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## Article

# Providing software support for economic analysis

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## PROVIDING SOFTWARE SUPPORT FOR ECONOMIC ANALYSIS

*Today, modern software and hardware of information technologies are used to automate production processes, starting from modeling of technical developments and automated computer systems. This study is aimed at describing the process of implementing software support for economic analysis of the enterprise, which will calculate the main economic indicators and informatively display the calculated data. The object of the study is an automated system for calculating and maintaining the main economic indicators of the enterprise. The subject of research is methods of database design and development, data visualization and web applications. A review of literature sources allowed to conclude that most often to assess the economic performance of the enterprise, standard technologies are used, which the authors adapt to specific economic problems. In addition, the analysis of modern research has not identified a single software product that would collect, accumulate, analyze information and calculate the main indicators of economic activity of the enterprise, as well as monitor changes in such indicators in the dynamics. Automation of calculation of economic indicators, statistical analysis and visualization of data gives the chance to carry out effective management of the enterprise in modern economic conditions. The developed system allows to analyze the use of fixed assets; working capital analysis; analysis of the use of labor resources; profitability analysis; analysis of financial stability of enterprises. The paper shows the process of developing a functional model of a web application for the automated calculation of key economic indicators, and presents the advantages and disadvantages of working with the PostgreSQL database management system. The structure of the developed database, which consists of four tables, is given. An example of the work of the developed web application is presented.*

**Keywords:** software, web application, financial analysis, automated system, database.

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## 1. Introduction

With the development of the latest technologies, the automation of processes and its support in the form of various work with data is becoming relevant in all areas of human activity. Production automation is the widespread use of automatic and automated equipment in production processes, in which management and control functions are transferred to the manager and automatic devices (machines).

For the successful operation of the company, it is necessary to conduct an economic analysis of the work and adjust it according to the obtained results. During the analysis of economic activity, the following points are evaluated:

- economic factors, phenomena and processes related to the work of the enterprise;
- implementation of plans by the company itself, its individual divisions and industry associations. Accounting, statistical and other reporting is used here;
- identification of reasons that positively and negatively affect the execution of planned orders;
- identification of regularities in the development of the enterprise, research of its reserves and lost opportunities [1].

All this determines the relevance of the theoretical and practical analysis of the production activity of the enterprise, its turnover, the study of prospects for the development of production for the future and the introduction of new technologies in the production of products.

Today, information technologies are widely used in the analysis, processing of results, summarization of the received data, forecasting of the performance indicators of enterprises and organizations. A number of scientific studies are devoted to the development of information technologies for conducting analysis at the enterprise [2, 3]. In research:

- the need to improve enterprise management based on automating the analyst's workplace is substantiated;
- the tasks and principles of the organization of the analytical process in the conditions of the functioning of the automated information processing system are defined;
- the main indicators of the effectiveness of the automation of the analysis and the determination of the amount of annual savings due to the improvement of management when using information in the conditions of the automation of economic analysis and the reduction of costs for processing information are given [2]. In the study [3], information technologies for automating

the analysis of financial results and auditing the financial stability of enterprises in the tourism sector using typical MS Office software (Access application) are proposed.

Studies [4, 5] are devoted to the analysis of the role of information technologies and their impact on economic growth and stability. The authors of these studies prove that with the help of information technologies, the country will be able to increase the production of goods and services.

Works [6, 7] are devoted to the analysis of the contribution of information technologies to the investment sector. The authors investigated the impact of technology on increasing returns from investments in the stock market, and also revealed the growing influence of technology in investment banking.

A consolidated information system is proposed as a result of the interaction of business entities in the information space; the information and communication direction of the virtual platform of integration is disclosed, the principles of its formation and the composition of the elements that make it up are substantiated [8].

The authors of the work [9] investigated modern directions of development of financial and economic potential on the example of united territorial communities of one region by introducing electronic technologies to choose a promising direction of development and create favorable conditions for modern business communications.

The conducted review made it possible to conclude that most often standard technologies are used to assess the indicators of economic activity of the enterprise, which the authors adapt to specific economic tasks. In addition, the analysis of modern research did not allow finding a single software product that would allow collecting, accumulating, analyzing information and calculating the main indicators of the economic activity of the enterprise, as well as observing the change of such indicators in dynamics.

*The aim of this research* is to describe the implementation of software support for the economic analysis of the enterprise's activities, which will allow the calculation of the main economic indicators and the informative display of the calculated data.

## 2. Material and Methods

*The object of research* is an automated system for calculating and supporting the main economic indicators of the enterprise. *The subject of research* is methods of database design and development, data visualization and web applications.

The main indicators of financial and economic analysis of enterprise activity include:

- analysis of the use of fixed production assets – the return on capital ratio and the index of capital intensity, the indicator of the profitability of production assets, the rate of depreciation of fixed assets;
- analysis of working capital – turnover ratio and recruitment ratio;
- analysis of the use of labor resources – the turnover rate and the staff stability rate, the number of employees working at the enterprise (organization, firm) and labor productivity;
- profitability analysis – gross income, profit margin, profitability of sales and profitability of sold products;
- analysis of financial stability of enterprises – coefficient of autonomy and coefficient of financial stability.

## 3. Results and Discussion

The developed information system allows automated calculation of the company's financial indicators. Fig. 1 shows the UML diagram of the activity of the analyst and shows the actions that the user must perform to obtain the required result.

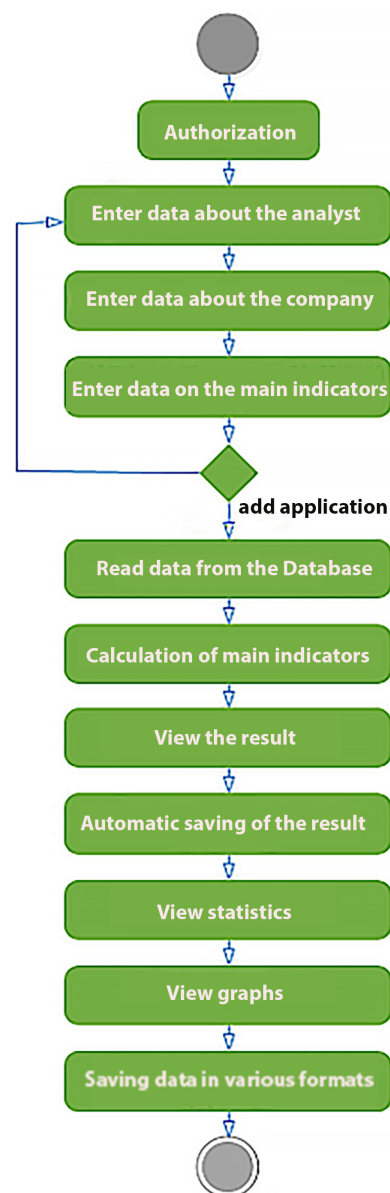


Fig. 1. Diagram of analytics activity

When designing a usage diagram, the actor is defined first, and then the actions that the actor can perform in the system [10]. In this case, the actors of the system are an analyst or an administrator. They can make a request to display a page in a web browser.

A detailed analysis of the precedent diagram performed by the system actor in relation to the browser, server, web application, and database is shown in Fig. 2.

From Fig. 2, the following actions can be distinguished from the options for use:

- entering the URL (from the English Universal Resource Locator) in the search term of the browser;
- transfer of the request from the browser to the server;

- transfer of the request from the server to the application;
- transfer of the request from the application to the database;
- receiving a response from the database by the application;
- receiving a server response from the application;
- receiving a response by the browser from the server.

Before the user sees the content of the site on its screen, the Web browser makes a request to the server to get the content. The client part of a web application is a graphical interface. That is, what the user will see on the page.

The input data to the automation system of the main economic indicators of the enterprise are:

- the cost of the production volume (c. u.);
- income from other activities (c. u.);
- taxes (c. u.);
- time spent on production (hours);
- initial cost of fixed assets (c. u.);
- amortization of fixed assets (c. u.);
- the cost of fixed assets at the beginning of the year (c. u.);
- received fixed assets (c. u.);
- retirees of fixed assets (c. u.);
- the value of fixed assets at the end of the year (c. u.);
- balance of working capital (c. u.);
- price (c. u.);
- short-term liabilities (c. u.);
- long-term liabilities (c. u.);
- income tax (c. u.);
- cost price (c. u.).

The initial data for the system of basic calculations of the main economic indicators of the enterprise are:

- fund rate of return;
- capital intensity factor;
- profitability of fixed assets;
- production;
- labor intensive;

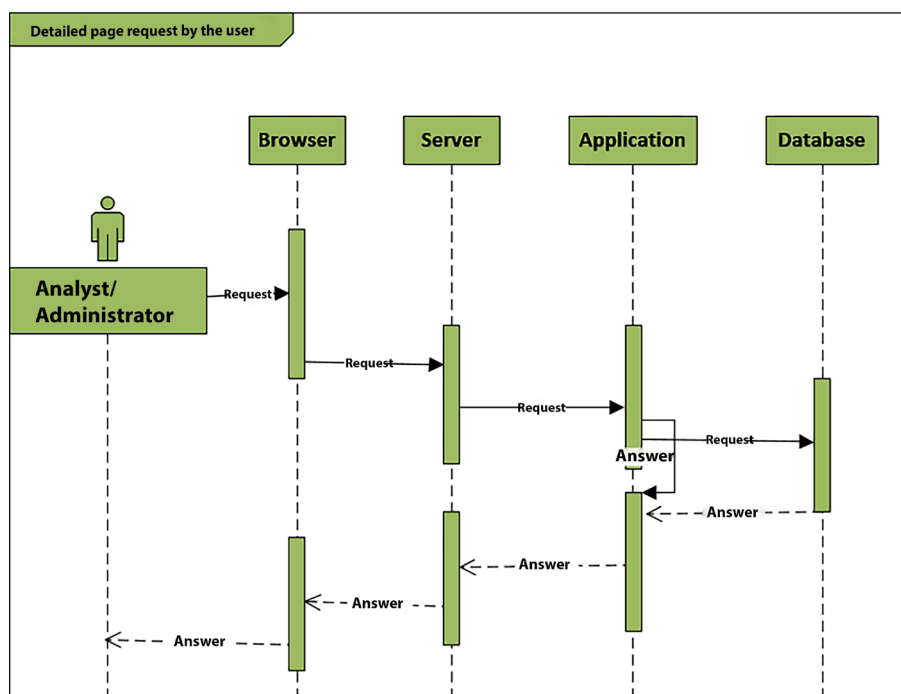
- revenue;
- profit;
- wear coefficients;
- turnover ratio;
- recruitment ratio;
- staff turnover rate;
- personnel stability coefficient;
- the number of employees working at the enterprise;
- productivity;
- coefficient of autonomy;
- coefficient of financial stability;
- profitability of products;
- profitability of sales.

The design of the information system was carried out by PostgreSQL, which is a relational DBMS (database management system). PostgreSQL supports SQL (Structured Query Language) and can be used as a SQL server. This means that it is possible to communicate with the server in the SQL language: the client sends a request to the server, which processes it and gives the client only the data that was obtained as a result of a specific request. Additionally, PostgreSQL is open source software, meaning it is free to learn and modify. The package is distributed under the terms of the GPL (General Public License) [11].

With the advent of Internet technologies that allow the creation of dynamic Web pages, the demand for DBMSs, which would be most suitable for this in terms of speed, reliability, and stability, has grown tremendously. One of the advantages of PostgreSQL is speed. Thanks to its internal multithreading mechanism, PostgreSQL is extremely fast.

PostgreSQL is advantageously different from many other DBMS. It has almost all the capabilities that are available in other databases (commercial or Open Source), as well as some additional ones.

PostgreSQL's disadvantages include that it does not support all of the ANSI SQL 92 standard and a small part of the ANSI SQL 99 standard, and is also slower than the equally popular MySQL database.



**Fig. 2.** Scheme of the page request by the user

The web application interacts with the database using the Active Record framework (a software platform that defines the structure of the software system), which not only implements object-relational mapping, but also includes a large number of connectors that connect Ruby applications with various DBMS. The Active Record schema is an approach to accessing data in a database. An object instance is bound to a single row in the table. After the object is created, a new row will be added to the table for storage. Any loaded object gets its information from the database. When the object is updated, the corresponding row in the table will also be updated. A wrapper class implements accessors or properties for each column in a table or view [12]. Typically, a foreign key relationship will be represented as an object copy of the appropriate type through the property.

The implementation of this template often violates the principle of single responsibility (SRP), which combines in one object both the representation and the internal logic of the object itself, as well as CRUD mechanisms (abbreviated from the English create, read, update, delete – «create, read, update, delete»), so Active Record can be considered anti-pattern. In other cases, this statement is contradictory, because the object itself implements ActiveRecord, which does not contain any business logic, and providing a table from the database has only one reason for change (table changes), which does not contradict the definition of the SRP principle [13, 14].

The structure of the developed database is shown in Fig. 3.

One of the examples of information output by the developed application is shown in Fig. 4.

The practical significance of the results of this research lies in the ability of the designed information system to perform automated calculation of the company's financial indicators.

Possible areas of practical application of the developed web application are:

- economic analysis of the enterprise's activity;
- economic justification of IT projects;
- information provision of financial activities of the enterprise.

This research closes the problematic part of information support of the enterprise's financial activity in the aspects of providing software support for economic analysis. This is achieved thanks to the functional model of the web application developed by the authors for the automated calculation of the main economic indicators and is explained by the corresponding results of the designed information system.

Among the shortcomings of the created functional model of the web application for the automated calculation of the main economic indicators should be attributed the fact that it does not take into account the situations of risk and uncertainty that may arise in the decision-making process.

As a result of the martial law conditions, input data for the design of the automation system of the main economic indicators of the enterprise had to be collected online.

Further areas of research may be:

- assessment of the effectiveness of information provision of financial activities of the enterprise;
- development of risk management techniques for enterprise activity;
- development of a methodology for supporting decision-making regarding the improvement of the quality of information support for the enterprise's financial activities.

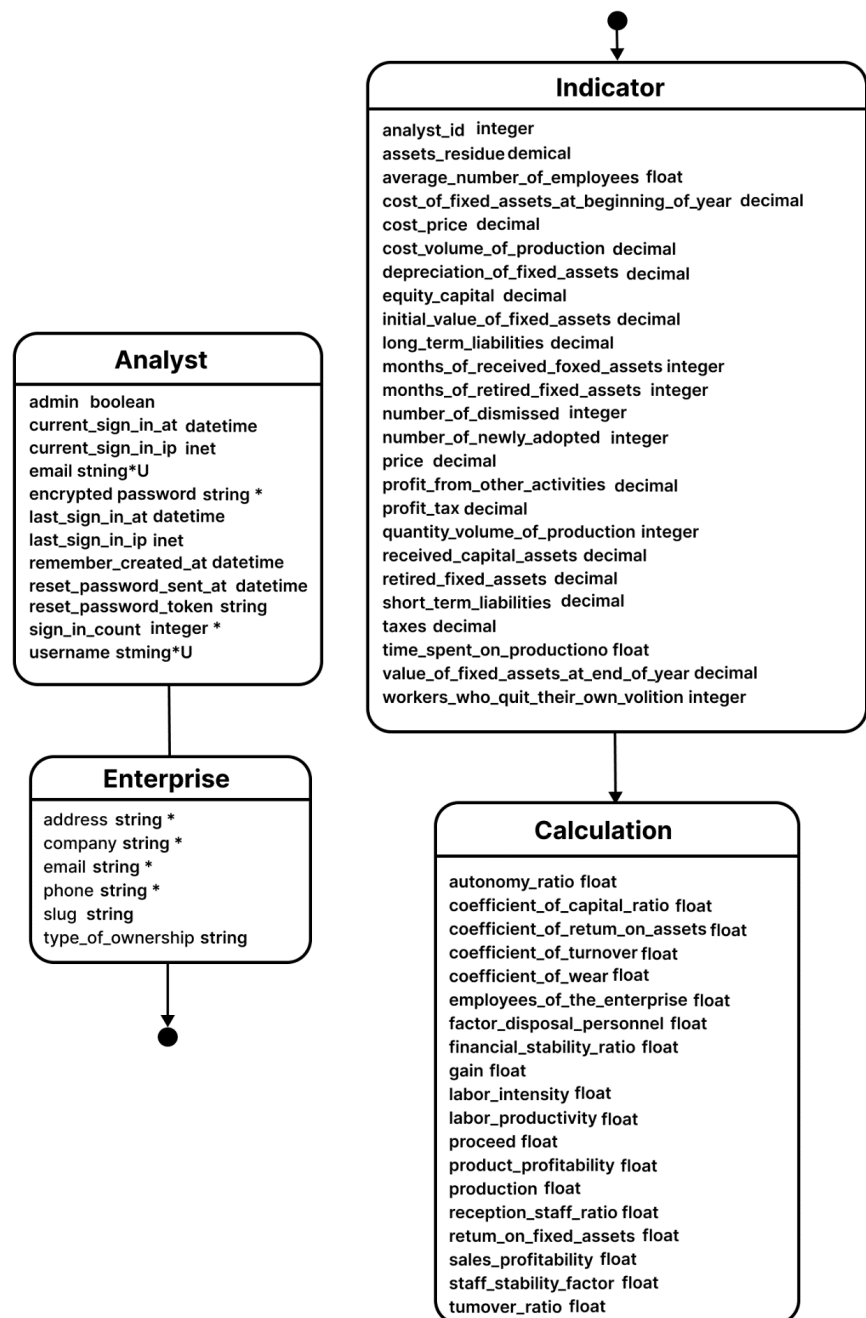


Fig. 3. Database structure



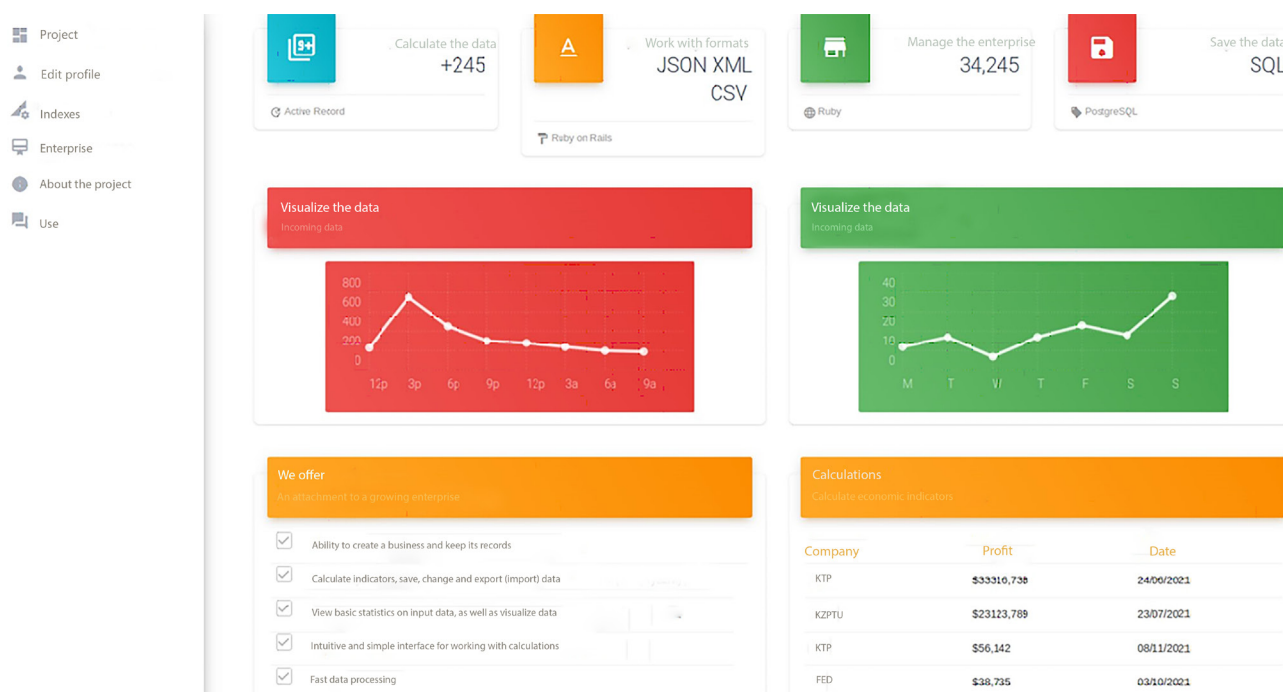


Fig. 4. The page of the developed web application for evaluating the economic indicators of the enterprise

## 4. Conclusions

The UML diagram of the analyst activity of the automated system of calculation and support of the main economic indicators of the enterprise has been developed. This makes it possible to implement the task of developing a software tool (web application) that provides the calculation of the main economic indicators of the enterprise.

An automated system for calculating and supporting the main economic indicators of the enterprise has been created. The implementation of software support for economic analysis and calculation of the main economic indicators will provide an opportunity to more dynamically influence the company's activities, reduce the routine burden on employees, and also conveniently and informatively show the results of calculations. The proposed list of factors that form the basis of the knowledge base of the information system for assessing the quality of the pre-press technological process.

A web application has been developed for evaluating the economic indicators of the enterprise. Using this web application will enable automated calculation of key economic indicators and interaction with the PostgreSQL database management system.

## Conflict of interest

The authors declare that they have no conflict of interest concerning this research, whether financial, personal, authorship or otherwise, that could affect the study and its results presented in this paper.

## Financing

The study was performed without financial support.

## Data availability

The paper has no associated data.

## Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies when creating the current work.

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