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# INFORMATION TECHNOLOGY OF DETERMINATION THE COMPANY'S FINANCIAL CONDITION FOR THE FINANCIAL PLANNING SUBSYSTEM OF THE EPM SYSTEM

*The **subject matter** of this article is the process of forming a company's development finance program. The goal is to develop the information technology to determine the company's financial condition for the financial planning subsystem of an enterprise performance management (EPM) System. The **tasks** are to develop a **method** for forming a company's development finance program as the basis for the financial planning subsystem of the EPM system; develop a methodology of determining the financial condition of the company as a component of the method; develop an information technology (IT) for determining the company's financial condition; develop a method for forecasting financial states on the strategic period using a neural network. The following **results** were obtained. The **method** for forming a company's development finance program is implemented as the financial planning subsystem for the EPM system. A methodology for determining the financial condition of a company as a component of this method is presented in this article. Information technology for the implementation of this methodology has been developed. The components of the IT are the calculation of financial indicators based on data from financial statements for a certain period; the analysis of return on equity; the determination of the company financial stability; the determination of the financial condition in dynamics; the forecasting of the company's financial condition for the strategic period; the formation of development strategies for forecasting financial condition. The method for forecasting financial states in the strategic period was implemented using a neural network with the Temporal Fusion Transformer architecture. **Conclusions**. The scientific novelty of the results obtained is as follows: 1) the stages of the process of forming a company's development finance program were improved by methodology for determining the financial condition of the company, by model for determining the rational ratio of own and borrowed funds, by technology for selecting possible sources of financing development projects, by method for determining investment project financing schemes;2) methodology for determining the financial condition of the company was further developed by including a component for predicting financial indicators using a neural network; 3) the company's financial condition module for EPM System was further developed by IT implementation, which implements the assessment and forecast of the company's financial condition is carried out and the financial strategy of the company's development is formed.*

***Keywords:*** *strategic management; enterprise performance management system; financial condition; information technology; strategy; forecasting; neural network.*

## Introduction

Strategic management practice shows that all the difficulties of decision-making at this level are usually related to the gathering and processing of a large amount of diverse information as well as the solving of complex poorly formalized tasks [1]. It increases the risks of the enterprise activity in the long-term and complicates the process of strategic plans formation for the company's development [2].

Strategic planning provides the structure to make day-to-day decisions that follow a larger vision of company's goals, creates a direction for competitive practice, and maximizes business options for influencing market environment [3]. In rapidly changing competitive environment, it is necessary to use different methods of company's management for company's successful functioning, for example, business process management, quality management, project office management, innovation management, etc.

The task of the paper [4] is to create a decision-making model based on using the mathematical apparatus of fuzzy sets and methods of operations research. The model considers the uncertainty of estimates for project requirements and the level of competence for team candidates.

The paper [5] proposes the component method of the justification for the choice of a diversified orders

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portfolio, which based on the advanced component architecture of complex products and the simulation of orders portfolio selection considering innovation and investor interests.

Thus, company's management systems increasingly include corporate information systems with strategic management modules, which implement methods for solving strategic level problems [6 – 8].

This is especially related to the level of a strategic management [9, 10].

For example, in paper [11] proposed an integrated management framework that provides a conceptual model of how to achieve consistency between the relevant goal and the planning levels by applying a rationalist view and drawing on the formal control theory.

The problem of developing adequate methods for management, which analytically and algorithmically support the processes of making strategic decisions within these modern management methods, remains relevant for different companies, for example, for IBM, GE, and Huawei [12].

Usually, companies use special software systems for informational and analytical support to the strategic planning process to solve individual tasks or complexes of strategic management tasks. These types of systems include performance management systems. The business efficiency management system (EPM – Enterprise Performance Management) is an enterprise management concept based on a set of information technologies that automate the base management processes: forecasting, planning, budgeting, monitoring, analysis.

It provides an opportunity for a comprehensive analysis of the enterprise performance and trends in their changes, integrates various components for local strategic management tasks. Also, the task of such a system is to provide management with up-to-date and reliable information for decision-making at all levels of organization management with minimal cost [13].

The market of such systems is considered broad enough: it includes large corporate products such as Oracle EPM, Oracle Hyperion Planning, IBM Cognos Disclosure Management, SAP EPM, IBM Cognos FPM, IBM Cognos TM1, SAS Strategy Management, as well as small open-source projects: Host Analytics, Infor, Longview Solutions and etc [14].

In this article, the financial planning subsystem as part of the EPM system will be considered. The main task of such a subsystem is to develop a strategic plan for financing the company's development program. To develop such plans, it is necessary to analyze financial activities, forecasting the financial conditions of the company in the strategic period, depending on changes in the market and the adopted development strategies of the company [15].

Large amounts of information are required to determine the financial condition of a company, and furthermore, it is necessary to solve the problem of ambiguity in understanding the financial information due to the interdependence of many financial parameters.

In the IT market, many different systems of financial analysis exist [16].

For instance, significant international companies often implement Oracle Essbase [17]. This is a multidimensional system for online analytical processing of financial data of a company (this includes different pre-installed models for analysis and forecasting, and also allows to add individually customized models). Another tool for financial analysis is Fathom. This software allows assessing profitability, controlling cash flow, growth of financial indicators, and other key performance indicators of the company.

Financial Analysis Software allow to determine deviations in economic activity that can carry potential risks and diagnose bankruptcy using several methods for calculating the probability of and using methods of computational intelligence [18].

Thus, the aim of the study is to develop a module for determining the financial condition of a company for an enterprise performance management system. To determine the future financial condition of the company in the strategic period, the forecast values of financial parameters are used. It is proposed to use neural networks for forecasting.

## 1. Literature Review

An important part of strategic planning is forecasting various parameters of the company's activities for different periods. Many researchers in the field of management pay additional attention to the analysis of the results impact for strategic forecasting on the management of company's activities, on development strategies.

Strategic forecasting is seen as a rebirth of long-range planning, albeit with new methods and theories. Companies should make the building of strategic forecasting capability a priority [19].

Strategic forecasting results are important for new product development. In the paper [20] the Strategic Planning method for the Sustainability Integration in the Product Development Process which aims to guide, facilitate and accelerate the sustainability integration into the product development process by make changes in the business management with the support of the strategic planning and the continuous improvement process is presented.

Forecasting is used in the process of determining the risks of development projects. In the book [21] it explains how to apply sanity checks to existing forecasts to rank project valuations, identify project risks, and select

the higher value creation projects; it provides guidance on forecasting for strategic decision-making.

Forecasting serves a vital function as an early warning system and an unbiased view of the future state for the business. Forecasts should be completed on a monthly or an as-needed basis, but they shouldn't be focused exclusively on the financials. They should focus on the progress of the initiatives and execution plans that are designed to drive the financial results [22].

Currently, forecasting systems are becoming part of intelligent decision-making systems. Neural networks and machine learning algorithms are increasingly used to predict financial performance. The using of computational intelligence tools for forecasting tasks is due to the fact that the accumulated financial information firstly must be structured, analyzed, and then used for forecasting.

However, statistical methods are used for many forecasting tasks in the financial sector. Combining the methods of mathematical statistics and machine learning methods allows solving complex economic problems in dynamics.

The study [23] represents a new forecast model on basis of fuzzy time series and improved C-fuzzy decision trees for forecasting stock index. Weighted C-fuzzy decision tree, a novel forecast model armed with *k* nearest neighbors, has been proposed and experimented on Shanghai Composite Index over a ten-year period.

Machine learning has a prominent role in solving clustering and classification problems as well as dimensionality reduction. Nevertheless, traditional statistical methods of forecasting continue to perform well in many practical applications.

The chapter considers critically the successes of machine learning in forecasting, using some case studies as well as theoretical considerations, including limitations on machine learning and other techniques for forecasting [24].

The tutorial [25] has covered two key directions for improving machine learning transparency: interpreting the concepts learned by a model by building prototypes, and explaining of the model's decisions by identifying the relevant input variables.

In the paper [26] the method "Temporal Fusion Transformer" (TFT) is proposed. TFT an attention based DNN (Deep neural net-works) architecture for multi-horizon forecasting that achieves high performance while enabling new forms of interpretability.

To obtain significant performance improvements over state-of-the-art benchmark, multiple novel ideas to align the architecture with the full range of potential inputs and temporal relationships common to multi-horizon forecasting – specifically incorporating is introduced:

– static covariate encoders which encode context vectors for use in other parts of the network;

– gating mechanisms throughout and sample-dependent variable selection to minimize the contributions of irrelevant inputs;

– a sequence-to-sequence layer to locally process known and observed inputs;

– a temporal self-attention decoder to learn any long-term dependencies present within the dataset.

The use of these specialized components also facilitates interpretability; in particular, there were to show that TFT enables three valuable interpretabilities use cases helping users identify globally-important variables for the prediction problem, persistent temporal patterns, and significant events.

An important financial task in strategic planning is determining the company's financial condition and forecasting it for a long period. The problem of financial condition is referenced to the class of defining problems and is solved using neural networks.

Classification algorithms are used in many domains to extract information from data, predict the entry probability of events of interest, and, eventually, support decision making.

The paper [27] explores the potential of extreme learning machines (ELM), a recently proposed type of artificial neural network, for consumer credit risk management. ELM possess some interesting properties, which might enable them to improve the quality of model-based decision support. The mathematical roots of ELM suggest that they are especially suitable as a base model within ensemble classifiers. The empirical results confirm the conceptual advantages of ELM and indicate that they are a valuable alternative to other credit risk modelling methods.

Neural networks are used to implement scoring models to determine the credit rating of bank borrowers, determine the solvency class, etc. [27].

Based on the analysis of SW-products in the area of financial management in the IT market and the functionality of the financial planning subsystems of existing EPM systems, a conclusion has been made those existing software systems do not offer forecasting of the financial condition for long-term period considering the company's development strategy.

For example, the paper [28] provides an overview of the Top 10 Financial Forecast Software Options for 2021. Let's analyze these software products.

The forecasting feature in Baremetrics implements cash flow and customer forecasts by months of the plan year. However, there is no possibility of strategic forecasting for the formation of financing for the development program.

Planful is a cloud-based planning and analysis platform for continuous planning. With Planful, you can

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quickly move from a spreadsheet-based, static annual budget to a dynamic, ongoing rolling forecast. However, all forecasts are made for the year.

Prophix gives users full control over their financial reports, including the ability to forecast for the reporting period. For example, a user can create a report to view actual and budget data for the current fiscal year with a monthly breakdown, as well as summary totals for annual forecasts for the next five years. However, it is not clear which methods are applicable for short-term and long-term forecasting.

The Idu-Concept product is intended for financial budgeting, for which it is proposed to use the forecasting of financial indicators for the budget period. There is no information on the types of forecasting. As far as budget forecasting is concerned, this is one-year forecasting.

Vena Foundation for FP&A is a preconfigured customizable solution that includes integrations, data models, reports, templates, and data analysis tools to support business financial planning and needs analysis. The application allows you to perform rolling forecasting for financial planning. Long-term forecasts are not made.

SAP Business Planning and Consolidation and Oracle Planning Cloud - forecasting is one of the functions of financial planning modules of ERP and EPM systems. The same algorithms are used to predict indicators regardless of the data structure. The use of the forecasting module is only possible within ERP or EPM systems.

Jira uses driver-based modeling to build budgets, sales plans, HR plans, rolling forecasts, what-if scenarios, and other financial tools you need to confidently accelerate your growth while always matching plan against actual. Since rolling planning is used, forecasts are made for a short period.

Float resource management platform is designed to plan the best work of the project team. Some short-term resource projections are made for project planning purposes. It is not clear how this platform can be used to manage the financial activities of the entire company.

So, after studying the functionality of these software products, we've concluded that they all have a financial forecasting and planning module, many of them are focused on short-term forecasting. Only platform systems (Oracle Planning Cloud, SAP Business Planning and Consolidation) have some connection between financial planning and development strategy.

Therefore, the problem of developing software products for strategic forecasting of financial indicators and planning the company's financial activities for the long term remains relevant, considering the company's development strategies.

## 2. The Module for Determining the Financial Condition of the Financial Planning Subsystem of the EPM System

### 2.1. Method of forming a development finance program

Currently, work is underway to develop a financial planning subsystem for the EPM system. The method of forming a development finance program was proposed (Fig. 1), which is a set of models and algorithms for solving financial problems to develop a strategic development program for the company.

The method for forming a company's development financing program includes a system of models that take into account the current and prospective (forecast) conditions of the company in the strategic period, sources and likely scenarios for investing in development projects. The novelty of the method lies in the fact that as a result of its implementation, a program for financing the development of the company is formed. This program is focused on achieving the company's strategic goal through the implementation of a set of financial strategies (rather than formed on the basis of current financial needs). Financial strategies are formed on the basis of building a strategic map and building a balanced scorecard. The use of this method makes it possible to form rational development financing plans and ensure the efficiency of the enterprise's financial activities.

Method of forming a development finance program (MDFP) includes the following:

1. Method for determining the financial condition of the company (MFCC). Determination of the financial condition and financial stability of an enterprise using the MFCC is carried out similarly to the procedure for assessing the solvency of clients by financial institutions based on the analysis of reports and expert assessments. Scoring models are used to analyze the company's ability to raise funds from the financial market, for example, bank lending, transactions with securities, etc.

2. Model for determining the rational ratio of own and borrowed funds (MROB). With the help of MROB, the problem of maximizing financial leverage is solved with restrictions on raising funds and the acceptable level of return on equity of the company. Attraction of optimal amounts of funds for development will allow the company to maintain its solvency during the planned period.

3. Technology for selecting possible sources of financing development projects (TSFS). With the help of TSFS, financial sources and volumes of raising money

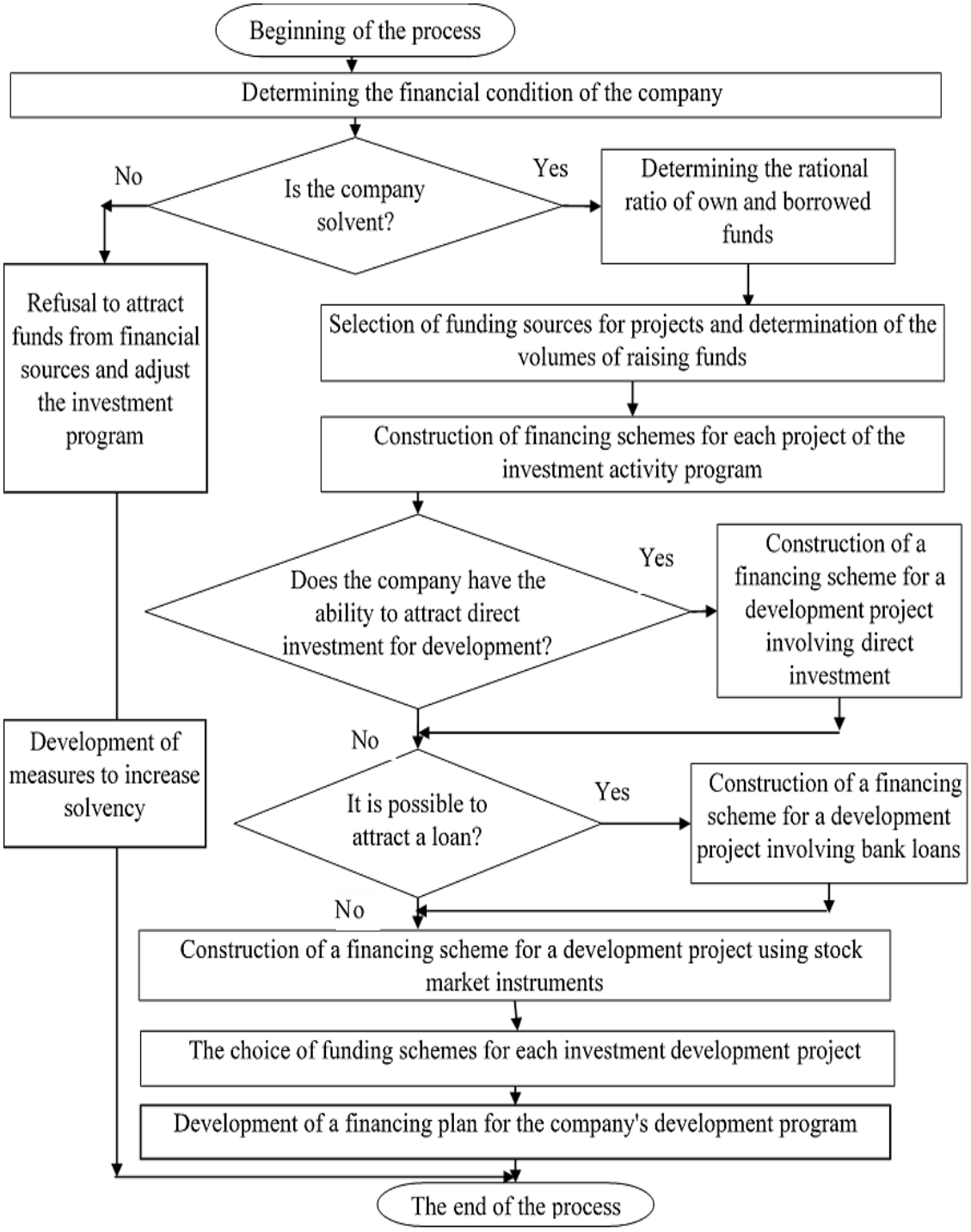


Fig. 1. Block diagram of the method implementation of forming a development finance program

for financing development projects of the company are determined. Experts form a list of sources from which the company can raise money; the factors influencing the efficiency and risk of project financing from these sources are determined. The degree of their influence is calculated based on expert estimates and the rank correlation method. The levels of attractiveness for sources are determined and their selection is carried out using the method of multivariate statistical analysis. A model of two-criteria optimization is formed with the criteria for minimizing the cost and minimizing the risk of raising limited funds. Using the convolution method for various values of the criterion importance coefficients, a set of effective investment volumes from financial sources is determined.

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4. Method for determining investment project financing schemes (MPFS). MPFS includes:

– Funding model involving direct investment (FMDI) [8];

– Funding model with the involvement of bank loans (FMBL) [8];

– Financing model involving stock market instruments (FMSM) [8];

– Technology for selecting a project financing scheme (TSFS).

The models and technology of the MPFS were considered and discussed in early publications of the authors' articles [7, 8, 10, 13, 14].

So, the method of forming a company's development financing program includes a system of models that consider the state of the company, sources and likely scenarios for investing in development projects.

The company's development financing program is focused on achieving the company's strategic goal through the implementation of a set of financial strategies.

Financial strategies are formed on the basis of building a strategic map and building a balanced scorecard [10].

The using of this method makes it possible to form optimal development financing plans and ensure the efficiency of the company's financial activities.

## 2.2. The information technology of determinate the company's financial condition on the strategic period

As can be seen from Fig. 1, at the first stage of the method for forming a development finance program, it is necessary to determine the financial condition of the company in the strategic period MFCC is used to solve this problem.

An information technology for the implementation of this methodology has been developed. As a result of IT implementation, the assessment and forecast of the company's financial condition is carried out and the financial strategy of the company's development is formed.

IT has seven main steps (Fig. 2).

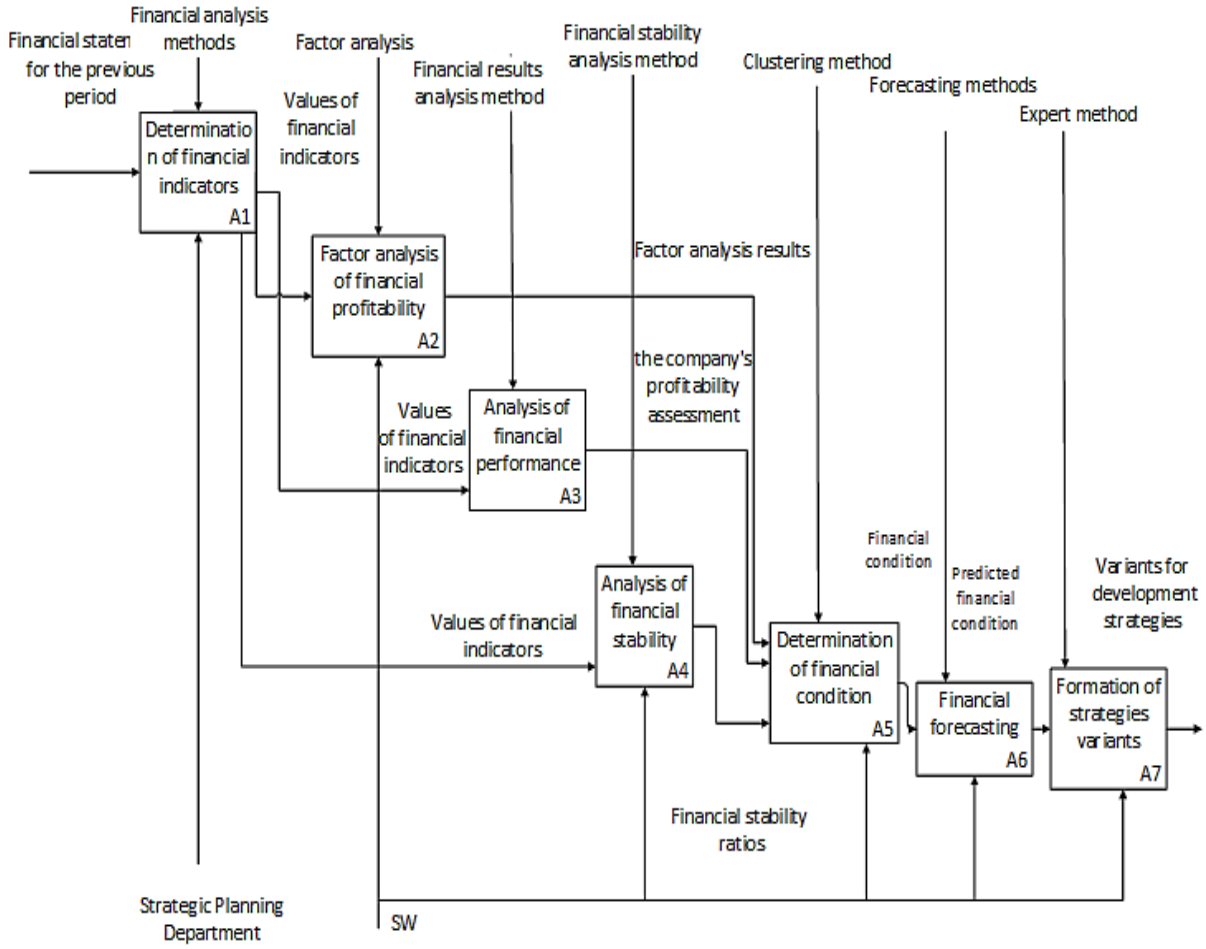


Fig. 2. Decomposition of the context diagram for the information technology of determination the company's financial condition on the strategic period

A 1. The calculation of financial indicators based on data from financial statements for a certain period. The length of the period (for instance, the number of years) is selected presuming that the dynamics of the financial condition of the enterprise are determined in the context of changing market conditions on the basis of the analyzed financial statements.

A 2. The analysis of Return on Equity (ROE). As a result, the most important parameters that affect the structure and return on equity are identified, as well as the company's business activity is assessed. Based on this analysis, it is possible to assess the risks of losing the company's business reputation in the strategic period.

A 3. The determination of the company financial stability based on the analysis of the financial balance between individual sections and subsections of the asset and liability balance sheet on a functional basis. As a result, the degree of production and financial risk is assessed.

A 4. The analysis of liquidity and solvency of the company. As a result, financial stability, the creditworthiness of the enterprise, and the risks of bankruptcy are assessed. This is the basis for the formation of the company's financial strategy.

A 5. The determination of the financial condition in dynamics. This stage combines the results of prior stages 2,3 and 4. As a result, a certain aggregate indicator is obtained by which the financial condition of the company is determined. To implement this stage, it is proposed to use scoring and clustering methods based on the neural networks.

A 6. The forecasting of the financial condition of the enterprise for the planned strategic period. Forecasting is carried out based on the processing of statistical data. The forecast values of the main financial parameters are determined. The approach proposes to carry out the forecast for different scenarios of changes in market conditions (e.g., optimistic and pessimistic scenarios). Based on the predicted values of the parameters, the forecast of the Return on Equity (ROE), financial stability, and the company's solvency are carried out.

A 7. The formation of variants for development strategies of options for predicting the company's financial condition. Considering the projected financial condition, the responsible person will be able to analyze and select the recommended company development strategy.

To implement the procedure for forecasting financial states in the strategic period of this process (Fig. 2), it is proposed to use neural networks.

## 3. Forecasting the financial condition of the company. Experiments and Results

Forecasting was implemented using a neural network with the Temporal Fusion Transformer architecture [26]. According to [26] TFT was designed to use canonical components to efficiently build feature representations for each input type for high forecasting performance. The financial condition forecasting module is implemented as a client-server application. For machine learning, the PyTorch and TensorFlow frameworks are used.

Machine learning is based on multi-horizon forecasting based on Deep Neural Networks (DNNs), which improves productivity over traditional time series models.

To predict all financial indicators, 13 models based on deep machine learning were created.

Data preparation for forecasting and network training was carried out as follows.

As a dataset, quarterly stock reports of several thousand American companies were used, which contain the main financial indicators, namely: assets; cash and cash equivalents at book value; proceeding income before taxes (EBT); net income; operating expenses; income; shareholders' equity; total capital; general liabilities and equity; cash and cash equivalents; total profit; long-term debt; operating income (loss).

All these data were taken from exchange reports and summarized in one dataset consisting of the following columns: period; the name of the company; stock ticker; the name of the financial indicator; currency; indicator value.

After that, the "raw" dataset was filtered so that only companies remained that had a complete list of indicators for three or more quarters. As a result, a dataset was obtained, a fragment of which is shown in Figure 3.

As an example, we present the results of preparing a dataset for an asset forecasting model.

To do this, columns unnecessary for training and all terms were removed from the main dataset, except for the row with data on assets.

After that, the column "time_idx" with the quarter number is added (Fig. 4).

The network was trained based on numerical series, each of which is a list of the value of the size of the company's assets on a quarterly basis.

The dataset was split into two parts at a ratio of 80 to 20. The large dataset was used to train the network, and the smaller one was used to test it.

After training, the network was checked on a control dataset and the forecast error - MAPE (Mean Absolute Percent Error) was calculated.

After training MAPE is equal to 14.34%. It was decided that a prediction accuracy of 85.66% for the test sample is acceptable (Fig. 5).

However, more research is needed to adjust the network learning process to improve the forecast accuracy.

The forecasting of the values of many indicators of the activities of various companies has been carried out.

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| | period | company | tickers | indicator | unit | amount |
|---|---|---|---|---|---|---|
| 0 | 2020 Q3 | 1347 Property Insurance Holdings, Inc. | PIH | Assets | US Dollar | 36,956,000 |
| 1 | 2020 Q3 | 1347 Property Insurance Holdings, Inc. | PIH | Cash and Cash Equivalents, at Carrying Value | US Dollar | 15,233,000 |
| 2 | 2020 Q3 | 1347 Property Insurance Holdings, Inc. | PIH | Cash and Cash Equivalents, at Carrying Value | US Dollar | 15,233,000 |
| 3 | 2020 Q3 | 1347 Property Insurance Holdings, Inc. | PIH | Income from Continuing Operations before Taxes | US Dollar | -9,590,000 |
| 4 | 2020 Q3 | 1347 Property Insurance Holdings, Inc. | PIH | Liabilities | US Dollar | 562,000 |
| ... | ... | ... | ... | ... | ... | ... |
| 18405 | 2019 Q2 | AMBAC FINANCIAL GROUP INC | AMBC | Stockholders' Equity Attributable to Parent | US Dollar | 1,492,948,000 |
| 18406 | 2019 Q2 | AMBAC FINANCIAL GROUP INC | AMBC | Total Equity | US Dollar | 1,553,000,000 |
| 18407 | 2019 Q2 | AMBAC FINANCIAL GROUP INC | AMBC | Total Liabilities and Equity | US Dollar | 14,713,066,000 |
| 18408 | 2019 Q1 | AMBAC FINANCIAL GROUP INC | AMBC | Assets | US Dollar | 15,022,899,000 |
| 18409 | 2019 Q1 | AMBAC FINANCIAL GROUP INC | AMBC | Cash and Cash Equivalents, at Carrying Value | US Dollar | 22,000,000 |

Fig. 3. Prepared dataset with financial indicators

| | tickers | company | period | time_idx | value |
|---|---|---|---|---|---|
| 0 | PIH | 1347 Property Insurance Holdings, Inc. | 2016-06-01 | 10 | 9.172200e+07 |
| 1 | PIH | 1347 Property Insurance Holdings, Inc. | 2016-09-01 | 11 | 9.245500e+07 |
| 2 | PIH | 1347 Property Insurance Holdings, Inc. | 2016-12-01 | 12 | 9.084900e+07 |
| 3 | PIH | 1347 Property Insurance Holdings, Inc. | 2017-03-01 | 13 | 9.182900e+07 |
| 4 | PIH | 1347 Property Insurance Holdings, Inc. | 2017-06-01 | 14 | 1.027050e+08 |
| ... | ... | ... | ... | ... | ... |
| 32574 | ZNGA | ZNGA | 2019-09-01 | 23 | 3.578014e+09 |
| 32575 | ZNGA | ZNGA | 2019-12-01 | 24 | 3.660614e+09 |
| 32576 | ZNGA | ZNGA | 2020-03-01 | 25 | 3.542421e+09 |
| 32577 | ZNGA | ZNGA | 2020-06-01 | 26 | 3.683602e+09 |
| 32578 | ZNGA | ZNGA | 2020-09-01 | 27 | 5.151247e+09 |

Fig. 4. Dataset with data on the size of assets

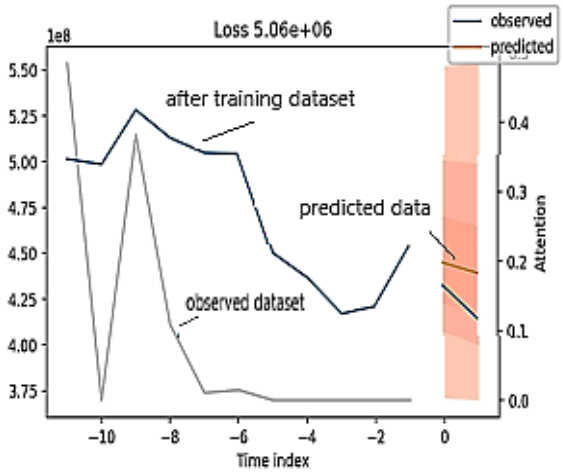


Fig. 5. Predicted changes in asset size after network training

Here are some predictions for indicators of Tesla, Inc. is an American electric car and clean energy company based in Palo Alto, California.

For example, the values of the following indicators were predicted to determine the financial condition of Tesla by quarters of 2021:

– assets (Fig. 6);
– liabilities (Fig. 7);
– the part of cash and cash equivalents in the book value (Fig. 8);
– short-term debt, long-term debt (Fig. 9);
– operating cash flow, operating expenses and profit operating, total and equity capital, working capital, gross income (Fig. 10);
– total profit (Fig. 11);
– net income (Fig. 12);
– profit before tax (Fig. 13).

## Conclusions

The difficulties of decision-making at strategic level are related to the gathering and processing of a large amount of diverse information as well as the solving of complex tasks. To solve complex of strategic management tasks, companies use the business efficiency management system – Enterprise Performance Management.

In this article, the financial planning subsystem is considered as part of the EPM system. Within the framework of the financial planning subsystem, the problem of predicting the financial conditions of a company by intervals of a strategic period is solved.

The method of forecasting financial states in the strategic period was implemented using a neural network with the Temporal Fusion Transformer architecture.

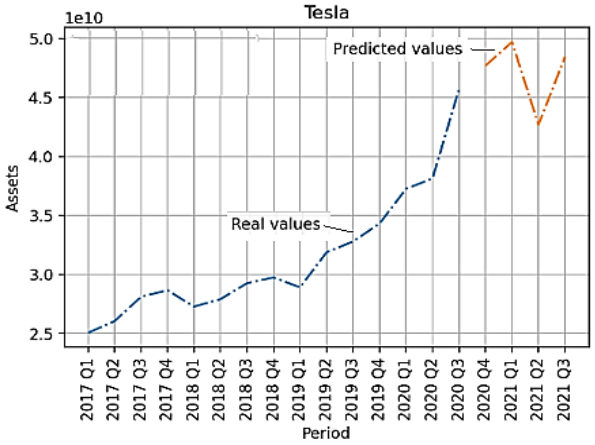


Fig. 6. The forecast amounts of assets

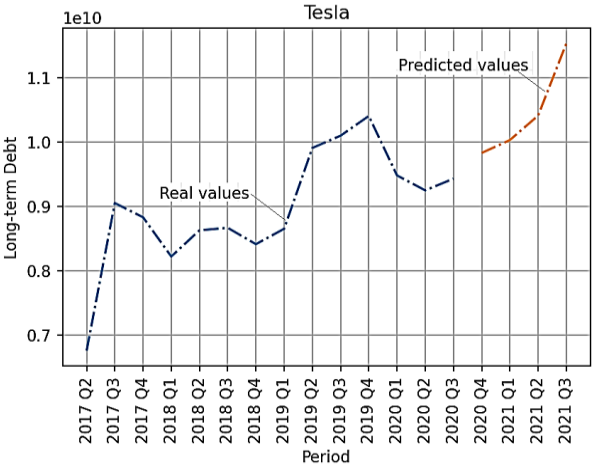


Fig. 9. The forecast amounts of long-term debt of the company

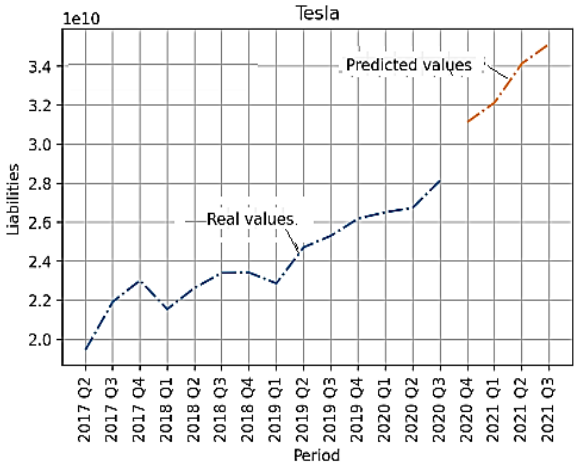


Fig. 7. The forecast amounts of liabilities company

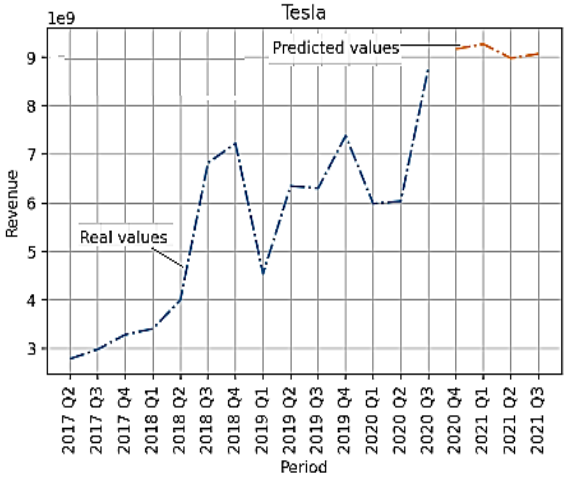


Fig. 10. Forecast of income

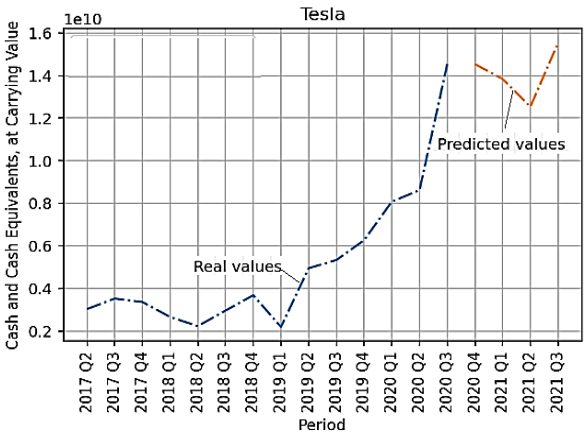


Fig. 8. The forecast of the part of cash and cash equivalents in the book value

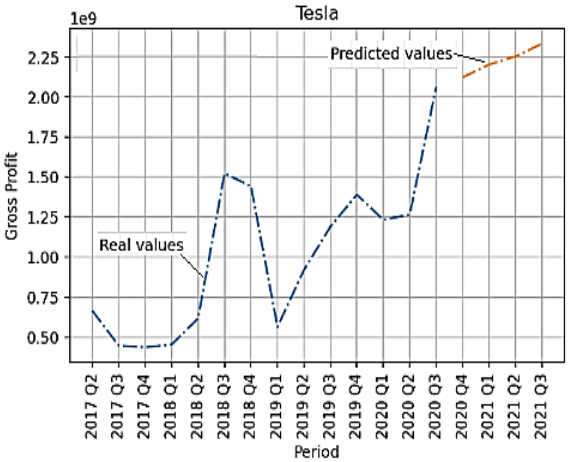


Fig. 11. Forecast of total profit of the company

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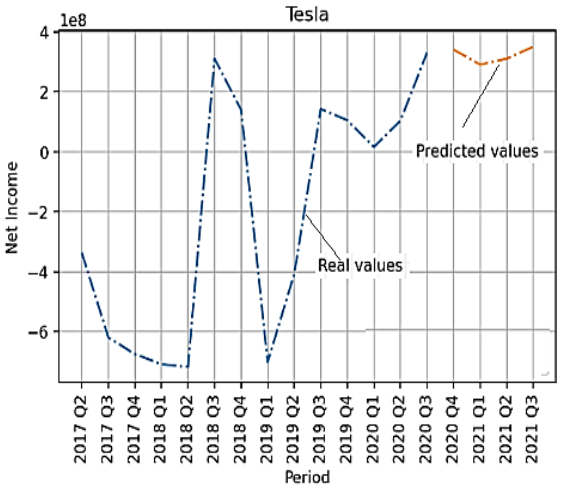


Fig. 12. Forecast of net income

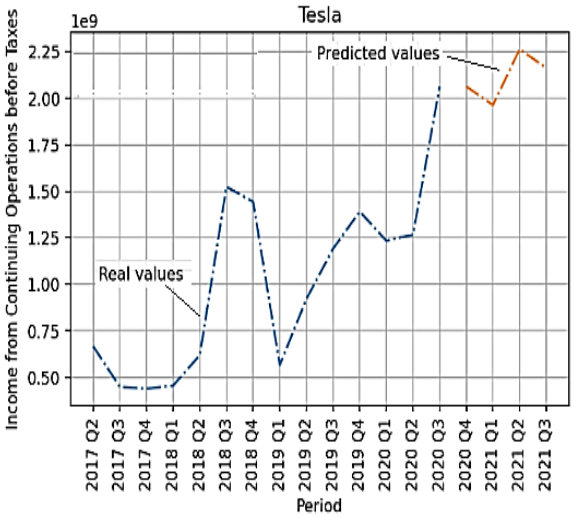


Fig. 13. Forecast of earnings before tax

The network was trained on data on 15 financial indicators. As a result of training the network, an acceptable forecast accuracy was obtained.

Based on the predicted values of these indicators, calculations of the predicted values of indicators of the effectiveness of the company's financial activities were made. It is necessary to determine the financial strategy of the company.

Thus, using the module of forecasting the financial condition of the company allow analyzing the financial condition of the company based on processing a large amount of heterogeneous information, making forecasts for the planned strategic period and choosing an adequate development strategy.

Forecasts and the chosen strategy will be the basis for the development of financial plans for the company's development program for the strategy period.

The future research of authors will be devoted to:

– the use of fuzzy neural networks to solve the problem of determining the financial conditions of the company on the strategic period;

– improving the method of forecasting financial performance indicators based on the use of machine learning methods;

– development of a recommendation system for choosing a financial strategy of a company using methods of computational intelligence and classical decision-making theory.

**Contribution of authors:** the conceptual provisions of the IT of determination the company's financial condition for the financial planning subsystem of an EPM System – **V. Moskalenko**; review financial analysis and planning software and review EPM systems – **N. Fonta**; literature review of strategic forecasting – **M. Grinchenko**; literature review of computational intelligence tools for forecasting tasks – **V. Moskalenko, E. Nikulina**; method of forming a development finance program – **V. Moskalenko**; the information technology of determinate the company's financial condition on the strategic period – **N. Fonta, M. Grinchenko**; the conceptual provisions of the forecasting the financial condition using a with the TFT neural network – **V. Moskalenko, N. Fonta**; prepared dataset of experiments and analyses results – **M. Grinchenko**; conducting experiments – **E. Nikulina, S. Ershova**; conclusion – **V. Moskalenko, S. Ershova**. All authors have read and agreed to the published version of the manuscript.

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## ІНФОРМАЦІЙНА ТЕХНОЛОГІЯ ВИЗНАЧЕННЯ ФІНАНСОВОГО СТАНУ ПІДПРИЄМСТВА ДЛЯ ПІДСИСТЕМИ ФІНАНСОВОГО ПЛАНУВАННЯ ЕРМ СИСТЕМИ

***В. В. Москаленко, Н. Г. Фонта, О. М. Нікуліна, М. А. Гринченко, С. І. Єршова***

**Предметом вивчення у статті** є процес формування програми фінансування розвитку підприємства. Метою є розробка інформаційної технології визначення фінансового стану компанії для підсистеми фінансового планування системи управління ефективністю підприємства (ЕРМ). **Завдання, що вирішуються**: розробити метод формування програми фінансування розвитку компанії як основу підсистеми фінансового планування ЕРМ системи; розробити методологію визначення фінансового становища підприємства як складову частину методу; розробити інформаційну технологію (ІТ) визначення фінансового стану компанії; розробити метод прогнозування фінансового стану на стратегічному періоді з використанням нейронної мережі. Були отримані такі **результати**. Метод формування програми фінансування розвитку компанії реалізовано у вигляді модуля підсистеми фінансового планування для системи ЕРМ. Розроблено методику визначення фінансового стану компанії як складову частину методу. Розроблено інформаційну технологію для реалізації даної методики. Компоненти ІТ: розрахунок фінансових показників на основі даних фінансової звітності за певний період; аналіз рентабельності капіталу; визначення фінансової стійкості підприємства; визначення фінансового стану в динаміці; прогноз фінансового стану компанії на стратегічний період; формування стратегії розвитку для прогнозованих фінансових станів. Метод прогнозування фінансового стану на стратегічний період реалізовано з використанням нейронної мережі з архітектурою Temporal Fusion Transformer. **Висновки.** Наукова новизна одержаних результатів полягає у наступному: 1) удосконалені етапи процесу формування програми фінансування розвитку компанії на основі методики визначення фінансового стану компанії, моделі визначення раціонального співвідношення власних та позикових коштів, технології вибору можливих джерел фінансування проектів розвитку та методики визначення схем фінансування інвестиційних проектів; 2) набула подальшого розвитку методологія визначення фінансового стану компанії за рахунок включення компонента прогнозування фінансових показників на основі нейронної мережі; 3) удосконалено модуль визначення фінансового стану компанії для ЕРМ системи за рахунок реалізації ІТ, в якій реалізовано оцінку, прогноз фінансового стану компанії та формування фінансових стратегій розвитку компанії.

**Ключові слова:** стратегічний менеджмент; система управління ефективністю підприємства; фінансовий стан; інформаційні технології; стратегія; прогнозування; нейронна мережа.

## ИНФОРМАЦИОННАЯ ТЕХНОЛОГИЯ ОПРЕДЕЛЕНИЯ ФИНАНСОВОГО СОСТОЯНИЯ ПРЕДПРИЯТИЯ ДЛЯ ПОДСИСТЕМЫ ФИНАНСОВОГО ПЛАНИРОВАНИЯ ЕРМ СИСТЕМЫ

***В. В. Москаленко, Н. Г. Фонта, Е. Н. Никулина, М. А. Гринченко, С. И. Ершова***

**Предметом изучения в статье** является процесс формирования программы финансирования развития компании. Целью является разработка информационной технологии определения финансового состояния компании для подсистемы финансового планирования Системы управления эффективностью предприятия (ЕРМ). **Решаемые задачи**: разработать метод формирования программы финансирования развития компании как основу подсистемы финансового планирования ЕРМ системы; разработать методологию определения финансового состояния компании как составную часть метода; разработать информационную технологию (ИТ) определения финансового состояния компании; разработать метод прогнозирования финансового состояния на стратегическом периоде с использованием нейронной сети. Были получены следующие **результаты**. Метод формирования программы финансирования развития компании реализован в виде модуля подсистемы

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финансового планирования для EPM системы. Разработана методика определения финансового состояния компании как составная часть метода. Разработана информационная технологии для реализации данной методики. Компоненты ИТ: расчет финансовых показателей на основе данных финансовой отчетности за определенный период; анализ рентабельности капитала; определение финансовой устойчивости компании; определение финансового состояния в динамике; прогноз финансового состояния компании на стратегический период; формирование стратегии развития для прогнозированных финансовых состояний. Метод прогнозирования финансового состояния на стратегический период реализован с использованием нейронной сети с архитектурой Temporal Fusion Transformer. **Выводы.** Научная новизна полученных результатов заключается в следующем: 1) усовершенствованы этапы процесса формирования программы финансирования развития компании на основе методики определения финансового состояния компании, модели определения рационального соотношения собственных и заемных средств, технологии выбора возможных источников финансирования проектов развития и методики определения схем финансирования инвестиционных проектов; 2) получила дальнейшее развитие методология определения финансового состояния компании за счет включения компонента прогнозирования финансовых показателей на основе нейронной сети; 3) усовершенствован модуль определения финансового состояния компании для EPM системы за счет реализации ИТ, в которой реализованы оценка, прогноз финансового состояния компании и формирование финансовых стратегий развития компании.

**Ключевые слова:** стратегическое управление; система управления эффективностью предприятия; финансовое состояние; информационные технологии; стратегия; прогнозирование; нейронная сеть.

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