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## Enterprise management system analytical tools

**Abstract.** High-quality information and analytical content can be used as a basis for making optimal and informed management decisions by analysing the impact of factors on business efficiency, which will allow us to explore the weaknesses of an enterprise and plan the directions of its strategic development. The study aims to provide a scientific synthesis of theoretical aspects and outline practice-oriented approaches to organising analytical support for the management system at an enterprise. The following methods were used: theoretical aspects were analysed using the generalisation, systematisation and grouping methods; the use of statistical analysis and business process modelling methods for the needs of enterprise management was analysed; the components of Data Science analysis were considered; the main material was presented using the descriptive method. Analytical tools of the enterprise management system were analysed. The emphasis is placed on the procedures of statistical analysis and modelling of business processes, application of Data Science tools and visualisation methods. The external and internal sources of information for the needs of enterprise management are allocated. Varieties of analytical tools that contribute to understanding the essence of problematic issues and determine the search for optimal and reasonable management decisions are presented. The SWOT-analysis matrix as an instrument for optimal combination of information modelling methods, analytical procedures and visualisation of the analysis results is presented. The need to use IT tools to improve the quality of the results of analytical procedures is emphasised. The expediency of developing analytical tools for the needs of optimising the enterprise management system using Data Science technology is substantiated. The advantages of using Big Data for making management decisions are determined. The components of Data Science analysis in the enterprise management system are allocated. The possibility of solving business problems or determining the enterprise development strategy by structuring and visualising a large array of data to identify patterns of enterprise development is emphasised. The tools of analytical support for the needs of organising the system of economic security of enterprise are generalised. The practical value of the work lies in the fact that an algorithm of actions for organising analytical support of the management system at an enterprise is proposed

**Keywords:** information and analytical content; management process; optimisation of analytical support; information modelling of business processes; Data Science technology

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## INTRODUCTION

An effective management system at an enterprise should be built on the use of optimal tools. One of the ways to optimise the management system of a business entity is to apply analytical procedures that will help to obtain high-quality and timely information content to prevent risks in the internal business environment. Analytical tools allow for the identification of problematic aspects of the enterprise's activities, assess the impact of factors, and develop directions for eliminating the negative impact of factors with further development of a development strategy. Interpretation of the results of the performance analysis helps to improve the efficiency of the management system at the enterprise. Scientists pay attention to research on the use of IT technologies in management decision-making. Analytical IT tools should be applied to a sufficient amount of qualitative and operational information, which will allow to effectively integrate research results into the management process at the enterprise.

I. Khvalchuk & L. Voloshchuk (2020) emphasise the importance of an adequate response of a business entity to market requirements, changing business environment, and customer requests. According to the scientists, such a reaction is possible in the presence of high-quality information content and its reasonable analysis. S. Skochyliias (2019) emphasises that information content serves as the basis for further analytical procedures to study trends, the impact of factors, the interconnection of these factors and their impact on the cost structure of a business entity. The expert also notes the need for constant, prompt, and systematic analysis of information on the activities of the enterprise, which will allow timely response to negative trends and support positive changes in business processes.

Zh. Kononenko *et al.* (2020) agree that high-quality information and analytical content should be the basis of the management process at the enterprise, starting with the development and planning of management actions. P. Putsenteilo & O. Humeniuk (2019) note that external and internal information should become the basis for the management system of an enterprise and be integrated into the management process as a whole.

Scientists consider Big Data analytics to be an effective tool for the management decision-making system at an enterprise. For instance, V. Lysak (2020) considers the structure of the decision-making system by levels of enterprise management, describes the impact of factors on management actions and identifies areas for improving the efficiency of the decision-making module as part of an integrated enterprise management system. In particular, the scientist summarises and describes the main stages of the management process, where each of the presented stages can be performed using IT tools.

According to O. Halan *et al.* (2022), the sustainable development of a business entity can be ensured by high-quality analytical tools. In particular, the authors assessed the advantages and identified threats in integrating Big Data tools into the management system of an enterprise, in particular in terms of applying an innovative approach to the

formation of the required level of economic security of an enterprise.

O. Balabanov (2019) investigated the fundamental provisions of analytics of a significant data set. The author summarised the aspects of integrating analytical procedures into the digitalised management system of a business entity by applying the proposed sequence of analytical actions and also announced further research on the review of analytical procedures in the field of Big Data.

O. Chubukova *et al.* (2020) noted current trends in the development of machine learning as a component of Data Science. In their research, the scientists analysed the peculiarities of the dissemination of Data Science technologies employing specific digital tools that allow obtaining the necessary amount of operational information and conducting its in-depth analysis available for optimising the management decision-making process. Scientists emphasise that the use of a set of Data Science algorithms (in the example of the banking sector) can ensure an increase in the efficiency of risk modelling by employing specific digital tools and relevant IT products (specialised programming languages such as Python and R, quantitative machine learning methods, neural networks).

I. Radionova & Ya. Fareniuk (2021) define Data Science tools as the most relevant for analysing the economy of uncertainty. Using specific examples, the authors summarised the capabilities of Data Science in the management decision-making process. In particular, the researchers concluded that the use of Data Science tools allows for assessing the impact of factors on processes and phenomena, uncontrollable chaos of events, and unexpected combinations of tools. Similar conclusions were reached by L. Chagovets *et al.* (2020), who assessed the development of Ukrainian regions using the above tools.

The external business environment creates both opportunities and threats that need to be considered. The study aimed to analyse an effective management system and the required level of economic security for the formation of a business entity's development strategy.

## MATERIALS AND METHODS

The informational basis of the study includes scientific articles of Ukrainian and world experts on the issues of analytical support of the management system at enterprises, fundamental research of individual specialists, as well as the authors' achievements in the course of scientific and professional activities. The study was conducted in the context of a systematic approach, which allowed the analysis of theoretical aspects and outline of practice-oriented approaches to organising analytical support of the management system at an enterprise. In particular, the theoretical developments of scientists on the management process at an enterprise were systematised. In general, the works of Ukrainian specialists were chosen as the basis for generalisation. The method of grouping allowed the formulation of the basic requirements for the process of making optimal

and reasonable management decisions. The works of international experts contributed to the experience of entrepreneurs' response to the challenges of the modern business environment. The authors' opinions were presented as research results using the descriptive method. In particular, the sources of information for optimising the management process were identified, the tools of statistical analysis for management needs were presented, and the methodology for information modelling of business processes was specified. The article summarises the opinions of scientists on the advantages and components of Data Science analysis. The method of logical and consequential connection provided an opportunity to develop practice-oriented approaches to building high-quality analytical support for the process of making optimal management decisions.

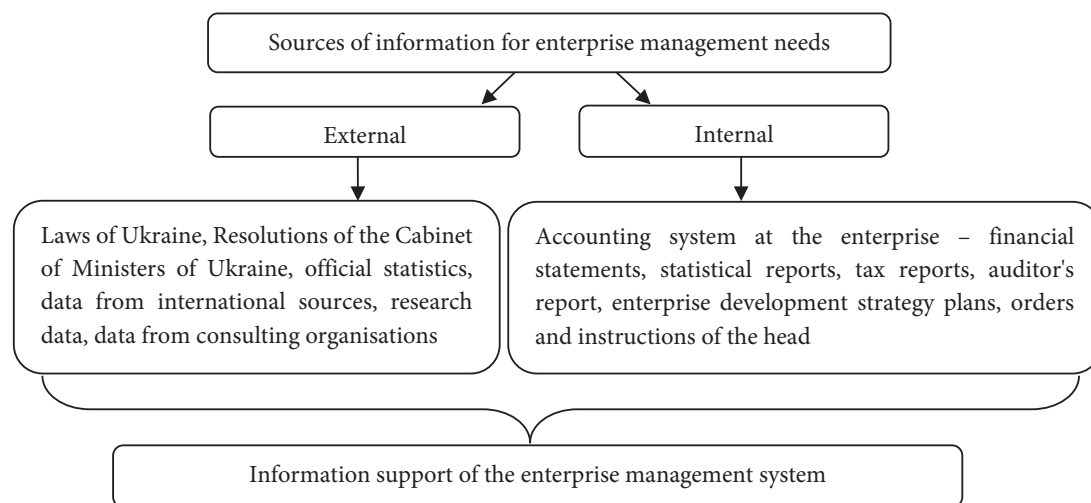
The analysis of the studies also contributed to outlining the directions of integration of the world experience of business management into the current realities of Ukrainian business entities. In particular, developments of Ukrainian scientists were used to identify the main principles of optimisation of analytical support of the process of making managerial decisions at an enterprise. The study was based on the scientific works of Ukrainian scientists to develop proposals on the specifics of entrepreneurial activity in the context of modern business requirements and regulatory policy in the country. These information sources in the field of regulatory and legal support for business entities registered in Ukraine will allow them to act effectively within the framework of legislation even when conducting international activities.

The study deals with interrelated scientific areas, in particular, the problems of information and accounting

support of business entities, business analytics of economic processes, aspects of the management process at the enterprise, as well as computer data processing. The knowledge and skills in the field of financial and statistical accounting, basics of enterprise reporting, statistics and analysis of economic activity, enterprise management, information technology, and research methodology were used. This research area provided a basis for the expediency of broad application of Data Science technology to develop optimal management solutions for the needs of the strategic and tactical development plan of a business entity. To visualise the results of the study, tabular and graphical methods were used.

## RESULTS AND DISCUSSION

Information sources for management needs can be distinguished according to external and internal factors (Fig. 1). O. Sytnichenko (2021) notes that the protection of information content should be the object of attention of state authorities in the context of regulatory and legal regulation. The management system of a business entity should be built on the current regulations on the regulation of business processes, and the formation of accounting content as a reliable source of information for the needs of making optimal and timely management decisions. Modern scientific research will help specialists integrate innovative tools into the management process of a business entity. Consulting organisations, including audit firms, can provide expert assistance in developing and arguing for the optimal tools of the business management system. Prompt and accurate information will make it possible to build an effective business development strategy and ensure the required level of economic security for a business entity.



**Figure 1.** Sources of information for enterprise management needs

**Source:** developed by the authors

As noted by I. Yaremko (2022), the basis for managing business processes is accounting and analytical data. This opinion is also shared by O. Polishchuk & V. Melnyk (2022), noting that the effectiveness of information and

analytical support depends on accounting information that affects the financial and economic security of an enterprise. I. Khvalchuk & L. Voloshchuk (2020) note that the provision of operational analytical information can ensure informed

management decisions. Zh. Kononenko *et al.* (2023) note the need to have IT skills to fully use accounting information for its analysis, which will allow to establish management actions and monitor their effective implementation. The authors of this article agree with the conclusions reached by the following scholars. O. Mykoliuk & V. Bobrovnyk (2021) note that nowadays any business is closely related to the development of digital processes. This opinion is also shared by P. Putsenteilo & O. Humeniuk (2019), noting that without IT solutions, it is impossible to process available information resources quickly and efficiently. Software products available in the modern IT environment allow for improving the quality of the results of analytical procedures.

The quality of the information content of a business entity depends on the construction of the accounting system. All accounting data are summarised in the financial, tax and statistical reports of the business entity, which are the basis for applying analytical procedures to develop optimal management decisions. The statistical reporting of an individual business entity becomes a component of the statistical data set of a region, industry, country, or the world. It is this array that is also of interest to management system specialists, but at the same time requires an innovative approach, modern digital tools, and skills. N. Khorunzhak *et al.* (2019) emphasise that even the automated accounting process does not fully implement the function of control and analysis, which limits the capabilities of managers in information modelling of business processes.

V. Nekhai & V. Nekhai (2020) formulated the concept of high-quality information support of the management system at an enterprise as a set of methodological techniques for systematising data, analysing them, and effectively and comprehensively interpreting the results of the analysis under the influence of factors that will ensure optimisation of management decisions and their effective implementation. A large number of scientists are expanding the tools for analytical support of the economic security system of an enterprise in the strategic and tactical aspects. In particular, experts distinguish the tools for analytical support of the enterprise management system in terms of tactical and strategic planning, the tactical tools include “relevant

analysis, operational analysis, margin analysis, CVP analysis, operational pricing”. At the same time, the strategic plan, according to scholars, should be based on such tools as “investment analysis, strategic analysis, strategic pricing, life cycle analysis, business process mapping, ABC analysis, SWOT analysis” (Putsenteilo & Humeniuk, 2019).

According to T. Suhak (2018), accounting information is an important resource, but it is necessary to consider modern processing methods to diagnose the state of financial and economic security of the enterprise, and to identify and eliminate external threats in the process of making management decisions. However, the authors of this study share the opinion that analytical procedures should be carefully planned to prevent unnecessary actions and irrelevant information (Skochylas, 2019). I. Belousova & T. Suhak (2019) emphasise the expediency of using modern methods of information protection for the needs of economic security of an enterprise. This opinion is shared by S. Lehenchuk *et al.* (2021), noting that credentials are confidential information, the loss of which in the context of the development of information technology can lead to reputational threats and financial losses. Thus, optimising the process of information content formation and its subsequent in-depth analysis is currently an important challenge for an enterprise in the context of ensuring the required level of economic security.

Information modelling plays an important role in the enterprise management system. Visualisation methods increase the understanding of the problematic issues and facilitate the search for optimal and reasonable management decisions. Such a tool as SWOT analysis combines the features of information modelling, analytical procedures, and visualisation of the analysis results. The analysis of an information resource is necessary to identify possible threats to management decision-making to counteract the negative impact of factors (Voroniuk, 2021). Scientists suggest visualising the results of such an analysis in the form of a SWOT analysis matrix (Tyurina *et al.*, 2022). The matrix of SWOT analysis of building information and analytical content to ensure the required level of economic security of the enterprise through the author’s view is presented in Table 1.

**Table 1.** Matrix of SWOT-analysis of building information and analytical content to ensure the required level of economic security of the enterprise

Possibilities	Threats
Investment attractiveness increases; Business activity increase; Company solvency improvement; Business expansion in the process of European integration.	Instability in the macroeconomic environment; Increased competition; Unauthorised information access; Analytical data representativeness errors.
Advantages	Disadvantages
Informed management decision-making; Information support digitalisation; High-quality analytical tools.	Insufficient enterprise financial stability; Low level of state support; Lack of analyst positions at enterprises; Lack of economic security services at enterprises.

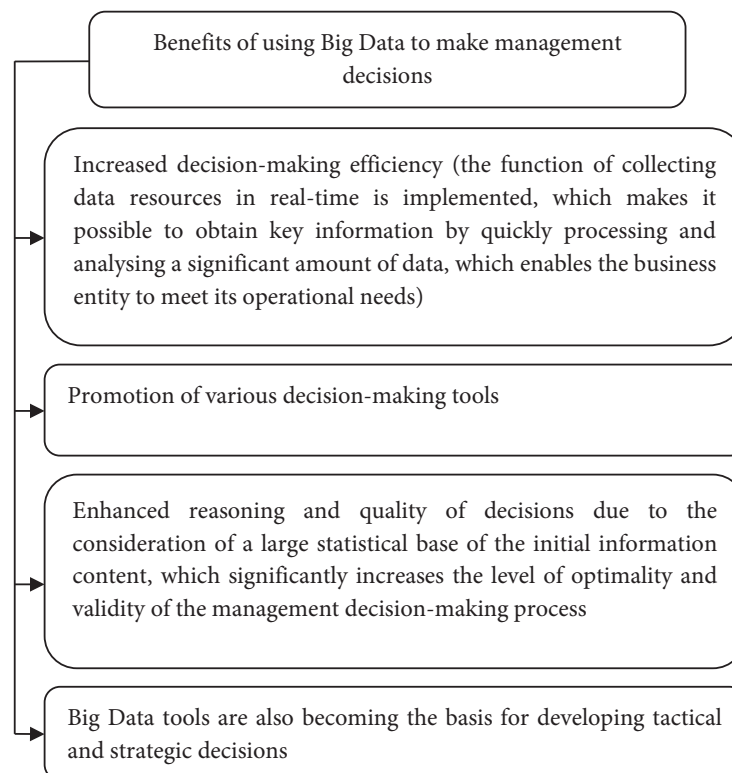
**Source:** developed by the authors

The SWOT analysis results of the analytical support organisation enable the development of measures to use business development opportunities, prevent the negative impact of threats, and combine the strengths and weaknesses of the enterprise to increase the level of economic security of the business entity.

It is worth noting that the process of management at an enterprise is characterised by the uncertainty of the operating conditions, which are influenced by external and internal factors, so the combination of external and internal data for its analysis is of particular relevance. Scientists emphasise the need to use special tools for analytical support of the management decision-making process. I. Radionova & Ya. Farenjuk (2021) suggest using Data Science tools for analytical support of the management decision-making process in an uncertain economy. In their opinion, the Data Science tool helps to implement a relevant analysis of

business processes in an uncertain business environment by identifying non-obvious relationships. At the same time, world experts have conducted fundamental research on analytical thinking, and principles of collecting and analysing valuable data for business needs (Provost & Fawcett, 2020).

L. Samoylenko (2018) suggests that with the development of the digitalisation of business processes, the number of IT tools offered is growing, which allows obtaining a variety of data for making management decisions through the analysis of a large amount of data (Big Data). Regarding the complexities and benefits of using Big Data, O. Chubukova *et al.* (2020) note that the high quality of predictive models is associated with a high cost of time and resources, complexity of calculation, and the need to use modern IT solutions. However, most scientists identify the following advantages of using Big Data in enterprise management (Fig. 2).



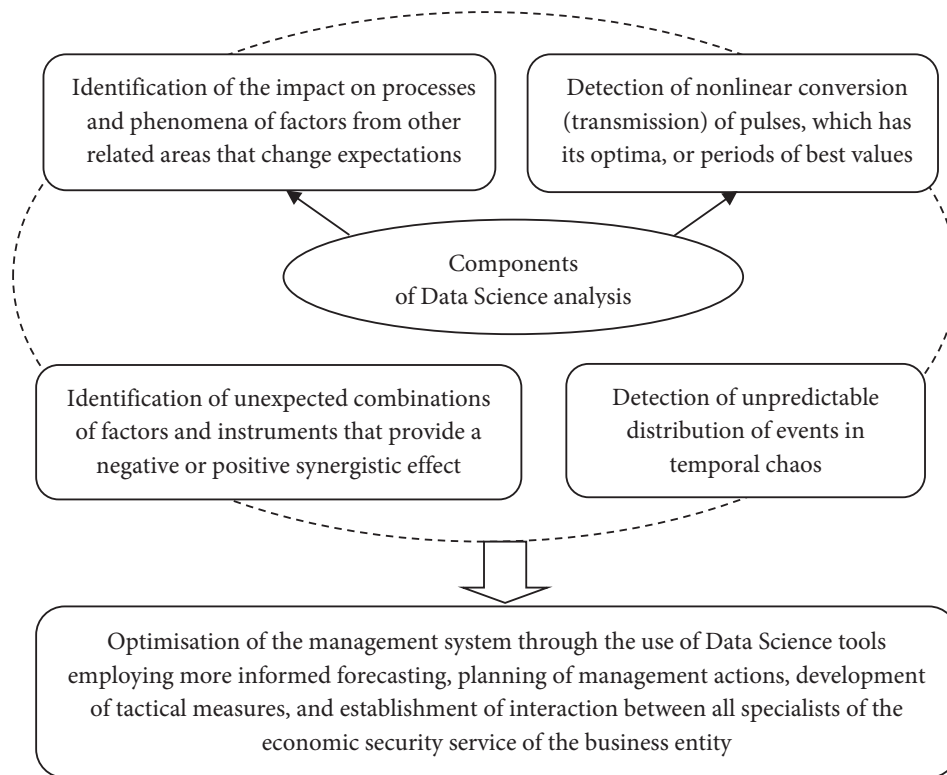
**Figure 2.** Benefits of using Big Data to make management decisions

**Source:** compiled by the authors based on O. Halan *et al.* (2022)

The Data Science tool analyses information using a foundation from various scientific fields of economic and mathematical direction, so it is difficult to overestimate its value in the face of uncertainty in business processes, as mathematical methods allow identifying significant factors and calculating quantitative and qualitative indicators of their impact (Radionova & Farenjuk, 2021). International experience shows a wide range of applications of this tool. In particular, I. Carmichael & J.S. Marron (2018) emphasise the continuous development of statistical methods in the context of business analysis. The authors emphasise the

combination of analysis methods with search analysis, machine learning technology, and game theory. C. Weihs & K. Ickstadt (2018) emphasise the need to apply a set of actions related to statistical methods, information technology, management, and communication principles. This implies that the combination of interrelated but self-sufficient tools in the management process will allow for a synergistic effect.

The implementation of Data Science technology in the field of management decision-making involves optimising the management system at an enterprise and includes the following components of Data Science analysis (Fig. 3).



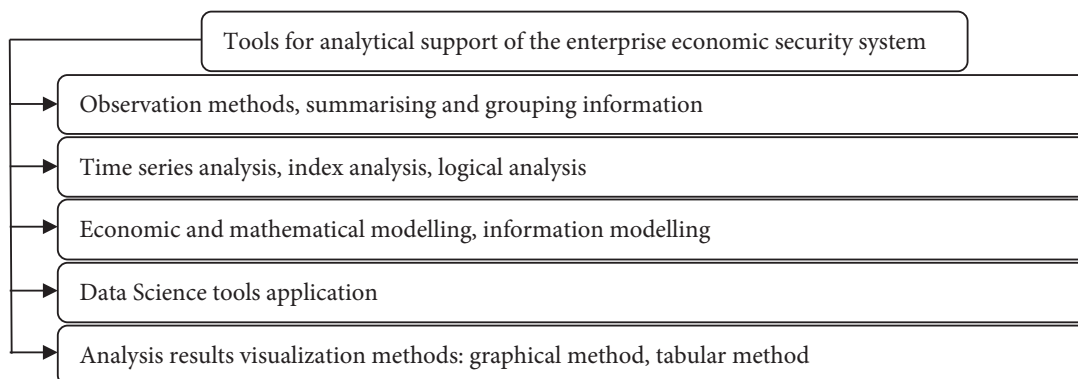
**Figure 3.** Components of Data Science analysis in the management system of a business entity

**Source:** compiled by the authors based on I. Radionova & Ya. Farenjuk (2021)

As such, the conducted literature analysis of scientific works demonstrates the relevance and feasibility of using analytical tools, including Data Science technologies, in the field of management decision-making. Data Science tools are gaining relevance in the development of optimal and sound management decisions. These advantages make it possible to assert the effectiveness of using this toolkit to formulate an enterprise development strategy based on tactical decisions through the collection, analysis, visualisation, and interpretation of a large array of data. A Data Science specialist can collect, analyse, visualise, and interpret large amounts of data using various tools to identify patterns that can be used to solve business problems or determine the company’s development strategy. In particular, the

practical use of economic and mathematical tools will allow us to identify weaknesses in the company’s activities, assess the risks of production and sales activities, and make forecasts of performance through the structuring and visualisation of a large data set. This will ensure the development of measures to use opportunities, prevent the negative impact of threats, and combine the strengths and weaknesses of the enterprise to make optimal management decisions.

The analytical tools for the needs of management and the formation of the required level of economic security of a business entity should include elements of statistical analysis, information and economic-mathematical modelling of business processes and Data Science tools, as summarised in Figure 4.

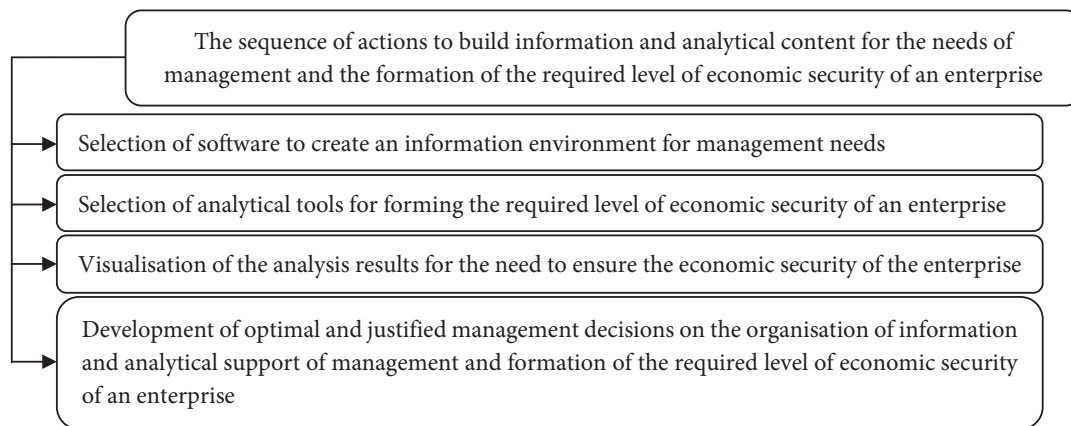


**Figure 4.** Tools for analytical support of the economic security system of a business entity

**Source:** developed by the authors

It is necessary to develop an appropriate algorithm of actions for building information and analytical content for the needs of management and forming the required level of

economic security of an enterprise. The following sequence of actions is advisable (Fig. 5).



**Figure 5.** Algorithm of actions for building information and analytical content for the needs of management and formation of the required level of economic security of an enterprise

**Source:** developed by the authors

Optimisation of optimal and sound management decisions requires managers to be aware of and possess the necessary skills to apply specialised digital tools for analysis needs, the ability to apply scientific methods and techniques, as well as a modern and creative approach to interpreting analysis results, responding quickly to the challenges of the modern business environment and adjusting decisions to meet the urgent needs of the business.

## CONCLUSIONS

As such, the decision-making efficiency depends on the tools of a business entity's management system. Analytical procedures can become the basis for obtaining a high-quality and timely information resource to eliminate the negative impact of business environment risks. Sources of information can be identified according to external and internal factors. The quality of information will ensure the development of an effective development strategy in the context of the financial and economic security of a business entity. The source of internal information is the accounting content concentrated in the financial, tax and statistical reporting of the business entity, based on which it is advisable to build the analytical component of the management system. The source of external information, in addition to information from regulations and data from consulting companies, is a statistical array of data of a region, industry, country, and the world, formed as a set of statistical reporting data of individual business entities.

The quality requirements for an information resource create new challenges for a business entity in the context of ensuring the required level of economic security, since data processing (both internal and external) requires special skills in various fields, including specialised IT solutions. Analytical tools are effective when combining elements of statistical analysis, information, and economic and mathematical modelling of business processes, as well as Data Science tools, which will provide a synergistic effect in the formation of a strategic and tactical plan for the development of the enterprise. The integration of the above approaches into the enterprise management system increases the requirements for economic security specialists, in particular, the availability of skills in the use of specialised digital tools, the use of modern approaches to interpreting the results of analysis with the ability to quickly respond to external challenges and adjust decisions following the needs of the business environment. The widespread use of Data Science technology to develop optimal management decisions for a business entity is a prospect for further research.

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## CONFLICT OF INTEREST

None.

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## **Аналітичний інструментарій системи управління на підприємстві**

**Анотація.** Якісний інформаційно-аналітичний контент може бути основою для прийняття оптимальних та обґрунтованих управлінських рішень завдяки аналізу впливу чинників на ефективність бізнесу, що дозволить дослідити слабкі місця суб'єкта підприємництва та спланувати напрямки його стратегічного розвитку. Метою дослідження є наукове узагальнення теоретичних аспектів і окреслення практико орієнтованих підходів до організації аналітичного забезпечення системи управління на підприємстві. Під час дослідження було використано наступні методи: теоретичні аспекти проаналізовано за допомогою методів узагальнення, систематизації та групування; проаналізовано використання методів статистичного аналізу та моделювання бізнес-процесів для потреб управління на підприємстві, розглянуто складові Data Science-аналізу; виклад основного матеріалу наведено за допомогою описового методу. У статті проаналізовано аналітичний інструментарій системи управління на підприємстві. Акцентовано на процедурах статистичного аналізу та моделювання бізнес-процесів, застосуванні інструментарію Data Science та методів візуалізації. Виокремлено зовнішні і внутрішні джерела інформації для потреб управління на підприємстві. Наведено різновиди аналітичного інструментарію, що сприяють розумінню сутності проблемних питань та обумовлюють пошук оптимальних та обґрунтованих управлінських рішень. Наведено матрицю SWOT-аналізу як інструменту оптимального поєднання методів інформаційного моделювання, аналітичних процедур та візуалізації результатів аналізу. Наголошено на необхідності використання ІТ-інструментів для підвищення якості результатів аналітичних процедур. Обґрунтовано доцільність розробки аналітичного інструментарію для потреб оптимізації системи менеджменту підприємства за допомогою технології Data Science. Визначено переваги застосування великих даних для прийняття управлінських рішень. Виокремлено складові Data Science-аналізу в системі управління підприємством. Наголошено на можливості вирішення бізнес-проблем або визначення стратегії розвитку підприємства за допомогою структуризації та візуалізації великого масиву даних для виявлення закономірностей розвитку підприємства. Узагальнено інструментарій аналітичного забезпечення для потреб організації системи економічної безпеки підприємства. Практична цінність роботи полягає в тому, що запропоновано алгоритм дій щодо організації аналітичного забезпечення системи управління на підприємстві

**Ключові слова:** інформаційно-аналітичний контент; процес управління; оптимізація аналітичного забезпечення; інформаційне моделювання бізнес-процесів; технологія Data Science