve a range of problems.

Forecasting the economic activity of the company is a process of scientific substantiation of possible quantitative and qualitative changes in its state in the future, as well as alternative ways to achieve the expected state [6, 14, 21, 23]. The main principles on which the forecast is based are shown in Fig. 2.

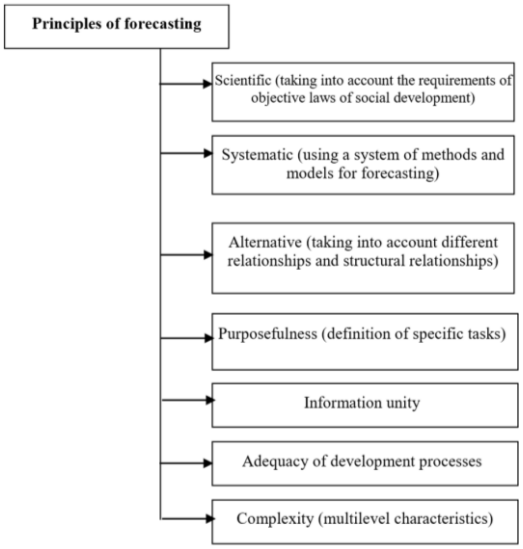

Fig. 2. Basic principles of forecasting

According to these principles, forecasts of the future state of the corporation are formed.

In practice, modern companies use different types of forecasting, the most common of which are [11, 13, 17]:

- forecasting, which is based on creative prediction of the future, using intuition,
- search forecasting, which is based on existing information and can be an extrapolation of the past into the future or one

of the alternative development options taking into account changes in the environment,
- normative-target, focused on specific goals using quality research methods.

Depending on the tasks, forecasting can be short, medium and long-term (by term), factual or heuristic (depending on available sources of information), exploratory, normative (on the topic of forecasts), passive and active (possibly influencing the future activities of the enterprise) [13, 16, 20, 29].

Consider forecasting methods to determine the features of their application in the process of modeling the economic activity of the company.

Factual methods allow you to make a detailed forecast of changes in time of individual features of the object under study or all of these features. Factual methods include extrapolation, functions, correlation and regression models (Fig. 2) [11, 13, 17].

The method of extrapolation is one of the main methods of predicting the development of complex production systems; it is based on the assumption of invariance of the factors that determine the development of the object of study. The essence of the method of extrapolation is to extend the patterns of development of the object in the past to its future [6, 13].

The method of functions refers to statistical forecasting methods based on the use of autocorrelation functions (autocorrelation – the expression of the relationship between neighboring members of the time series). The process of forecasting using autocorrelation functions is to formulate the forecasting task, determine the criteria for its solution and reflect the process of development of production system parameters over time based on time series, which allows to determine the forecast value for the long term while minimizing predictive errors [13].

Prediction using correlation models (methods) is to find mathematical formulas that characterize the statistical relationship of one indicator with another (pairwise correlation) or with a group of others (multiple correlation). A prerequisite for the possibility and feasibility of such methods is to establish the degree of reliability of correlation formulas based on logical analysis of a sufficient statistical sample [11, 13, 17, 20, 23].

Heuristic forecasting methods involve the implementation of forecasting developments using logical techniques and methodological rules of theoretical research. Specific forecasting methods for this group include two subgroups – intuitive and analytical. Among the main methods of the first group are methods of expert evaluation and „brainstorming", and the second – methods of morphological analysis, construction of „goal tree", information modeling, optimization [12, 17, 25].

In the absence of sufficient statistical information or in its unsuitability for forecasting certain phenomena, it is necessary to use the method of expert assessments. It is based on a method of collecting the necessary information, mainly through questionnaires. The expert questionnaire should be compiled in such a way that it is possible to obtain [23]:
- quantitatively unambiguous answers to the questions offered to the expert,
- formalized information on the nature of the sources of argumentation, the degree of influence of each of the sources on the expert,
- quantified by the expert assessment of the level of his knowledge of the subject proposed for analysis and conclusions.

When using the method of expert assessments, two approaches to forecasting are used: individual and group assessments. Individual assessments are that each expert gives an independent assessment in the form of an interview or an analytical note. Group assessments are based on the collective work of experts and obtaining a summary assessment from the entire group of experts involved in the forecast assessment of specific economic processes.

The „brainstorming" method is a kind of group expert assessment and consists in the creative cooperation of a certain group of experts to solve the task by way of discussion („brainstorming"). Participants in such a discussion must follow two rules of conduct [17, 20, 24]:
- do not allow criticism and negative comments on the views of opponents,
- not to deny new ideas, no matter how absurd they may seem in terms of its possible practical implementation.

The method of building a „goal tree" is used in forecasting in order to divide the main tasks into subtasks and create a system of „balanced" according to expert assessments of relationships. Interaction matrices and graph theory are widely used to select factors for the prognostic model and to construct a system of relationships [24].

A specific method of forecasting is the method of information modeling. It is based on the fact that the characteristics of mass flows of information create conditions for forecasting the development of specific objects on the basis of analysis of the maximum possible number of factors related to production and financial and economic indicators and take into account the degree of their interaction [11, 16, 24].

Causal modeling is the most complex in terms of mathematics. It is used in cases where there is more than one variable. Causal modeling is an attempt to predict what happens in similar situations by studying the statistical relationship between the factor and other variables [21, 22, 26].

For businesses, when certain circumstances do not allow the use of complex models, it is advisable to use methods of naive forecasting, which do not require significant costs and are easy to apply. Thus, in particular, in cases where it is necessary to take into account shifts in the data structure during certain periods, use the method of „moving average", which is calculated as the average of a number of elements in expression (1) [13, 20, 31]:

$$\hat{Y}_{t+1} = \frac{(Y_t + Y_{t-1} + Y_{t-2} + ... + Y_{t-k+1})}{k} \tag{1}$$

where $\hat{Y}_{t+1}$ – the average value of the elements $Y_t + Y_{t-1} + Y_{t-2} + ... + Y_{t-k+1}$ for k – periods of time.

In cases where the data have a trend (α), it is advisable to use exponential Holt smoothing (2) [13, 26]:

$$L_i = \alpha Y_i + (1-\alpha)(L_{i-1} - T_{i-1}) \tag{2}$$

where L_i – exponentially smoothed rows (level estimation).

Forecasting for p periods ahead is carried out by expression (3) [26]:

$$\hat{Y}_{i+p} = L_i + pT_i \tag{3}$$

If the data are seasonal, it is advisable to use the Winters model (4) [13, 26]:

$$L_i = \alpha \frac{Y_i}{S_{i-s}} + (1-\alpha)(L_{i-1} - T_{i-1}) \tag{4}$$

The assessment of seasonality is carried out by expression (5) [6, 17]:

$$\hat{Y}_{i+p} = (L_i + pT_i)S_{i-s+p} \tag{5}$$

In addition, these methods are effective when it is necessary to make short-term forecasts for a large number of product names, or when there is no information about previous sales volumes.

Although small and medium-sized enterprises with relatively simple business can be guided by naive forecasting methods, large firms and firms with complex business structures are forced to use regression analysis to study the relationship between several variables based on estimating the multidimensional regression function (6) [20, 23, 24]:

$$f\{Y\} = \beta_0 + \sum_{i=1}^{n} \beta_i x_i + \sum_{\substack{i;l=1 \\ i<l}}^{n} \beta_{il} x_i x_l \tag{6}$$

where $f\{Y\}$ – target function that characterizes the integrated performance of the corporation, β_i, $i=1,2,...,l$ – unknown coefficients of influence, x_i, $i=1,2,...,l$ – influencing factors, n – the total number of studies of influencing factors.

Estimation of theoretical coefficients β_i, β_{il} carried out on the basis of sample coefficients of influence b_i, b_{il}. To do this, first select the intervals of variation for each of the factors. Under the interval of variation according to the theory of statistical modeling [20] understand the number (characteristic of each factor), which as a result of addition to the zero level, gives the upper, and as a result of subtraction – the lower level of the factor. In the first stage (when obtaining a linear model), the factors always change only on two levels. The interval of variation cannot be less than the error with which the factor level is fixed, otherwise the upper and lower levels will be the same. In addition, the lower and upper levels must be within the scope of the factors [20, 23].

If the number of factors is known, then to vary the factors at two levels in the linear model, the number of observations of factors can be determined by the formula (7):

$$n = 2^k \tag{7}$$

where n – number of factor studies, k – number of factors.

To simplify the planning and processing of results, it is recommended to convert measured controlled factors into dimensionless normalized $z_i = (x_i - x_{i0}) / \Delta x_i$, which makes it easier to write the planning matrix, as the upper and lower levels of variation and in relative units are equal to +1 and -1 regardless of the physical nature of the factors and the values of the main intervals of variation of factors [20, 22, 26].

The process of finding a mathematical model for [17] has the following sequence: planning and conducting research on factors; verification of reproduction (homogeneity of sample variances); obtaining a mathematical model of the object of study with verification of the statistical significance of sample regression coefficients and verification of the adequacy of the mathematical description.

Mathematical planning for the determination of influential factors involves the construction of a matrix according to the following requirements [1, 20, 23]:

1. Each i-th row of the matrix must contain a set of coordinates of the point at which the study of the g-th factor.

2. Because of variables take values only +1 and -1, all interactions $z_i, z_l (i; l = 1,2,3; i \neq l)$ can only take the same values.

3. In the first line (i = 1) all controlled factors are selected at the lower level, ie = -1. The following i-th variants of variation in the compilation of the planning matrix are selected so that in the sequential search of all options, the frequency of change of the sign of the factors for each subsequent factor was twice less than the previous one.

4. After conducting research, it is necessary to test the hypothesis of equality of general variances $\sigma^2\{Y_1\} = \sigma^2\{Y_2\} = ... = \sigma^2\{Y_n\}$ according to the formula (8) [3, 4, 16]:

$$s^2{}_j = s^2_{VIDT} = \frac{1}{l-1}\sum_{g=1}^{k}(Y_{gj} - \bar{Y}_j)^2 \tag{8}$$

Since all estimates of variances are obtained from samples of the same number of parallel studies, the number of degrees of freedom for all will be:

To test the hypothesis of homogeneity of estimates variances it is necessary to use the Cochren test [16], which is based on the law of distribution of the ratio of the maximum estimate of variance to the sum of all compared estimates of variance as reflected in the expression (9):

$$G = \max\{s_j^2\} / \sum_{g=1}^{k} s_j^2\{Y\} \tag{9}$$

Independent estimates must be determined to obtain a mathematical description of the response function b_0, b_i, b_{il} corresponding coefficients $\beta_0, \beta_i, \beta_{il}$, scilicet $b_0 \to \beta_0, b_1 \to \beta_1, b_2 \to \beta_2, b_3 \to \beta_3$. These estimates are in terms of expressions (10–12) [20, 23, 24]:

$$b_0 = \frac{1}{n}\sum_{i=1}^{n} z_0 \bar{Y}_j \tag{10}$$

$$b_i = \sum_{i=1}^{n} \bar{Y}_j z_{ij} / n,\ j = 0,1,2,...,m, i = 1,2,...,n \tag{11}$$

$$b_{il} = \frac{1}{n}\sum_{i=1}^{n} z_{ij} z_{lj} \bar{Y}_{j,} (i; l = 1,2,...n; i \neq l) \tag{12}$$

After determining the estimates of the b regression coefficients, it is necessary to test the hypotheses about their significance, ie to test the corresponding null hypotheses β = 0. The hypothesis of the significance of the coefficients is tested using the Student's test (13) [23, 24, 32]:

$$t = |b| / s\{b\} \tag{13}$$

$$s^2\{b\} = \frac{1}{nm} s^2_{VIDT}\{Y\} \tag{14}$$

where $s^2\{b\}$ – variance of the coefficient estimation b; n – number of observations, m – number of parallel observations.

According to the requirements of significance, if the calculated value of *tri* for the corresponding coefficient b exceeds the value *tκ*, found from the Student's t-distribution table, the null hypothesis H_0:β = 0 rejected and the corresponding assessment of the coefficient is considered significant. Otherwise, the null hypothesis does not reject the assessment bi considered statistically insignificant, ie β = 0.

Checking the adequacy of the mathematical description of the response functions is to estimate the deviation of the predicted by the obtained regression equation of the magnitude of the response $\hat{Y}_j$ from research results $\bar{Y}_j$ at the same points of the factor space. The scattering of the results of observations near the regression equation estimating the true response function is determined by the variance of adequacy (15) [18, 23, 24]:

$$s^2_{AD} = \frac{m}{n-d}\sum_{i=1}^{n}(\bar{Y}_j - \hat{Y}_j)^2 \tag{15}$$

where d – the number of members of the approximating polynomial.

In order to check the adequacy of the model, it is necessary to calculate the relationship between the variance of adequacy s^2_{AD} and estimating the variance of response reproducibility . If these estimates of variance are homogeneous, then the mathematical description adequately reproduces the results of research, otherwise the description is considered inadequate. Using Fisher's F-test allows us to test the hypothesis of homogeneity of two sample variances s^2_{AD} and $s^2_{VIDT}\{Y\}$.

In case $s^2_{AD} > s^2_{VIDT}\{Y\}$, F-criterion is characterized by the ratio (16) [2, 20, 23]:

$$F = s^2_{AD} / s^2_{VIDT}\{Y\} \tag{16}$$

Next is the Fischer F-distribution table with significance level q for degrees of freedom $v_{1AD} = n-d, v_{2AD} = n(m-1)$ is the value *Fkp*. If the value of Fisher's F-test calculated for (16) is less than *Fkp*, the adequacy hypothesis is not rejected and the mathematical description is considered adequate. Otherwise, the obtained mathematical description is considered inadequate and requires additional research [19, 30].

Thus, the constructed mathematical model makes it possible to investigate and determine the coefficient of influence of each of the predetermined influencing factors on the type of objective

function, which is an integral indicator of the financial institution and apply appropriate measures to optimize this impact.

The multidimensional regression function is used to study different market segments to determine which variables actually affect market share, frequency of purchases, product availability, commitment to a particular product or brand, and many other factors [33].

With the help of regression analysis, HR managers investigate the relationship between the level of wages and geographical location of companies, the unemployment rate in the region, the growth rate of industry and more.

Financial analysts identify the reasons for rising stock prices by analyzing dividends, earnings per share, stock splitting, expected interest rates, savings, inflation, and more.

Thus, regression analysis provides managers with a powerful and flexible tool for studying the relationship between dependent and multiple independent variables.

When the amount of information is insufficient or management does not understand the complex method, qualitative forecasting models can be used [3, 23, 24]. In this case, forecasting the future is carried out by experts who seek help. The most common among high-quality forecasting methods are „jury opinion", „collective view of sellers", „consumer expectation model".

Forecasting by the „jury opinion" method is to combine and average the opinions of experts in relevant fields. A variant of this method is „brainstorming", during which participants first try to generate as many ideas as possible. Only after the process of generating ideas are evaluated. This method can be time consuming, but gives useful results, especially when the company needs a lot of new ideas and alternatives [8, 23, 24].

The method of „aggregate view of sellers" is based on the fact that experienced sales agents can very well predict future demand. They are well acquainted with consumer demand and can take it into account faster than they can build a quantitative model.

The „consumer expectation model" is a forecast based on the results of customer surveys of the organization. They are asked to assess their own future needs as well as new needs. Having collected all the data obtained in this way, the manager, taking into account his own experience, can better predict future demand [12, 23, 24].

Therefore, based on the considered methods and models of forecasting, it is possible to determine the features of their application depending on the tasks, lead time, availability of input information and so on.

The results of the analytical review are presented in table 1.

The data presented in table 1 indicate that in cases where it is necessary to make a detailed forecast of changes in the studied factor (eg demand) and there is information for previous periods, it is advisable to use factual, causal methods. And in cases where there is no information for previous periods and you need to get alternative solutions and new ideas, it is more appropriate to use heuristic and high-quality methods [9, 10, 18].

Table1. Features of forecasting methods in the process of modeling the economic activity of the company

Characteristic features	Forecasting methods			
	Factual	Heuristic	Causal	Qualitative
Features of application	To make a detailed forecast combination	For forecasting developments	For a large number of variables	For more information
Advantages	Detailed forecast	Independence from data for past periods	Establishing closeness between studied factors	Getting a lot of new ideas and alternatives
Disadvantages	The need for information from previous periods	Dependence on the human factor	The need for input information	It takes a lot of time

Thus, based on the analytical review of known forecasting methods, the features of their application were identified and the advantages and disadvantages were analyzed, which will take them into account in the process of modeling the company and promote economic development, competitiveness and optimize business processes.

3. Experimental research

Currently, there are a large number of software tools for forecasting using regression analysis methods. Thus, in particular, the analytical platform Deductor Studio allows, using the built-in tools of linear regression and neural network learning, to predict the values of the target function for future periods.

We present a generalized algorithm for determining the correlation between variables and the response function; the importance of the influence of these variables on the response function and the construction of a regression model based on important influencing factors. When developing the block diagram of the algorithm, we will use the existing standards.

As input data for building a regression model, we will use the corporation's data on the sale of its goods for past periods, denoted by *Xi* and the response function under the influence of these parameters – *Y*. Then, according to the correlation-regression analysis method, we will use blocks of procedures to determine the correlation coefficients between the input variables and the response function and estimates of the significance of determining these coefficients.

To check whether the coefficient is significant, we will use a conditional block. If the condition $tri > t\kappa$ is fulfilled, then procedure blocks are used to include this variable in the regression model. Next, the procedure for building a regression model is implemented. After that, a conditional block is used to check the adequacy of the constructed model. If the model is adequate, its parameters are derived and graphically visualized, if not, the model building procedure is used again. The algorithm for automating the construction of a correlation-regression model is presented in Fig. 3.

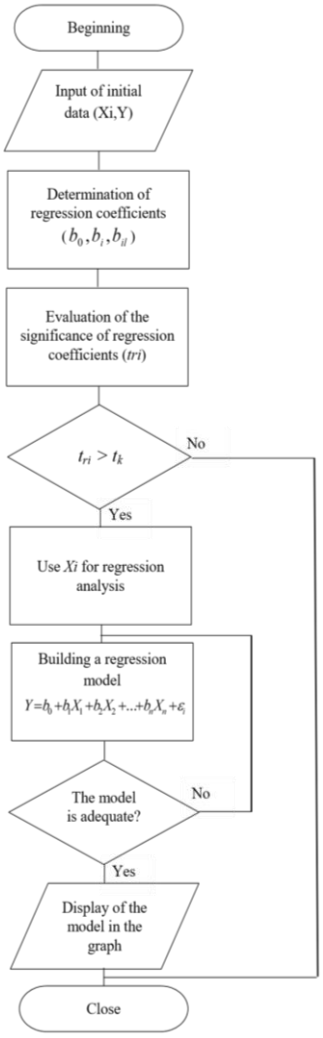

Fig. 3. Block diagram of automation of regression analysis

Here is an example of the use of regression analysis tools in Deductor Studio, where based on the actual input data of the corporation, reflecting the sales of its products for 2019–2021 (Fig. 4, 5) forecasting sales for 2022 (Fig. 6, 7).

In the first stage, Deductor Studio imported initial data on the sale of goods by the corporation, which is presented in the form of a graph to improve visualization. We see that they have a lot of noise and need partial processing to remove anomalous values (Fig. 4).

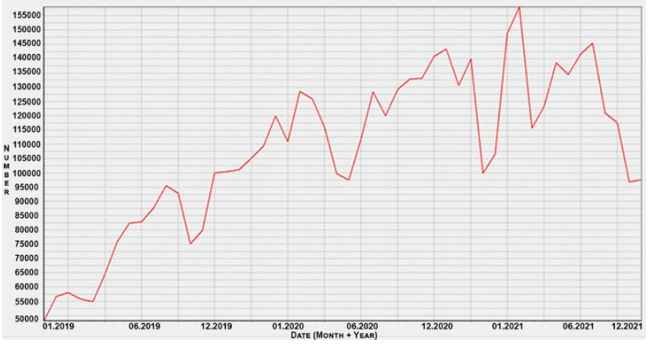

Fig. 4. Initial sales data imported into Deductor Studio as a chart

After applying the partial processing tool in Deductor Studio, it can be seen that the graph got a smoother shape as a result of eliminating values that differed significantly from the total data set (Fig. 5).

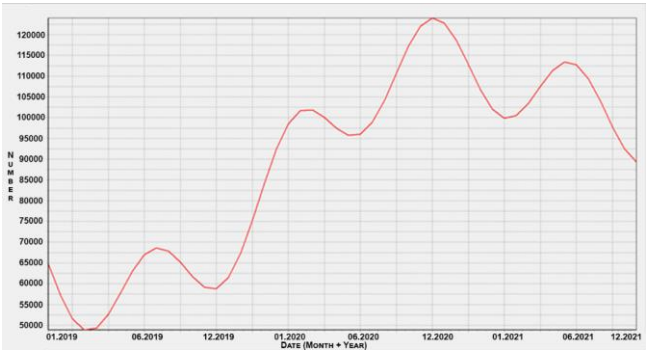

Fig. 5. Initial sales data after partial processing

Then the parameters for forecasting sales indicators for future periods (3 months) were adjusted and the forecasting process was performed using the mathematical apparatus of regression analysis (expressions (6) – (16)) and neural network tools (Fig. 6).

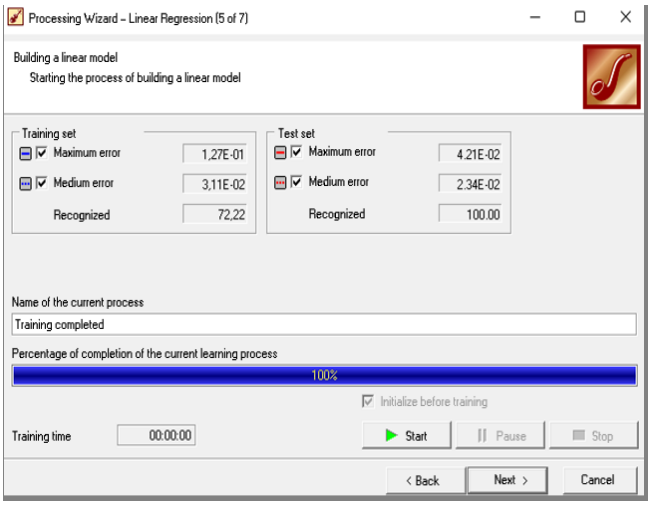

Fig. 6. Forecasting settings based on regression analysis and neural network

As a result of the use of forecasting tools in Deductor Studio on the basis of actual data for 2019–2021, the estimated sales of goods for the first three months of 2022 were obtained, which are marked in blue on the chart (Fig. 7).

As can be seen from the graph presented in figure 5, compared to the actual data on sales of goods by the corporation for 2019–2021 (marked in red) in early 2022, a downward trend is forecast, and then there will be significant growth by the end of the first quarter of 2022. This can be explained by the projected growth in demand in the first half of the year, as it happened in the corresponding previous periods in 2019–2021.

Thus, based on the results obtained, it is possible to get an idea of both the sales of certain goods for the forecast periods, and see the general trend of sales of goods in the future, which indicates the effectiveness of these forecasting methods.

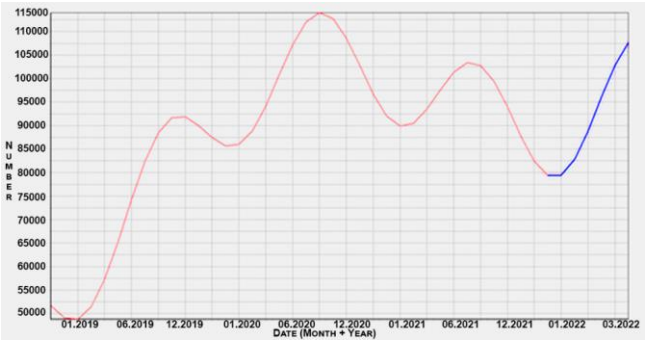

Fig. 7. Projected sales data for the coming months

4. Conclusions

Strategically important processes of companies were the analysis of the market and consumer needs, the study of changes in their needs and behavior, which determine all future policies for product creation, production, delivery to the consumer and profit. Only integrated systems can provide an adequate rapid response to rapid changes and growing variability of the business environment in the corporate governance system. The process approach is the consideration of all the activities of the corporation as a set of interacting processes that take place within the organizational structure and realize the purpose of its existence. That is why the need to apply a process approach to their management comes to the fore in the functioning of companies. The main object of the process approach to management is a business process, which is a planned algorithm of interrelated actions or workflows, which is subject to systematic change under the influence of external and internal factors, which involves all company resources to meet consumer demand and profit maximization. If the profit exceeds the cost of business processes, then the company's activities can be considered effective. Therefore, to provide the company with stable profits and reduce costs, it becomes necessary to carry out competent business process management. A necessary component of analytical modeling of business processes is forecasting to determine the future prospects of the company. That is why the greatest interest for company analysts is the issue of effective forecasting of business processes. Business process forecasting will allow modeling and optimizing business activities in the future. Implementing forecasting tools in an integrated corporate governance system can make business more predictable, manageable and controlled.

Given the development of information technology and analytical systems with components of artificial intelligence, it is necessary to understand that digital technologies will evolve as hybrid solutions. Thus, the sooner a corporation embarks on the path of digitalization, the more effective corporate governance will be.

The mechanism of effective corporate governance significantly expands the opportunities to attract investment in business, promotes productivity and competitiveness of companies.

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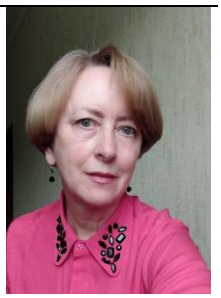

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