The object of this study is the business processes of making an investment decision based on determining the state of the investment attractiveness of the enterprise.

To support the adoption of investment decisions under the conditions of a fast-moving and dynamic environment, information-analytical support to the algorithm using intelligent information systems has been developed. The relevance of the study is justified by the continuous development of digitization processes, in particular in the financial realm. The traditional approach to the reproduction of management decision-making technology is complemented by the tools and methods of intelligent information systems. In particular, the modeling of the target subject area using UML made it possible to determine the main requirements for the projected information-analytical support (user roles, available options, types of connections and the logic of interaction between them). SQL queries to the information database speed up the process of processing and obtaining the necessary data samples. Business intelligence (BI) tools are used to create interactive reports that provide access to operational financial data. At the stage of making investment decisions, these tools make it possible to study a wide range of analytical data based on the results of the assessment of the investment attractiveness of the enterprise obtained at the previous stage of the developed algorithm. Monitoring of the main indicators of the enterprise's investment attractiveness is carried out on the basis of a dashboard, an information panel (display) with graphs, tables, and figures that clearly reflect the dynamics and rates of change of the investigated indicators. The results of the use of algorithmic information-analytical support make it possible to quickly prepare and make investment decisions. A visual description of the projected information-analytical support, visual content of the results of investment analysis, the validity of decisions due to the use of reliable retrospective information from an aggregated database

Keywords: business process algorithm, investment attractiveness, information-analytical support

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INFORMATION-ANALYTICAL SUPPORT TO BUSINESS PROCESSES FOR MAKING INVESTMENT DECISIONS

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1. Introduction

In the modern technological space, the speed and quality of analytical information processing with the help of information technology tools is a determining criterion for achieving the effectiveness of an adopted investment decision. The strategic importance and high risk of investment activity increases the importance of information-analytical support for making an investment decision. In the process of meeting the information needs of making investment decisions, it is information technology tools that play a decisive role in ensuring the criteria of their efficiency, adequacy, and effectiveness. Modern information technology tools contribute to the duality of management of investment business processes. Firstly, through the formation of a decision-making information base that is sufficient and convenient for interpretation and analysis, and secondly, through flexible analytical procedures for its processing and visualization.

A well-founded sequence of analytical business processes is a tool for visual display of the process of combining the necessary tools, methods, rules, and actions for the development of information-analytical support for making an investment decision. Their logical and gradual implementation will create a comprehensive information base regarding the state of the dynamic environment, factors and conditions under which company management should develop and approve investment measures. However, there is currently no list of universal steps for diagnosing various aspects of business functioning under unstable conditions for building its investment programs. Such an approach should be situational, in particular in the selection of analytical tools and procedures for justifying investments. Streamlining the necessary basic business processes and their subsequent changes can be achieved through flexible algorithmizing of tasks that the investment manager solves.

The algorithm helps in structuring and organizing the actions necessary to solve an issue or a problem on the way to

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making an investment decision. It contributes to a structured and easy understanding of the process of their implementation, reduces the number of steps that must be taken to achieve a result, thereby ensuring the optimal use of resources.

The work of finance specialists when making an investment decision involves the analysis and evaluation of a significant array of data using statistical, economic-mathematical, expert, and other methods of data processing. Under the conditions of digital development, these procedures are simplified by the use of modern intelligent information systems, which combine separate tools for performing a specific task at the stage of making an investment decision and can be used as a basis for the development of appropriate software. In this context, the algorithm is a means of communication between a specialist in solving a financial business problem and an IT specialist. Such communication involves the transfer of a clear technical task, with the definition of input and output data, as well as expected results. For a programmer, a technical task and an algorithm are the basis for writing a program code in a certain programming language, which automates the execution of the task and obtaining the result, helps to identify possible errors and shortcomings in the process of solving the task in advance, and makes this process easier. The set tasks are the basis for the development of an algorithm that describes the sequence of actions to solve the task. The author of work [1] points out that many of them are implemented using an inefficient approach to the programming process, which consists in the fact that each new project is considered from "scratch", without taking into account already existing programs. Because of this, as well as taking into account the variable number of input parameters for investment projects of various fields, it becomes expedient to form a basic algorithm for making investment decisions, which will allow combining various tools and form an informational and analytical basis for the investor. The investment decision-making algorithm provides for the implementation of business processes that create an informational and analytical basis for choosing directions of possible capital investments in order to maintain the organization's activities, increase its competitiveness, conduct research, qualitatively update assets, or expand production capacities.

In today's world, information technologies play a key role in optimizing business processes. The integration of systems and the automation of processes with the help of IT tools provide companies with a number of significant advantages that make the business more flexible, efficient, and competitive. Financial data necessary for making investment decisions must be downloaded from verified sources operated by the company and systematized according to its information needs. The level of implementation of IT technology in the activities of enterprises plays an integral role here. ERP (Enterprise Resource Planning) systems integrate various aspects of business and provide access to key data and processes. E-commerce platforms expand the scope of geographical restrictions, provide access to a global customer base. CRM systems (Customer Relationship Management) help optimize internal processes related to customer service, establish communication and update customer data. Business analytics using the latest technologies also helps optimize business processes. The BPMN (Business Process Model and Notation) program enables companies to model and optimize business processes. It provides tools for visualization, analysis, and automation of business processes, which helps increase efficiency and reduce costs.

2. Literature review and problem statement

Information technology tools are used to optimize business processes in the field of financial decision-making. According to the Statista portal [2], the number of companies in the world working in the field of financial technologies increased from 12,131 units in 2018 to 29,935 units as of 2024. The scope of application of intelligent information technologies is also expanding. In the financial sector, machine learning algorithms are used to detect fraud, automate trading, and provide financial advice to investors. Owing to management information systems, financial institutions have the opportunity to justify credit decisions based on access to information about the borrower's financial condition.

An intelligent information system for financial institutions (IISFI), which helps predict cases of fraud in financial reporting, was developed in [3]. The authors of the paper conclude that the higher the quality of financial reporting, the better the organizational efficiency of the institution. In fact, they solve one of the problems in the process of making a financial decision, namely: not admitting to consideration financial requests from entities that provide known inaccurate information in financial statements. Data on the subject's real financial condition and risks that may affect it are not taken into account when making decisions.

In order to avoid cash gaps in the activities of organizations, a stochastic model for calculating the optimal portfolio of supplier payment risks is proposed in [4]. The segmentation matrix created on their basis provides practitioners with the cognitive ability to choose appropriate supply chain financing solutions for suppliers. The proposed method can be implemented in an artificial intelligence-driven explanatory recommendation system using the Python programming language. Limitations in the use of stochastic risk forecasting models for decision-making are associated with the difficulty of taking into account a significant array of factors and factors that can strategically change the expected results. Including too many components in the model makes it less clear and accurate, and the development process itself leads to many difficulties during development.

In work [5], it is proposed to deepen the application of methods of using linguistic systems in the banking sector by introducing the morphological analysis algorithm and automated decision-making products (Decision Making Helper). That made it possible to improve the quality of card service for the bank's client due to the speed of the data processing process and taking into account the client's individual needs. Intelligent data processing systems based on the use of artificial intelligence (AI) have found application in financial analysis in banking institutions. Through such systems, bankruptcy forecasting, credit decision-making, bank card approval, detection of money laundering, stock analysis [6] are carried out. The scientific achievements of the authors of the studies highlighted in works [3–6] represent the validity of using automated decision-making products to solve a specific financial problem.

The influence of information systems on the efficiency of investment processes at enterprises was studied in [7]. However, the author paid more attention to the system of evaluating the economic efficiency (attractiveness) of investment projects than to the informational and analytical justification of the decisions that precede them. Thus, the issues of automating the drawing up of the investment project plan of the enterprise, which the author tried to solve, and which

should be built on the basis of a well-founded algorithm for the implementation of analytical business processes, were left out of consideration.

The results of research [8, 9] on the use of information technologies in investment processes tackle robotic financial management. Such management involves the introduction of artificial intelligence into traditional financial advisory services instead of physical robots that help clients manage their financial affairs. In work [8], more attention is paid to the technical features of the operation of "robot-consultants". The problem of minimizing the risks of decision-making based on the advice of artificial intelligence is solved. Work [9] analyzes the effect of the advice of "robot-consultants", which consists in improving an individual investment decision. The effect of robot-advisor advice is that, with the help of algorithms and artificial intelligence, they can analyze investment opportunities and recommend optimal strategies for investors. This can help investors make better decisions about their investments and improve their financial performance. However, when it comes to large investment projects where many factors need to be considered, such as risks, cost of capital, strategic plans, etc., robot-advisors may be less effective. Large projects may require complex strategies and solutions that may be beyond the capabilities of robot-advisors and therefore require human expertise and analytics. To solve the main problems faced by financiers, enterprises need to reduce time spent on analytical procedures, which can be achieved by means of information technologies and effective decision-making due to the reliability of their results.

No financial decision is complete without analyzing dynamic and large volumes of data. Access to databases, speed of processing requests, structured information are criteria for the productivity of a financial analyst. SQL (Structured Query Language) is a programming language used in finance to process and analyze data such as transactions, budgets, reports, etc. SQL makes it possible to query databases to obtain the information you need, perform data aggregation, filter and sort data, and perform data analysis for financial decision making. SQL can also be used to create reports and dashboards that help manage the company's finances. Database management systems undergo constant changes due to the transformation of the nature of data from structured to unstructured. This led to the fact that new versions of the SQL structured query language began to be created, which are characterized by efficient storage and management of such data that cannot be processed by traditional RDBMS (Relational Database Management System) methods. Proposals for improving the SQL operator were given in [10]. Having received the new version 2.0 of transparent SQL, the authors achieved the result of providing multi-level detailing of data. That was made possible by the presentation of valuable and intermediate versions of data, which can be useful from the point of view of security of data analysis and information design. A separate advantage is the absence of additional implementation costs because it can be implemented like standard SQL in various mechanisms. The authors of paper [11] reveal the advantages of using NoSQL (Not Only SQL) databases in the financial realm. However, the question of their further processing for the purpose of making investment decisions is not revealed.

Designing models of subject areas of a financier's activity is an important stage in the development of information systems used to manage financial processes. This process includes the creation of structured models that reflect key aspects of financial transactions, processes, and relationships. Works [12–14] tackle certain aspects of financial process management modeling. With the help of UML modeling (using the Unified Modeling Language) and integration of the created model into the ERP (Enterprise Resource Planning) system as part of the Business Intelligence component or the Scorecard component/module, the company can find out the value of the Anghel rating at any time. The latter indicates its financial condition, demonstrates stability or the risk of bankruptcy. However, in the face of uncertainty, there is also a need to apply flexible tools to examine the factors that led the business to current results.

Of course, the list of intelligent information systems that have already been implemented or can be implemented in the activities of companies to optimize financial management processes is not exhaustive. Functional capabilities, availability, and effectiveness of using some of them create the presence of unsolved problems. A financial analyst/manager cannot limit his/her activity to only one of them. The work should be based on the use of a set of tools for data formation, processing, analysis, modeling, and forecasting, united by a single algorithm that facilitates the adoption of informed management decisions. The main obstacle to ensuring the implementation of intelligent information systems in the activities of companies that are residents of developing countries is their relatively low level of digitization compared to developed countries. However, recently many companies have started to implement digital solutions to automate business processes, improve communication with customers, optimize production, and manage data.

3. The aim and objectives of the study

The purpose of our work is the development of information-analytical support for business processes of making investment decisions. This will make it possible to save time for their preparation and acceptance, ensure accuracy due to the use of reliable retrospective information from the aggregated database.

To achieve the goal, the following tasks were set:

– to devise and substantiate the detailed procedures of the algorithm of the business process for determining the state of the investment attractiveness of the enterprise;

– to design information-analytical support for the algorithm of the business process of determining the state of the investment attractiveness of the enterprise.

4. The study materials and methods

The object of our research is the business processes of making an investment decision based on determining the state of the investment attractiveness of the enterprise. The subject is informational, technological, methodical, and practical tools for making investment decisions.

The use of specialized information-analytical support for data collection, analysis and visualization can significantly simplify the business process of making an investment decision. Analysis of financial indicators, market conditions, competitive situation and other factors will allow to objectively assess investment opportunities and risks based on the state of investment attractiveness. The application of the business process algorithm based on the analysis of

information on investment attractiveness will help reduce randomness and improve the quality of investment decisions.

The research is based on the application of a comprehensive approach that includes system analysis, data integration, logical and structural analysis. Methods of comparative analysis are also used to study innovative approaches in the development of information-analytical support. The research methodology is aimed at understanding and analyzing new technologies and methods that can be used to make informed investment decisions.

The use of UML (Unified Modeling Language) for modeling the subject area makes it possible to define the main requirements for the designed information-analytical support: the role of the user, available parameters, types of links and the logic of interaction between them. The developed algorithm for determining the state of investment attractiveness of the enterprise is fundamental. The UML model of the subject area adapts to changes under the conditions for making management decisions. That is, its elemental structure is expanded or shortened according to the current list of precedents that reflect the main tasks of a financial analyst. SQL queries to the information database will be updated to retrieve the required sample data. The methods of intellectual analysis are determined based on the relevance of the UML model for solving precedents. Business Intelligence (BI) tools are used to create interactive reports that provide access to operational financial data. At the investment decision-making stage, these tools make it possible to explore a wide range of analytical data based on the results of the assessment of the company's investment attractiveness obtained at the previous stage of the developed algorithm. Monitoring of the main indicators of companies' investment attractiveness is based on information panels (displays) with dashboards, graphs, tables, and figures that visualize the dynamics and speed of change of the studied indicators.

5. Results of research into the development and design of the investment decision-making algorithm

5. 1. Detailing the procedures of the algorithm of the business process of determining the state of the investment attractiveness of the enterprise

In the modern business environment, it is necessary to implement a number of business processes. In order to make management decisions, it is necessary to carry out high-quality modeling of business processes in the financial realm in order to create information-analytical support for financial management operations of a business entity. Structured representation of the content of business processes became possible owing to the use of modern digital technologies. This makes it possible to convey to the target audience important points about the state of the subject area of research in the financial sector and formulate reasonable conclusions for making management decisions. One of the problems that arises in the process of research in the financial sector is the choice of an appropriate approach to the systematization and structuring of business processes covering various financial operations and functions. Errors in the organization of the implementation of such business processes reduce the efficiency of the economic entity as they can lead to incorrect interpretation of the situation by persons who make decisions regarding economic systems and phenomena.

When designing business processes for managing the organization's finances, it is important to consider the following aspects:

– detailed understanding of the logic and interrelationships of the organization's business processes;

– compliance of the system with the requirements and expectations of users;

– the model should include a clear data structure that reflects all the necessary elements of the financial system, such as customers, transactions, accounts, payments, etc.;

– the model must take into account all business rules and restrictions that apply in the financial sector to ensure the proper functioning of the system;

– standard methodologies such as UML (Unified Modeling Language), BPMN (Business Process Model and Notation), etc. can be used for effective model design;

– testing and validation of the model for correctness and efficiency of its operation.

In summary, designing financial management models for an organization is a complex process that requires a deep understanding of business processes, data, and user needs. Carrying out this process systematically and carefully, one can create an effective and functional intelligent information system for managing financial processes.

Adhering to the requirements for the design of business processes of financial management of the organization, its beginning requires setting a specific task that is put before the financial analyst. Continuous monitoring of the subject's financial condition is his/her exclusive task. At the same time, the coverage of information in reports based on the results of monitoring and analysis may differ depending on the requests received from users of such information from the external and internal environment.

After a significant recovery in 2021, global foreign direct investment fell 12 % in 2022 to USD 1.3 trillion, largely due to overlapping global crises – the war in Ukraine, high food and energy prices, and rapid growth of public debt. The decline was felt mainly in advanced economies, in which FDI fell by 37 % to USD 378 billion. But flows to developing countries rose by 4 % – albeit unevenly, with a few large developing countries attracting most of the investment, while flows to least developed countries declined. The decline was felt mainly in developed economies, in which foreign direct investment fell by 37 % to USD 378 billion. But flows to developing countries increased by 4 %. International investment in the field of sustainable development goals in developing countries has ensured a growth in the number of projects in the areas of infrastructure, energy, water supply and sanitation, agri-food systems, health care and education. Statistics show that in the period 2021–2022, the number of international private projects in the infrastructure sector (transportation, production and distribution of electricity (except renewable), telecommunications) increased by 26 %; in the renewable energy sector by 8 %; provision of industry and households with water and sewage – 20 %; in the sector of agri-food systems (agricultural production and processes; fertilizers, pesticides and other chemicals; R&D; technologies) – 6 %; in the sector of health care and education (hospital premises, school buildings and other infrastructure for providing services) – 8 % [15].

Solving the problem of business readiness for investment development is relevant for the realities of the Ukrainian economy. The post-war state of Ukrainian enterprises will re-

quire significant investments to restore and develop the economy. The war caused serious damage to businesses in the form of destroyed infrastructure, loss of equipment and technology, disruption of supply chains, and reduced production and sales. Foreign and domestic investments can become a key factor in the recovery of Ukraine's economy after the war. Therefore, in response to these requests, the task of reproducing and introducing in the activity of the entity that needs investment resources, the model of information-analytical support for making investment decisions using the use of information systems is crucial. So, in response to this request, the task of reproducing and introducing in the activity of the entity that needs investment resources, the model of information-analytical support for making investment decisions with the help of the use of intelligent systems is crucial.

Fig. 1 shows an algorithm of the business process of determining the state of investment attractiveness of the enterprise.

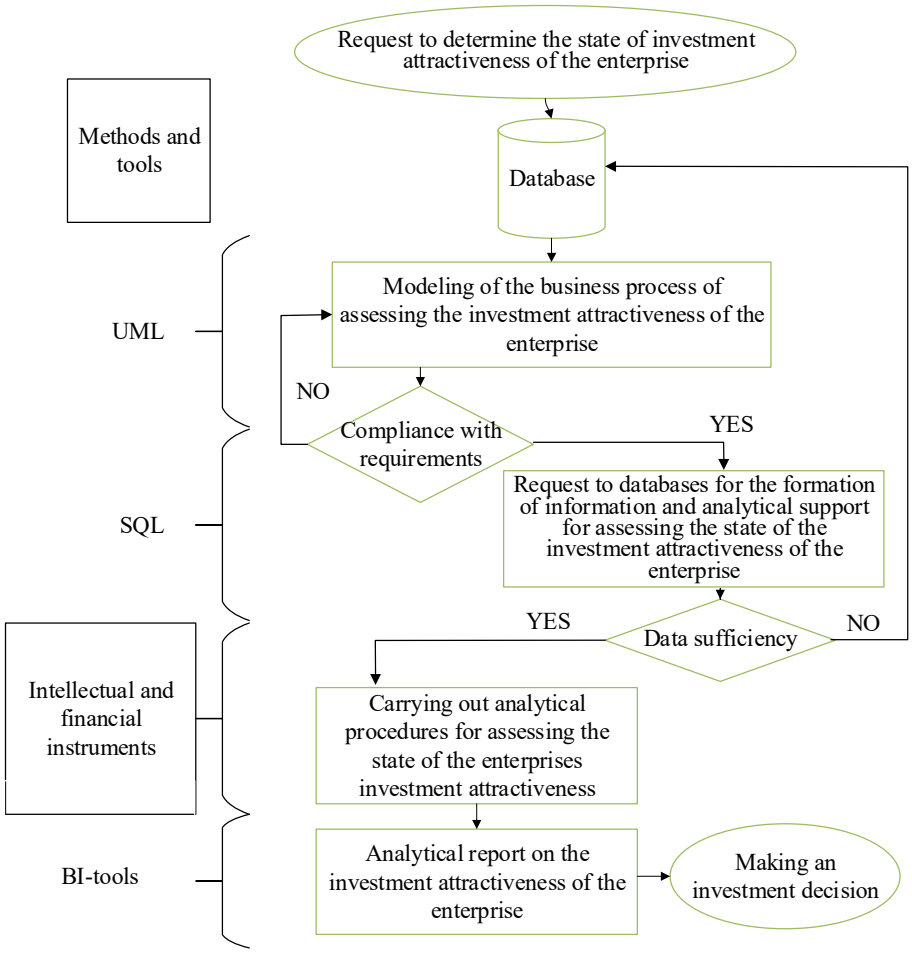


Fig. 1. Algorithm of the business process of determining the state of investment attractiveness of the enterprise

The implementation of the algorithm involves setting the task of determining the state of the investment attractiveness of the enterprise, the implementation of which will contribute to supporting the adoption of an investment decision. The reproduction of the algorithm involves the use of a significant array of information, the processing of which is provided by the use of intelligent information systems tools: UML modeling, SQL queries, intelligent and financial data analysis tools. The algorithm is implemented in the following sequence:

– modeling of the business process of assessing the investment attractiveness of the enterprise. With the help of UML modeling, the functionality of the designed information-analytical support is reproduced with a description of the procedures for analysis and assessment of the financial condition, necessary for further adoption of investment decisions. Satisfying the requirements for the adequacy of procedures and functionality, which satisfy the analyst's needs in the formation of an investment decision, ensures the transition to the next stage of algorithm implementation;

– a request to databases for the formation of information-analytical support for assessing the state of the investment attractiveness of the enterprise. The condition of sufficiency of information-analytical support allows the transition to the next stage – conducting analytical procedures for assessing the state of the enterprise's investment attractiveness. In the case of its insufficiency, the query to the databases is corrected and refined by means of SQL until the criterion of their completeness is met for the analysis and adoption of an investment decision.

The penultimate stage of the algorithm, which reproduces the possibility of making an investment decision, is the formation of an analytical report on the state of the enterprise's investment attractiveness. Its implementation may involve the use of various tools of intellectual and financial analysis, which are available, understandable, and chosen by the analyst to perform the procedures. Using the example of making an investment decision, it is proposed to use classic tools of financial analysis to assess the state of the enterprise's functioning and outline the factors of its investment attractiveness with the simultaneous use of cluster analysis methods. The method of cluster analysis satisfies the requirements of conducting a comparative analysis among the set of investigated enterprises, with the definition of a group (clusters) of potentially attractive enterprises for making an investment decision.

5. 2. Designing the information-analytical support to the business process algorithm for determining the state of the investment attractiveness of the enterprise

The design of information-analytical support for the implementation of the presented algorithm begins with the

construction of a model of the description of the subject area by means of UML. The unified modeling language makes it possible to form requirements for information-analytical support, which will satisfy the needs of a financial specialist in the formation of a reasonable basis for making management decisions.

To determine the components of the projected subject area, it is advisable to form a use-case diagram. Thus, the UML model will make it possible to describe the functionality of the designed information-analytical support, which will be available to different categories of financial specialists. It is worth noting that conducting analytical procedures for assessing investment attractiveness involves researching the financial condition of the enterprise based on its financial statements and identifying the impact of the main factors on investment attractiveness [15]. Therefore, Table 1 gives the characteristics of the components of the use-case diagram, which describes the procedures for analyzing and evaluating the financial condition, necessary for further investment decisions.

The model formed by UML tools should graphically describe the implementation of the business process of assessing the state of the investment attractiveness of the enterprise through the study of its financial state, provide for the separation of its functional components from the position of the roles (users) involved. The developed model of precedents (options of use) is shown in Fig. 2. Precedents reflect the expected behavior of the projected information-analytical support, represent a set of possible functions, actions or tasks that must be implemented during the assessment of the investment attractiveness of the enterprise. The model uses "include" connection types to the use case "Evaluation of solvency", "Profitability analysis", "Analysis of financial stability", "Evaluation of business activity". This certifies the mandatory performance of these actions in the course of evaluating partial indicators by the user of information support with the role of "Financial Analyst". The type of connection "extend" reflects the additional functionality of the projected information-analytical support for the use case "Assessment of the enterprise's operating environment (factors of influence)", namely the possibility of carrying out strategic, regression, factor or cluster analysis according to the need or requirement of the actor.

To clarify the logic of the use option "Evaluation of the financial state of the enterprise to determine investment attractiveness", a sequence diagram was created, which reflects its implementation scenario and determines the elemental composition (Fig. 3). The given sequence of actions is initiated by a financial analyst, as a user of information support for assessing the investment attractiveness of an enterprise and demonstrates the behavior and interaction of the latter's components. Therefore, the user interface of the analytical and information support (the form "Evaluation of investment attractiveness") should enable the financial analyst to choose the type of evaluation, the need for which has arisen, to enter the initial data (previously obtained through an SQL query to the database). The calculation results should be displayed on a separate interface (the user can only view them).

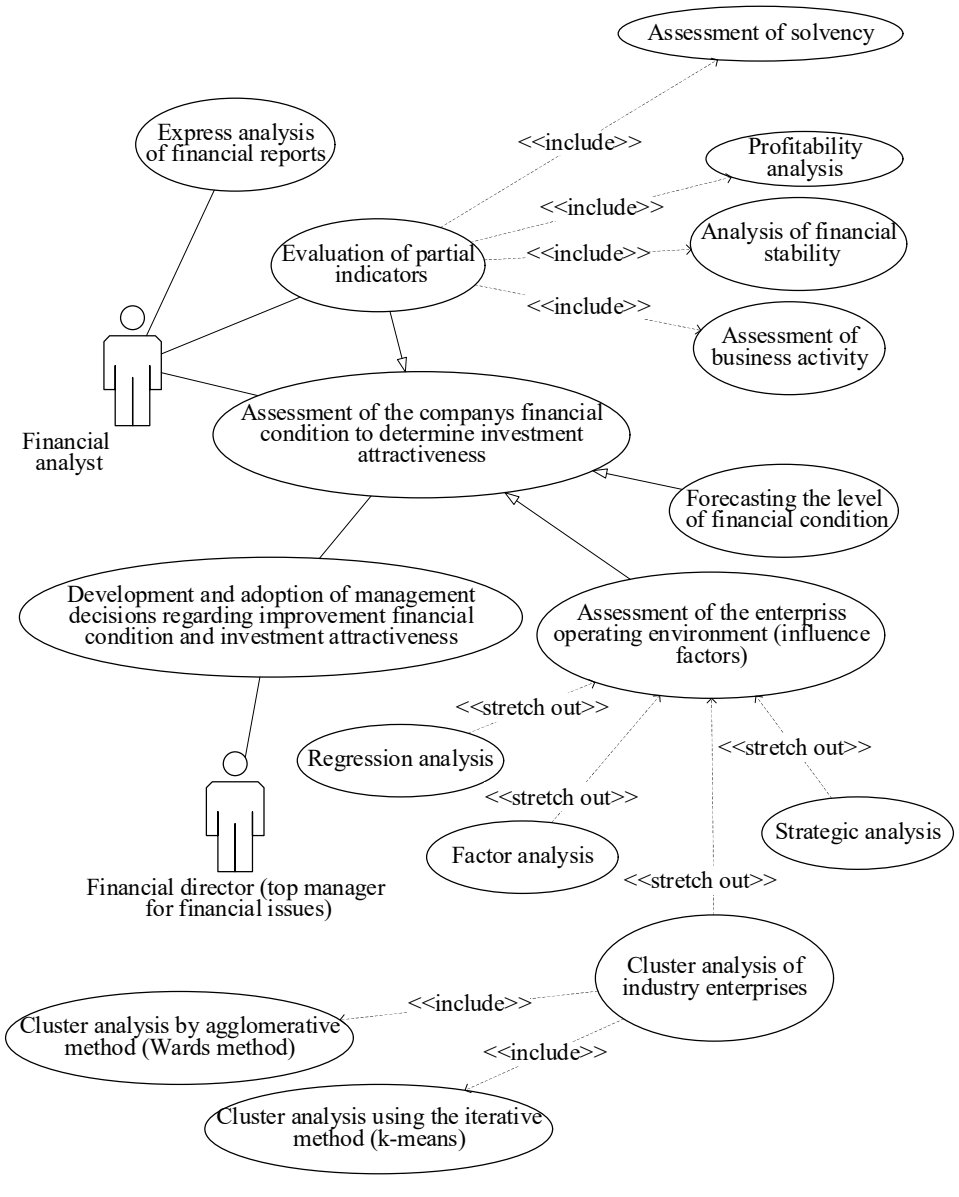


Fig. 2. Modeling the assessment of the financial state of the enterprise in the system of researching its investment attractiveness using UML tools

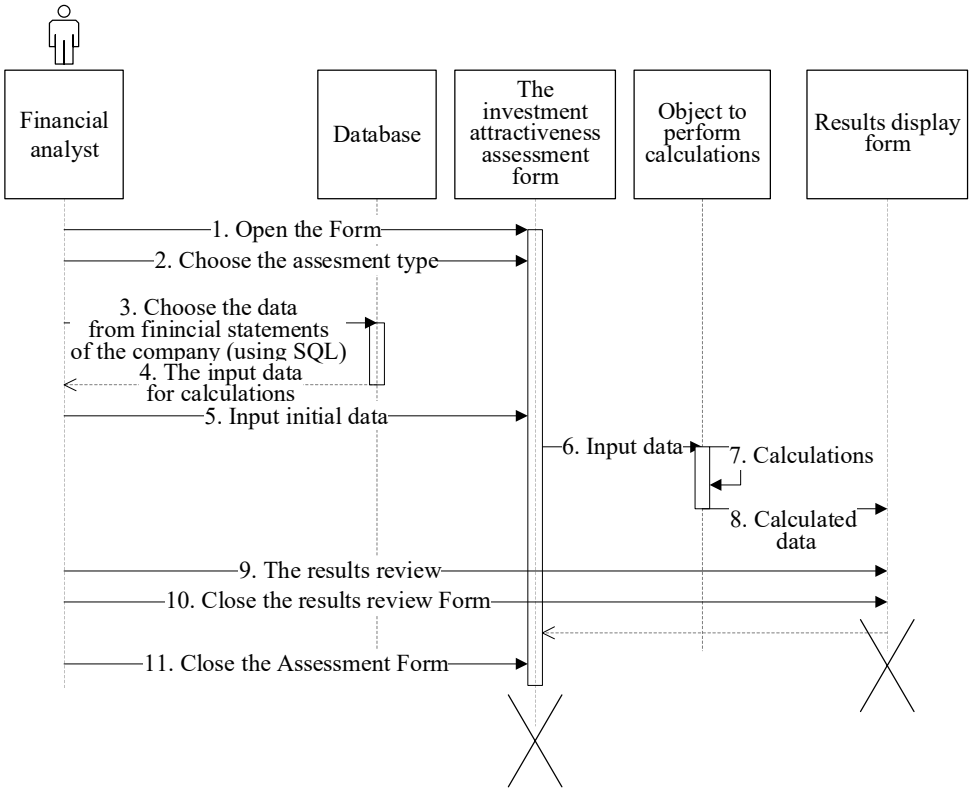


Fig. 3. Sequence diagram for the use case "Evaluation of financial condition to determine investment attractiveness"

Table 1

Basic warehouse use-case models of the subject area in evaluating the financial condition of the enterprise for the analysis of investment attractiveness

Option of use	Characteristics of the content	Actor
Express analysis of financial statements	Analysis of the structure and dynamics of changes in funding sources and directions of use of financial resources	Financial analyst
Assessment of the company's financial condition to determine investment attractiveness	Processing of financial reporting data to calculate financial indicators	
Evaluation of partial indicators	Forming a list of different groups of financial analysis indicators	
Analysis of financial stability	Calculation of the level of partial indicators of the company's financial condition, comparison of the obtained results with standards	
Assessment of business activity		
Profitability analysis		
Assessment of solvency		
Integral assessment of financial status	Generalization of calculation results by groups of partial indicators	
Forecasting the level of financial condition	Forecast of the dynamics of changes in the integral level of the enterprise's financial condition	
Assessment of the enterprise's operating environment (influence factors)	Assessment of the factors of the enterprise's functioning environment	
Development and adoption of management decisions to improve financial condition and investment attractiveness	Determination of the program of measures, formation of the basis for revising the investment strategy of the enterprise	CFO

The next stage of the development of information-analytical support for the implementation of the algorithm of financial decisions is the formation of data arrays, their separation from information stores for the necessary calculations. An example of its implementation for the sub-process "Cluster analysis of the industry" provided by the auxiliary use case for the element "Evaluation of the operating environment (influence factors)" of the UML model is shown in Fig. 2.

In the difficult-to-predict environment of Ukrainian enterprises, caused by the state of war, one of the important components of assessing the financial condition of business entities is the identification of factors affecting it. In order to implement the appropriate use case, a cluster analysis is performed on the given UML model. Its implementation involves the identification of groups of enterprises in the industry with similar features in development and activity by the Ward agglomerative method and further confirmation of its results by the *k*-means method. Creation of arrays of financial data for the implementation of cluster analysis is carried out using SQL queries.

The input represents a large array of data. SQL was used to form a sample of information necessary for making investment decisions (Fig. 4).

The database, as an object of analytical and information support, can be tabular (created in the MS Excel environment) or built according to the relational model (in the MS Access environment). The structure of the data required for the implementation of the algorithm is given in Table 2. The table demonstrates the structure of the accumulated information necessary for further analytical calculations and the creation of an information basis for decision-making.

A set of indicators of the financial condition was formed by the ratio of current liquidity, the ratio of provision of stocks and costs with own working capital, the ratio of autonomy, the ratio of turnover of assets, and the ratio of profitability of property. A fragment of the query and its results is shown in Fig. 4.

The obtained data sample is the basis for the implementation of the last stage of the algorithm for determining the state of investment attractiveness of the enterprise (Fig. 1) using intellectual and financial tools. Among the tasks solved by means of intelligent data analysis, the following

are distinguished [16]: classification, clustering, association, sequence, forecasting, visualization, and summarization. An example of the implementation of the specified approaches, in particular clustering and visualization for secondary use cases related to "Cluster analysis of the industry", based on the data sample obtained by SQL tools at the previous stage of the algorithm implementation, is considered below.

Table 2

The structure of the "Initial Data" table of the database in MS Access, necessary for calculating the investment attractiveness of the enterprise

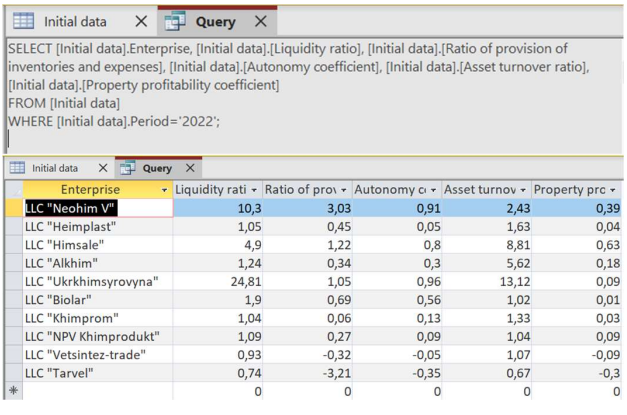
Field	Data type
Code (primary key)	Autonumbering
Period	Short text
Enterprise	Short text
Current liquidity ratio	Numerical
Coefficient of security of stocks and costs	Numerical
Coefficient of autonomy	Numerical
Asset turnover ratio	Numerical
Property profitability ratio	Numerical

In 2022, an agglomerative approach to clustering – Ward's method – was used to make assumptions about the possible number of clusters formed by enterprises in the field of wholesale trade in chemical products. Cluster analysis conducted by Ward's method makes it possible to put forward a hypothesis about the possible number of clusters for a set of studied enterprises of the same industry based on a dendrogram and provides an opportunity to group them based on the similarity of the levels of financial condition indicators. The specified procedures take place during the implementation of the use case "Cluster analysis by agglomerative method (Ward's method)" of the developed UML model (Fig. 2).

Another auxiliary use case "Cluster analysis by the iterative method (k-means)" verifies the proposed assumption about the available number of groups of enterprises (using the example of the chemical wholesale industry) through the use of the iterative k-means method. The difference in the features of the financial condition of enterprises of different clusters is evaluated by the graph of their average values. Visualization of the results of cluster analysis using hierarchical and iterative approaches is shown in Fig. 5, it makes it possible to form the basis for the development and adoption of investment decisions by the top management of the enterprise at the last stage of the developed algorithm. Thus, the identified common features in the state of business entities of the same industry are critical information for creating an analytical report on the state of investment attractiveness of enterprises.

The generated visualizations based on the results of the cluster analysis allow us to find out that the highest values of individual indicators in 2022 remain for the first cluster. This is, in particular, the value of the current liquidity ratio, autonomy ratio, asset turnover ratio and property profitability ratio. The mentioned cluster is also characterized by the lowest level of the coefficient of provision of stocks and expenses with own working capital. The third and second clusters have low values for all five indicators.

The penultimate module of the algorithm in Fig. 1 is aimed at forming an analytical report on the state of the enterprise's investment attractiveness. In the future, investment decisions will be made on this basis. The analytical report forms a generalized representation of the results of the performed analytical procedures for assessing the state of investment attractiveness in terms of various financial indicators.



Enterprise	Liquidity rati	Ratio of prov	Autonomy c	Asset turnov	Property pro
LLC "Neohim V"	10,3	3,03	0,91	2,43	0,39
LLC "Heimplast"	1,05	0,45	0,05	1,63	0,04
LLC "Himsale"	4,9	1,22	0,8	8,81	0,63
LLC "Alkhim"	1,24	0,34	0,3	5,62	0,18
LLC "Ukrkhimsyrovyna"	24,81	1,05	0,96	13,12	0,09
LLC "Biolar"	1,9	0,69	0,56	1,02	0,01
LLC "Khimprom"	1,04	0,06	0,13	1,33	0,03
LLC "NPV Khimprodukt"	1,09	0,27	0,09	1,04	0,09
LLC "Vetsintez-trade"	0,93	-0,32	-0,05	1,07	-0,09
LLC "Tarvel"	0,74	-3,21	-0,35	0,67	-0,3
	0	0	0	0	0

Fig. 4. Formation of the array of data by means of SQL in the course of the implementation of analytical and information support for assessing the state of the investment attractiveness of enterprises

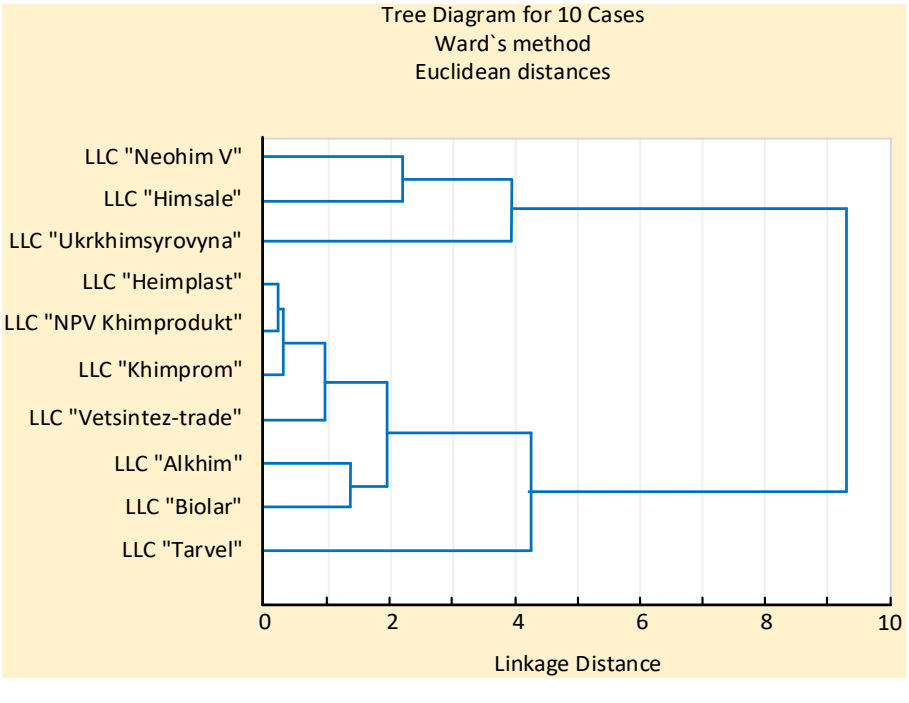


Fig. 5. Results of analytical procedures using cluster analysis tools during the implementation of the algorithm for assessing the investment attractiveness of enterprises

The evaluation of financial indicators is carried out in order to determine and verify investment decisions in order to meet the needs of decision-makers, to realize their goals and objectives. Business intelligence tools can be used to build interactive reports that provide access to operational financial data. So, at the stage of forming an investment decision, these tools make it possible to examine a wide range of analytical data based on the results of evaluating the investment attractiveness of the enterprise, obtained at the previous stages of the developed algorithm. In addition, in the future, the use of BI tools will ensure constant monitoring of the effectiveness of the implementation of the adopted investment decisions.

The values of financial indicators create a basis for evaluating the effectiveness of implementation of investment decisions both individually and within the limits of a certain investment project as a whole. Monitoring of key indicators of the enterprise's investment attractiveness is implemented on the basis of a dashboard represented by an information panel (display), which displays graphs, tables, and diagrams – visualization of the dynamics and rates of change of the studied indicators.

Taking into account the operating conditions of enterprises caused by the presence of uncertainty during man-made disasters, epidemics, martial law, the search, and use of free or demo versions of tools for the systematization and generalization of financial and analytical data necessary for making investment decisions is relevant.

Dashboard (dashboard, information panel) is a visual representation of the most important information, grouped by content on one screen so that it can be easily understood. A fragment of a dashboard that visualizes analytical financial data, critical for making an investment decision, in the environment of a modern business analytics tool (MS PowerBI) is shown in Fig. 6.

The formed representation of financial information makes it possible to control the critical indicators of the investment attractiveness of the enterprise at the stages of implementation of individual investment decisions and, accordingly, to quickly adjust the investment strategy of the activity.

6. Discussion of research results regarding the development and design of an algorithm for making investment decisions

Thus, as a result of the development of an information-analytical algorithm for the implementation of the determination of the state of investment attractiveness of the enterprise (Fig. 1), a combination of various means was demonstrated. The latter will improve the course and efficiency of financial activities. In particular, the modeling of the subject area by means of UML (Table 1, Fig. 2, 3), [12, 16] made it possible to determine the main requirements for the designed information-analytical support. Namely, the role of users, the options available to them, the types of connections and the logic of interaction between them. The formation of the information sample according to the criteria provided by financial indicators, from the database using SQL to obtain verified information for further calculations (Table 2, Fig. 4), [10, 17]. The use of intelligent approaches to data analysis (clustering (Fig. 5) and visualization (Fig. 6) made it possible to create a basis for the development of managerial investment measures.

The results of the use of information-analytical support of the algorithm for determining the state of the investment attractiveness of the enterprise will help save time for the preparation and making of investment decisions by the top management of the enterprise. Provide financial managers with top-level accuracy through the use of reliable retrospective information from an aggregated database.

The developed algorithm for determining the state of investment attractiveness of the enterprise is basic. In the case of developing an algorithm or changing the conditions for making management decisions, the presented components will be refined. UML models of the subject area undergo adaptation – their elemental composition will expand or decrease according to the current list of precedents that reflect the main tasks of financial analysts. SQL queries to the database will be updated to obtain the required sample data. Mining methods will be refined, taking into account their relevance for solving the precedents of the UML model.

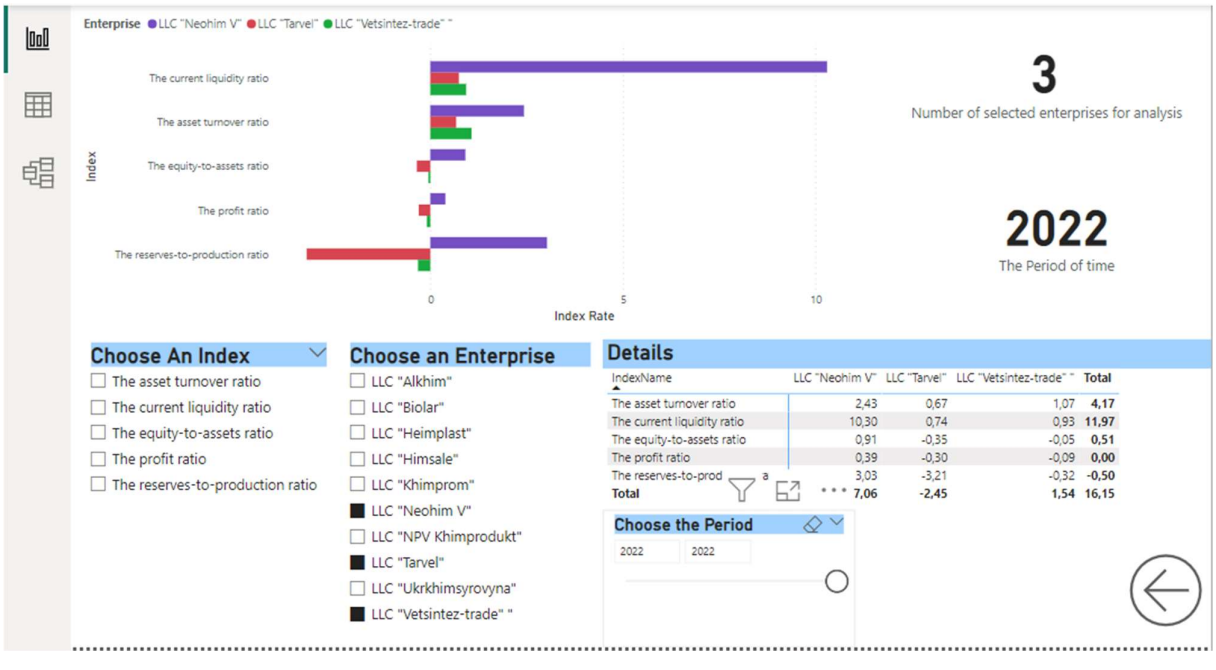


Fig. 6. A fragment of a financial data visualization dashboard for making an investment decision in the PowerBI environment

In the case of impossibility of using modern software (including due to lack of financial resources of the business or lack of necessary personnel qualifications) or if the top management is not ready to implement actual digitalization tools, this algorithm cannot demonstrate unreliable results.

Further research will focus on the development of information-analytical support to business processes of developing a financial strategy to support the appropriate level of investment attractiveness of enterprises, taking into account the results of the algorithm formed in the current work.

7. Conclusions

1. It has been proven that information technology is an effective time-saving tool for the execution of certain business processes. Their application makes it possible to expand the possibilities of access to information and improve the quality of implementation of investment goals and the objectivity of making investment decisions. The proposed information-analytical support of the algorithm includes the connection of various computational business processes that solve certain aspects of intelligent data analysis. Implementation of the specified analytical procedures allows obtaining a more complete and objective analysis, which helps make better decisions in the investment field.

2. The design of the information-analytical support to the business process algorithm for determining the state of the investment attractiveness of the enterprise has been completed. It is detailed and considered on the example of the use of the toolkit of the business process algorithm for determining the state of the investment attractiveness of the enterprise. In particular, the modeling of the target subject area using UML made it possible to determine the main requirements for the designed information-analytical support (user roles, available options, types of links, logic of interaction between them). SQL queries to the information database are updated to obtain the required data samples. The methods of intellectual analysis are specified because of their relevance for solving precedents in the UML model. Business intelligence (BI) tools are used to create interactive reports that provide access to operational financial data. The combination of separate components of information-analytical support creates a multifaceted basis for making investment decisions in dynamic and turbulent conditions of business development. At the same time, the decision-maker has the flexibility to choose specific tools of intelligent data analysis within the limits of the developed algorithm.

Conflicts of interest

The authors declare that they have no conflicts of interest in relation to the current study, including financial, personal, authorship, or any other, that could affect the study and the results reported in this paper.

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Data availability

The manuscript has associated data in the data repository.

Use of artificial intelligence

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

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