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DATA MINING AND BUSINESS INTELLIGENCE IN MANAGING THE BUSINESS PROCESSES OF THE PROJECT OFFICE OF AN OUTSOURCING COMPANY

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The article carries out a comprehensive study of the possibilities of applying modern business analytics and intelligent data analysis methods to optimize project management processes in the conditions of an outsourcing IT company. The work justifies the relevance of the problem associated with the avalanche-like growth of data volumes during the implementation of IT projects and the possibilities of innovative technologies for their intellectual analysis to identify hidden patterns. Scientific works of leading experts in project management and informatization have been critically analyzed, but a lack of comprehensive studies regarding data analysis specifically for project offices was noted. To achieve the research goal, a thorough analysis of the essence and possibilities of business analytics and intelligent data analysis was carried out, their role in managing modern organizations was examined in detail, and the scientific advantages of implementation in project offices of outsourcing companies were justified. The study of the practical use of business analytics and intelligent data analysis tools to solve the specific task of searching for new projects in the marketing activities of the IT outsourcing company was conducted. Effective methods of data collection, processing, and analysis concerning clients, market, competitors, communication channels, etc., were thoroughly analyzed. Thus, the article carries out a comprehensive study of the theoretical foundations and applied aspects of using advanced business analytics and intelligent data analysis tools with the aim of improving and optimizing the marketing activities of the modern project office of an outsourcing IT company by making timely well-founded managerial decisions based on deep analysis of available data sets.

ІНТЕЛЕКТУАЛЬНИЙ АНАЛІЗ ДАНИХ ТА БІЗНЕС-АНАЛІТИКА ПРИ УПРАВЛІННІ БІЗНЕС-ПРОЦЕСАМИ ПРОЄКТНОГО ОФІСУ АУТСОРСИНГОВОЇ КОМПАНІЇ

Чеверда С.С., Янкін Д.М.*Запорізький національний університет**Україна, 69600, м. Запоріжжя, вул. Жуковського, 66***Ключові слова:**інтелектуальний аналіз даних,
data mining, бізнес-аналітика,
управління проектами,
проектний офіс, аналіз даних,
прийняття управлінських
рішень, інформаційні технології

У статті здійснено комплексне дослідження можливостей застосування сучасних методів бізнес-аналітики та інтелектуального аналізу даних для оптимізації процесів управління проектами в умовах аутсорсингової ІТ-компанії. У роботі обґрунтовано актуальність проблеми, пов'язаної з лавиноподібним зростанням обсягів даних під час реалізації ІТ-проектів та можливостями інноваційних технологій їх інтелектуального аналізу для виявлення прихованих закономірностей. Критично проаналізовано наукові праці провідних фахівців з питань управління проектами, інформатизації, проте констатовано відсутність комплексних досліджень стосовно аналізу даних саме для проектних офісів. Для досягнення мети дослідження проведено ґрунтовний аналіз сутності та можливостей бізнес-аналітики й інтелектуального аналізу даних, детально розглянуто їхню роль в управлінні сучасними організаціями та науково обґрунтовано переваги впровадження в проектних офісах аутсорсингових компаній. Дослідженню практичного використання інструментів бізнес-аналітики й інтелектуального аналізу даних для вирішення конкретного завдання пошуку нових проектів у маркетинговій діяльності ІТ-аутсорсингової

компанії. Детально проаналізовано ефективні методики збору, обробки та аналізу даних щодо клієнтів, ринку, конкурентів, каналів комунікації тощо. Отже, у статті здійснено комплексне дослідження теоретичних засад та прикладних аспектів використання передових інструментів бізнес-аналітики й інтелектуального аналізу даних з метою удосконалення та оптимізації маркетингової діяльності сучасного проєктного офісу аутсорсингової ІТ-компанії шляхом прийняття своєчасних обґрунтованих управлінських рішень на основі глибинного аналізу наявних масивів даних.

Statement of the problem

In the modern world, where data volumes are growing exponentially, the ability to analyze vast arrays of information and extract useful knowledge from them is of paramount importance. Data mining is the process of discovering hidden patterns, subtle correlations, and significant trends in data using automated methods. The application of data mining is becoming increasingly prevalent in various sectors, especially in the management of companies' business processes. Analyzing vast amounts of information about business processes helps to identify "bottlenecks", optimize procedures, and increase efficiency.

One of the most promising areas for the application of data mining is project management and project offices. This is because project management accumulates a vast amount of diverse information – about task execution, resource expenditure, risks, team communication, changes in requirements, and so on. According to analysts, on average, a large IT project generates over 1 terabyte of data. However, the potential of data mining of these data is still underutilized. There are numerous studies dedicated to analyzing specific aspects of project management using data mining methods. These include tasks related to predicting the duration and cost of projects, risk assessment, team productivity analysis, resource allocation optimization, etc. However, there is no comprehensive research regarding the capabilities of data mining tools to model and support all key processes in project office management.

The relevance of such comprehensive research is determined by several important factors.

Firstly, in the context of rapid changes and stiff competition, project-oriented companies desperately need effective tools for making informed managerial decisions in projects. The capabilities of traditional approaches to project data analysis are exhausted, as the volumes of information are rapidly increasing. Without the implementation of modern technologies for intelligent data analysis, the competitiveness of project-oriented companies significantly decreases.

Secondly, the volume of data generated during project activities is rapidly increasing. According to analysts, on average, a large IT project generates over 1 terabyte of data. Analyzing them using traditional methods (manual processing, simple charts) is becoming increasingly complicated. Without intelligent analysis, it's impossible to effectively process such data.

Thirdly, the latest technologies for intelligent data analysis (machine learning, artificial intelligence, neural networks, etc.) open up vast opportunities for project management. They can drastically improve the quality

of analytics and forecasting in projects. However, these possibilities are not yet sufficiently studied and generalized.

Conducting a comprehensive study of intelligent data analysis tools specifically for the field of project management will allow the systematization of achievements in the field of using intelligent data analysis in project management and will promote the development of effective solutions based on modern data processing technologies for optimizing the activities of project offices.

Analysis of recent studies and publications

The study of the features of business process management of the project office of the outsourcing company is devoted to the work of many researchers who cover various aspects of project management, organizational culture, international standards, innovative methods and tools for optimizing business process management.

In the Project Management Handbook, Harold Kerzner [1] provides a comprehensive overview of the basic principles, methods, and tools used in project management. The author considers a systematic approach to planning and control, which is relevant for the analysis of the project office of outsourcing companies.

One of the most important sources of project management knowledge used in outsourcing companies is the PMBOK® Guide from PMI [2], which includes a description of processes, essential tools and techniques.

The key principles, topics and processes that help ensure effective project management are presented in the PRINCE2® international project management standard [3], which is used by many outsourcing companies.

A comprehensive approach to risk management in projects using international standards ISO 31000 and IEC62198 is provided in the Project Risk Management Manual [4], in which the author discloses the methods of identification, analysis and response to risks, as well as provides recommendations for the implementation of an effective risk management system in outsourcing companies.

The analysis of the influence of organizational culture on the management of business processes in the project office of outsourcing companies examines Edgar Shane [5], who reveals the influence of organizational culture on the success of companies, as well as the role of leadership in the formation and development of such culture.

In his work [6], Thomas Davenport considers the possibilities of using information technologies to optimize business processes. The work reveals strategies and approaches to the reengineering of work processes through the introduction of the latest technologies, which is an important aspect for research in the context of the project office of outsourcing companies. In the article [7],

the authors present a model of the success of information systems, which considers critical success factors for the implementation and evaluation of the effectiveness of information systems in various organizational contexts. The model can be used to analyze the impact of information technology and automation on business process management of the project office of outsourcing companies.

In the studies of Kaplan and Norton [8], the concept of a balanced system of indicators is presented, which helps organizations to translate their strategy into concrete actions, which allows to develop methods of measuring the effectiveness of business process management in the project office of outsourcing companies.

In their work, Jeff Sutherland and Ken Schwaber offer a deep understanding of the Scrum methodology – an agile approach to project management that can be applied in the project office of outsourcing companies to increase flexibility and adaptability in managing business processes and resources.

Despite the large number of scientific works devoted to the peculiarities of business process management of the project office of the outsourcing company, several problems remain unsolved, namely the application of intelligent data analysis and business analytics systems to improve the efficiency of management decisions of the project office of the outsourcing company, which functions in constantly changing requirements clients without losing control over resources and the quality of project implementation.

Objectives of the article

The aim of this article is to explore the peculiarities of applying business analytics and intelligent data analysis in managing business processes for making marketing decisions, specifically in finding new projects for an outsourcing IT company.

The main material of the research

In the current conditions of digitalization of management processes, artificial intelligence, cloud computing, distributed database technologies, and numerous other cutting-edge technical directions define the methodologies of the project management office of an outsourcing company. The emergence of innovative technologies that allow connecting devices to the network, storing and processing data in virtual clouds, and automating business processes, facilitate the refinement of intelligent data analysis systems.

Intelligent data analysis and business analytics systems allow the integration of all the enterprise’s informational resources into a single digital environment. This assists

in thoughtfully allocating resources and timely making essential management decisions based on the study and interpretation of relevant data. Such analysis systems are actively used in numerous business sectors to support the making of informed economic decisions.

Together, business analytics and intelligent data analysis help outsourcing companies effectively use information, considering constant changes in the IT project market.

Business analytics (Business Intelligence) involves examining data to discover trends, patterns, and new ideas. Conclusions based on this data provide a clear understanding of business operations and their outcomes. Business analytics can anticipate future performance. By analyzing past and current data, business analytics systems track trends and demonstrate how these trends will evolve over time.

Data mining is a method of processing large data sets to discover relevant information. Companies use data mining for business analytics and to identify specific data that can assist in making more considered management decisions.

Business analytics and data mining tools analyze key performance indicators (KPIs) in different ways. While business analytics monitors and reports, data mining uncovers and visualizes information (Table 1).

The information under study is chaotic and unorganized, yet data intelligence analysis allows for deciphering these complex data arrays, providing companies with the ability to identify the primary causes of certain trends and apply business analytics to determine ways to benefit from them.

Software for business analysis gives companies the opportunity to consolidate different data sources into a single standard, align and organize the information, and also provide end-users with an interface for generating reports and dashboards for making informed business decisions.

Business analytics systems vary in performance indicators, functionality, and features of cloud solutions, yet they share common methodologies and technical subsystems for information processing (Fig 1).

Typical business analytics systems have the following functionalities:

- Generating reports based on data from various sources;
- The complexity, reliability, and accuracy of data are ensured through special methods of working with information;
- Comprehensive analysis in different aspects: the ability to introduce new indicators and analytical tools without modifying the repository;
- Automatic creation of ready-to-use reports;
- Generating reports thanks to a graphical editor that does not require knowledge of programming languages;

Table 1 – Distinctive features of Data Mining and Business Intelligence

Characteristic features	Data Mining	Business Intelligence
Goal	Studying and formatting data to find answers to business problems	Interpret and present data to stakeholders to justify data-driven decisions
Amount	Processing specific data sets for targeted analysis	Relational database processing to track metrics at the enterprise level
The results	Unique data sets in a user-friendly format	Dashboards, graphs, charts, reports
Direction	Definition of new KPI	Demonstration of KPI progress

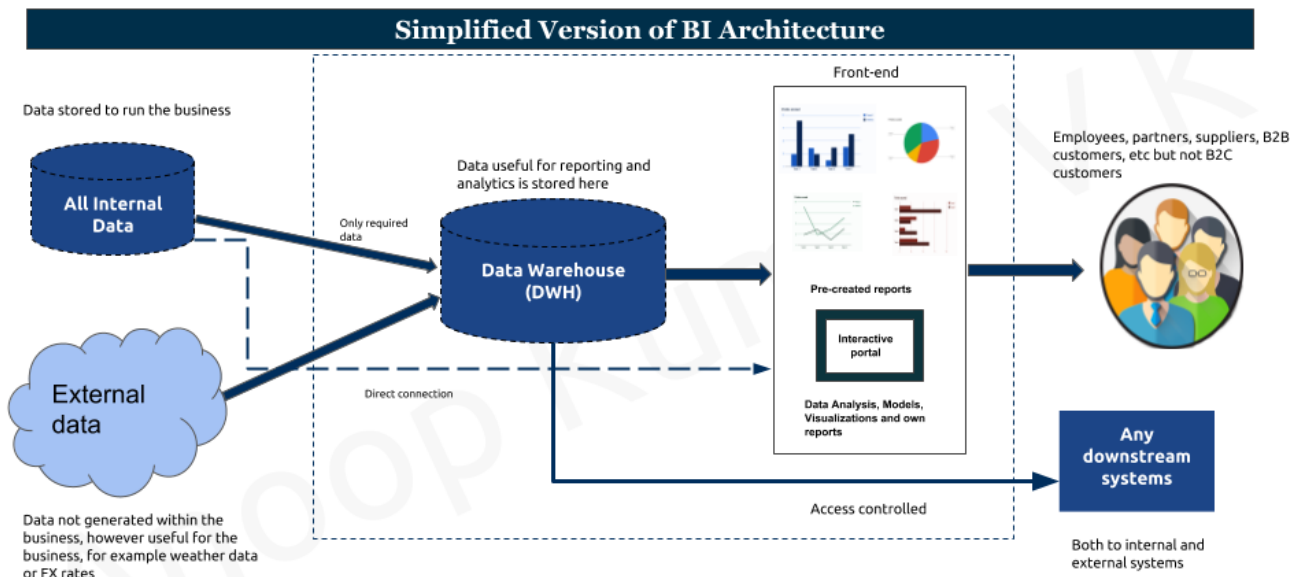


Fig. 1 – Workflow scheme of the business analytics system

- Version support: current and archived reports for tactical and strategic decisions;
- Choice of visualization type: diagrams, schemes, charts, tables;
- Access via a web browser from any device, including mobile ones;
- System deployment on specific servers or in the cloud;
- Setting up user profiles with variable access rights;
- Operation in both open and closed networks.

The process of data analysis and management decision-making using the business analytics system is depicted in Figure 2.

In the process of digital transformation of outsourcing companies, a vast amount of data emerges. These data are formed by different information systems and have various appearances. The business analytics system transforms this data into a unified standard, stores it in a centralized location, and presents it as comprehensible infographics.

Creating reports manually requires time and high expertise of employees. The business analytics system quickly generates reports using an intuitive interface that doesn't require programming knowledge. It's challenging to track the source and credibility of certain metrics.

However, the business analytics system clearly indicates the origin of each one.

The mutual impact of company performance indicators on others may not always be evident. Therefore, optimization decisions might not lead to expected outcomes. Thanks to the business analytics system, causal relationships between metrics can be identified, enhancing the quality and speed of analysis and decision-making.

In today's conditions, with the development of big data and open information initiatives, business analytics is becoming more accessible for companies of any size. Now, thanks to intelligent tools, data analysis is more efficient, paving the way for business analytics systems with artificial intelligence. Intelligent data analysis allows for detecting valuable patterns and making managerial conclusions, helping companies understand trends. Given the vast volumes of information, modern enterprises use intelligent solutions for big data analysis, ensuring informed decision-making.

Outsourcing companies have already recognized the advantage of increased accuracy provided by data analytics software. New solutions and improvements in these tools also indicate that the implementation of data analytics methodologies for various businesses has become simpler and more beneficial.

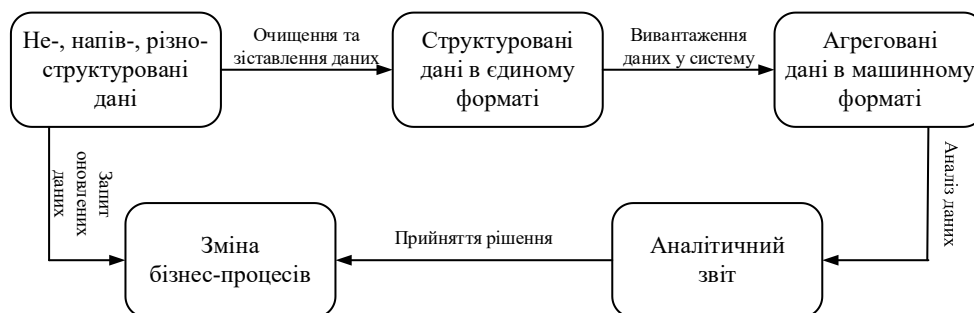


Fig. 2 – Cycle of data analysis and management decisions based on the business analytics system

There are several different methods of data analytics that can be applied.

Classification – used for data segmentation by categories. The process is done by reviewing already classified data and then using artificial intelligence rules to apply them to new information.

Association – used to identify patterns in datasets and to determine relationships between them. Artificial intelligence uses detected patterns to predict future behavior. For example, how retail sites offer products to customers based on their previous purchases or the issuance of potential projects on freelance exchanges for outsourcing agencies.

Clustering – involves classifying data by segments created by software. One of the biggest advantages of this method is that the technology can detect subtle differences or similarities, thus creating more accurate segments.

Enterprises investing in both business analytics tools and data analytics tools can execute, test, and interpret big data in real-time. Therefore, data analytics and business analytics help simplify marketing processes and enhance financial returns.

While business analytics systems primarily focus on monitoring datasets and tracking data according to business goals and key performance indicators (KPIs), the practice of data analytics is used to analyze datasets to identify new patterns and market trends. Data analytics does this by applying complex methods to data that help organizations achieve a specific goal or business task.

Data analytics is an integral part of business analytics when it comes to standardizing and using business data to create accurate and reliable forecasts that can allow companies to operate at a higher level than just relying on historical data.

Business analytics and data analytics are actively used in making marketing decisions, specifically in the search for new projects for an outsourcing IT company.

To support and stimulate financial flows, outsourcing IT companies almost always face the task of searching for new projects to execute. Given that the decision to take on a project might not be made by a single person, but by a group, it can be quite challenging to not miss some of the available information during the communication process for making this decision. To simplify the decision-making process regarding project selection, it is advisable to use a data analysis system that can

provide recommendations to all participants in this process regarding the projects under consideration.

Practical applications of business analytics in addressing the issue of finding new projects for an outsourcing IT company include:

Client Analysis. In today's digital world, consumers have more opportunities to interact with a brand, including: social networks, email, chatbots, web forms. All these touchpoints allow tracking numerous metrics and gathering more data about the target market and clients. This offers the opportunity to determine which elements of the marketing strategy are effective and which are not, as well as to identify similarities and behavior patterns that will ensure a steady influx of new projects and clients.

Market Research. Business analytics and intelligent data analysis provide a deeper understanding of competing companies and the market as a whole by analyzing web traffic, reviews, mentions on social media, and market trends.

Communication Channels Research. Determining the most effective communication channels with the target audience by analyzing different types of channels used by consumers or types of clients that need to be attracted.

Data analytics is used in the marketing activities of an outsourcing IT company for processes such as sales forecasting, market segmentation, and database marketing. Intelligent data analysis allows increasing the company's revenue by identifying, for example, which products or services interest clients, which then allows tailoring their experience, reducing client churn.

Conclusions

The demand for data analytics and business analytics is growing due to the ubiquitous spread of big data and cloud technologies. Data analytics professionals can set up data pipelines that feed directly into business analytics tools. As long as customers continue to use the Internet, mobile apps, and social networks, data analytics and business analytics will continue to evolve in the process of attracting new clients and acquiring new projects for outsourcing companies.

Investments in data analytics help outsourcing companies maintain a competitive edge. The ability to efficiently and timely process and interpret complex datasets leads to the rationalization of business processes, increased customer satisfaction, and increased profitability of investments.

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