

7. MODERN TECHNICAL SOLUTIONS AS A SOURCE OF INNOVATIVE DEVELOPMENT IN THE CONTEXT OF PERMANENT CRISIS

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CHAPTER 7.1. BUSINESS ANALYTICS: SYNERGY OF TECHNOLOGY, DATA AND STRATEGIC THINKING

The section is dedicated to exploring the role of business analytics in the modern context of digital transformation and its impact on organizational management efficiency. It reveals the key idea of the synergy of technology, data, and strategic thinking as a triune mechanism for achieving sustainable development and business competitiveness. Technology provides tools for processing and analyzing large volumes of data, data serves as the foundation for informed decision-making, and strategic thinking directs these resources toward achieving long-term goals. Special attention is given to building a model of interaction between these three components, where technological potential enhances the speed and efficiency of data processing, and quality analytics ensures the accuracy of forecasts and strategic decisions. Strategic thinking, in turn, ensures the integration of analytical results into the organization's overall strategy. The section also emphasizes the need for implementing analytical tools and fostering a data-oriented corporate culture. The authors highlight the importance of continuous staff training, integrating technological innovations, and adapting business processes to rapidly changing market conditions. In conclusion, the study demonstrates that the synergy of technology, data, and strategic thinking is a key factor for the successful transformation of businesses in the digital age and ensuring their sustainable development.

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РОЗДІЛ 7.1. БІЗНЕС-АНАЛІТИКА: СИНЕРГІЯ ТЕХНОЛОГІЙ, ДАНИХ І СТРАТЕГІЧНОГО МИСЛЕННЯ

Розділ присвячено дослідженню ролі бізнес-аналітики у сучасних умовах цифрової трансформації та її впливу на ефективність управління організаціями. Розкривається ключова ідея синергії технологій, даних та стратегічного мислення як триєдиного механізму для досягнення стійкого розвитку та конкурентоспроможності бізнесу. Технології забезпечують інструментарій для обробки та аналізу великих обсягів даних, дані виступають основою для ухвалення обґрунтованих рішень, а стратегічне мислення спрямовує ці ресурси на досягнення довгострокових цілей. Особлива увага приділена формуванню моделі взаємодії цих трьох компонентів, де технологічний потенціал підвищує швидкість та ефективність обробки даних, а якісна аналітика забезпечує точність прогнозів та стратегічних рішень. Стратегічне мислення, своєю чергою, забезпечує інтеграцію результатів аналізу у загальну стратегію організації. Розділ також акцентує на необхідності впровадження аналітичних інструментів та розвитку корпоративної культури, орієнтованої на дані. Автори підкреслюють важливість постійного навчання персоналу, інтеграції технологічних інновацій, а також адаптації бізнес-процесів до швидкозмінних умов ринку. У підсумку, дослідження демонструє, що синергія технологій, даних і стратегічного мислення є ключовим фактором для успішної трансформації бізнесу в цифрову епоху та забезпечення його стабільного розвитку.

Introduction

In today's globalized world, where information and data are key assets of any organization, business analytics gains special significance as a tool for making effective managerial decisions. The rapid development of digital technologies, artificial intelligence, and machine learning has significantly transformed approaches to data analysis, interpretation, and utilization. Business analytics has become a vital element of strategic management, enabling enterprises to quickly respond to market changes, optimize operational processes, and enhance competitiveness.

The volume of data generated daily grows exponentially. Through business analytics tools, organizations can not only store this data but also transform it into valuable information for decision-making. Analytical approaches allow uncovering hidden patterns, forecasting trends, and assessing potential risks.

Modern enterprises face the necessity of integrating digital technologies into their business processes. Business analytics acts as a catalyst for this transformation, enabling companies to optimize costs, automate routine processes, and increase productivity.

Business analytics provides managers with tools for in-depth situation analysis, scenario modeling, and making well-founded strategic decisions. This helps avoid intuitive mistakes and improve forecasting accuracy.

Companies that actively use analytical tools can adapt more quickly to changes and implement innovative solutions. Business analytics enables a better understanding of customer needs, optimizing products and services, which, in turn, increases customer satisfaction and loyalty to the brand.

Business analytics has a wide range of applications—from finance and banking to healthcare, education, and public administration. In each of these areas, it contributes to enhancing efficiency, minimizing costs, and achieving strategic goals.

The relevance of business analytics in today's world is hard to overestimate. It not only provides opportunities for analyzing large amounts of data but also helps develop strategies based on well-substantiated conclusions. In a rapidly changing world, possessing effective business analytics tools is a key factor for success and sustainable organizational development.

Research Goal: To reveal the significance and key role of business analytics in the context of digital transformation and to analyze its impact on organizational management efficiency through the synergy of technologies, data, and strategic thinking.

Research Objectives:

1. Outline the modern context of business analytics development.
2. Define the role of business analytics in the digital transformation of enterprises.
3. Explore the synergy between technologies, data, and strategic thinking.

Review of Scientific Works on the Research Topic

Nisar Ahmad in his work [1] shows how businesses can leverage the synergy of data analytics, artificial intelligence, and blockchain technologies

to deliver transparency and sustainable growth. The author focuses on the integration of modern technologies into strategic planning and supply chain management.

Another researcher in his article [2] considers the role of artificial intelligence and other analytical tools in the transformation of organizations. Particular attention is paid to task automation and strategic thinking in the digital age.

The role of synergy in achieving value from business intelligence systems is explored by I. A. Someh, G. Shanks [3]. In their article, they focus on the interaction of business intelligence resources with other organizational resources.

Mikalef, I. O. Pappas, J. Krogstie, P. A. Pavlou examines how big data technologies integrate with strategic thinking to create added value in organizations [4].

Researchers such as I. Asadi Someh, G. Shanks in his work [5] consider key factors and mechanisms that provide synergies between business intelligence resources and strategic objectives.

Authors A. O. Adewusi, U. I. Okoli, T. Olorunsogo in his work [6] analyze how the integration of business intelligence and big data provides a competitive edge and supports strategic thinking.

A. Alfonzo в своїй праці «Data Analytics Exploitation for Growth Synergies in Multi-Business Companies» [7] considers the use of data analytics to create synergies between different divisions of multi-business companies.

In turn, the authors of G. Laursen, J. Thorlund in his book «Business Analytics for Managers: Taking Business Intelligence Beyond Reporting» [8] emphasize that modern business analytics goes beyond reporting and promotes strategic thinking emphasize that modern business analytics goes beyond reporting and promotes strategic thinking.

Despite numerous studies in this area, the issues of integrating technology, data and strategic thinking to achieve business values, transparency and effective management of organizations have not been fully disclosed. Despite numerous studies in this area, the issues of integrating technology, data and strategic thinking to achieve business values, transparency and effective management of organizations have not been fully disclosed.

7.1.1. Theoretical and Technological Aspects of Business Analytics

This research is based on the following key concepts.

Business intelligence is the process of collecting, processing and analyzing data to support informed management decisions.

Key business intelligence components include:

Data collection - use of internal and external sources of information.

Data analysis - the use of statistical methods, machine learning and data visualization.

Forecasting - modeling future scenarios based on data.

Decision making - implementing strategies to achieve business goals.

Business analytics helps to optimize operational processes, improve efficiency and reduce costs.

Strategic thinking is the ability to see the big picture, anticipate future challenges and opportunities, and form long-term plans to achieve goals. Key components of strategic thinking include:

Analysis of the external environment - identifying trends, threats and opportunities. Strategic thinking is the ability to see the big picture, anticipate future challenges and opportunities, and form long-term plans to achieve goals. Key components of strategic thinking include:

Analysis of the external environment - identifying trends, threats and opportunities.

Formulating a vision is creating a clear picture of the future.

Setting goals - setting priorities and strategic guidelines.

Flexibility - adaptation to changes in the external environment.

The main role of strategic thinking is to help organizations remain competitive in the face of uncertainty.

Technological innovation is the creation and implementation of new or significantly improved technological solutions to improve the efficiency, productivity or quality of products and services.

Key components of technological innovation are as follows:

Research and development (R&D) - creation of new technologies and products.

Technology integration - introducing innovations into business processes.

Digital transformation - using digital solutions to optimize operations.

Innovative culture - stimulating creativity and openness to change.

Technological innovations allow businesses to adapt to market changes, reduce costs and improve product quality.

These three concepts interact, ensuring the sustainable development and competitiveness of organizations in a dynamic environment (Fig. 1).

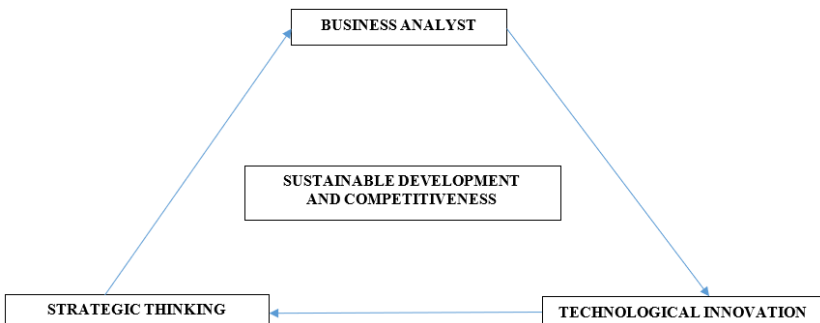


Fig. 1. Interdependence between the basic concepts of research

Source: formed by the authors

The concept presented in Fig. 1 demonstrates the following interdependence between concepts:

1. *Business analytics* – provides data for strategic thinking.
2. *Strategic thinking* – determines the direction for innovation.
3. *Technological innovation* – is a tool for implementing strategic plans.
4. At the center – sustainable development and competitiveness as a result of interaction.

Business Analytics (BA) is the process of collecting, processing and analyzing data to make informed management decisions. It combines statistical methods, computational algorithms, analytical tools and strategic thinking. The main goal of business analytics is to identify hidden patterns, predict trends and optimize business processes.

Business analytics encompasses several key areas: descriptive analytics (describing the current state), diagnostic analytics (identifying the causes of phenomena), predictive analytics (predicting future outcomes), and prescriptive analytics (developing optimal strategies).

The history of business analytics dates back to the Industrial Revolution, when entrepreneurs began using statistical methods to optimize production. In the 1960s, the first decision support systems (DSS) appeared.

In the 1980s, analytical platforms that allowed for the automation of data processing processes were widely used. In the 2000s, the development of Big Data and machine learning technologies opened up new horizons for analytics. Today, business analytics is increasingly based on artificial intelligence (AI) and automated algorithms [9].

Modern business analytics is based on several fundamental approaches:

- Data as an asset.
- Data management.
- Real-time analysis.
- Integration of different data sources.

Let's consider these approaches in more detail.

Data as an asset

Today, data is no longer just a tool for operational management or reporting – it has become a key strategic resource that can provide companies with a competitive advantage, which is that:

- Companies use data to analyze market trends, customer behavior, and operational efficiency.
- Data helps identify new opportunities for business development or improvement of existing products.
- Through data analysis, companies can better understand customer needs and offer customized solutions.
- Analytics allows you to predict possible risks and prevent financial losses.

Companies that effectively collect, process, and analyze data gain not only temporary advantages but also long-term strategic stability.

Data management

Data governance is a strategic approach to managing data in an organization that includes policies, processes, and standards to ensure its quality, security, availability, and integrity. Data governance encompasses several key aspects:

- Data standardization - ensuring consistent formats and rules for data collection, processing, and storage.
- Data quality - detecting and correcting errors, ensuring information is accurate and up-to-date.
- Data access - implementing clear rules and access rights for different users.
- Regulatory compliance - adhering to privacy and data protection standards.

Effective data management allows organizations to minimize risk, improve productivity, and ensure the accuracy of business intelligence reports.

Real-time analysis

This is an approach to data processing and analysis that allows you to receive relevant information at the moment it arrives. By using streaming data, organizations can quickly respond to changes in the environment, ensuring more accurate and faster decision-making.

Key aspects of real-time analysis:

- Stream Processing - modern technologies allow you to process huge amounts of data in real time.
- Event Monitoring - tracking important indicators and changes for instant response.
- Sensor Integration and IoT Data from sensors and connected devices is often used to control and automate processes.
- Rapid visualization - Tools like Tableau and Power BI provide real-time data visualization, making it easier to understand key trends.

Real-time analysis allows companies to be more agile, respond faster to changes, and manage resources more efficiently.

Integration of various data sources

It is the process of combining data from various internal and external sources to create a single information environment that allows for deeper analytical insights.

Key aspects of data integration:

- Internal data sources - CRM systems, ERP systems, financial reports, sales and marketing data.
- External data sources: Open source data, social media, market research, competitive analytics.
- Data integration technologies - ETL (Extract, Transform, Load) processes, APIs, data management platforms such as Talend, Informatica and Apache Nifi.
- Single platform for analysis - Consolidation of data on centralized platforms such as Data Warehouse or Data Lake.

Among the benefits of data integration are improved data quality through standardization and synchronization, comprehensive analysis for strategic planning, and increased forecast accuracy through access to a wider range of data.

For example, in retail, integrating internal sales data with external market trend data allows for more accurate demand forecasting and inventory management. In the financial sector, integration allows for

the detection of fraudulent transactions by analyzing transactions with external behavior patterns.

Popular business intelligence tools include (Table 1):

- BI systems (Business Intelligence): Power BI, Tableau, Qlik.
- Big Data platforms: Apache Hadoop, Spark.
- Machine learning tools: Python (pandas, scikit-learn), R.
- Artificial intelligence: TensorFlow, PyTorch.

These tools provide the ability to process large amounts of data, build forecasts, and optimize strategies.

Table 1

Comparison of modern business intelligence tools

Category	Examples	Key features	Areas of application
BI systems	Power BI, Tableau, Qlik	Data visualization, reporting	Business reporting, KPI analysis
Big Data platforms	Apache Hadoop, Spark	Processing large amounts of data	Analytics, data storage
ML Tools	Python (pandas, scikit-learn), R	Modeling, forecasting	Analytics, risk modeling
Artificial intelligence	TensorFlow, PyTorch	Deep learning, decision automation	Forecasting, optimization

Source: compiled by the authors based on [8]

A brief summary of business intelligence tools:

These tools work in synergy, allowing companies to efficiently process data, predict outcomes, and make informed decisions.

Cloud technologies have become an integral part of business intelligence due to their flexibility, scalability, and availability. Platforms such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP) provide the infrastructure for processing and storing data.

Table 2 compares key cloud platforms for business intelligence.

Table 2

Comparison of key cloud platforms for business analytics

Platform	Main features	Advantages	Disadvantages	Website
AWS (Amazon Web Services)	Large set of analytical tools, scalability	High performance, flexibility	Difficulty in setup	aws.amazon.com
Microsoft Azure	Integration with products Microsoft, AI-аналітика	Ease of integration, multifunctionality	High cost	azure.microsoft.com
Google Cloud Platform (GCP)	BigQuery analytics, optimization for ML and AI	Fast data processing, optimized architecture	Less support for corporate customers	cloud.google.com

Source: compiled by the authors

These platforms provide the necessary resources to process, store, and analyze large amounts of data, allowing organizations to effectively implement business analytics into their processes.

Cloud analytics solutions allow companies to quickly implement analytical tools, providing access to data at any time.

Automation of analytical processes allows you to reduce data processing time and increase the accuracy of forecasts. Analytical dashboards provide visualization of key performance indicators (KPIs) in real time. Below is a comparative table of the main tools for creating analytical panels (Table 3).

Table 3

Analysis of the main tools for creating analytical panels

Tool	Main features	Advantages	Disadvantages	Website
Tableau	Data visualization, dashboards	Intuitive interface, flexibility	High cost	tableau.com
Power BI	Integration with MS products, reporting	Affordable price, integration with Excel	Limited performance with big data	powerbi.microsoft.com
Looker	Built-in analytics, integration with BigQuery	Deep integration with Google Cloud	High cost	looker.com

Source: compiled by the authors

Tools such as Tableau, Power BI and Looker allow users to create interactive dashboards for fast and informed decision-making.

With the growth of data volumes and the introduction of artificial intelligence technologies, cybersecurity is becoming critically important. Key cybersecurity measures include: data encryption, user authentication, regular backups, anomaly monitoring. Data protection standards such as GDPR (EU) and CCPA (US) play an important role in this.

The theoretical and technological aspects of business intelligence cover a wide range of concepts, tools and methods. The effective use of business intelligence allows companies not only to analyze the past, but also to predict the future, adapting to dynamic market conditions.

7.1.2. The Role of Data in Business Analytics

Data is a fundamental resource for business intelligence because it provides the basis for making informed decisions. Data sources can be classified as internal and external.

Internal data sources include:

- Operational systems (ERP, CRM, SCM).
- Financial reports and accounting records.
- Customer and transaction data.
- User activity logs.

Operational systems (ERP, CRM, SCM) are important tools for collecting, processing and analyzing data in business analytics. ERP (Enterprise

Resource Planning) systems allow you to integrate and manage core business processes such as finance, logistics, production and human resources. CRM (Customer Relationship Management) systems help analyze customer data, improve service and increase loyalty. SCM (Supply Chain Management) systems ensure effective supply chain management, cost optimization and timely order fulfillment. These systems generate large amounts of structured data that can be used for strategic analysis and management decision-making.

Financial statements and accounting records are key sources of data for business intelligence, as they reflect the financial position of the enterprise, its revenues, expenses, profits and financial risks. These reports include balance sheets, profit and loss statements, cash flow statements and other financial documents. Accounting records provide detailed information about all financial transactions of the company, which allows you to track financial flows, identify inefficient expenses and make informed financial decisions. In addition, regular analysis of financial data allows the management of the enterprise to identify potential problems in time and take corrective measures.

Customer and transaction data is a critical source of information for business intelligence, as it allows you to understand customer behavior, their needs, preferences and habits. This data includes purchase history, transaction frequency, average check, customer reviews, as well as interaction with marketing campaigns. Customer data analytics allows you to segment customers according to various criteria, predict their behavior and create personalized offers. Transactional data, in turn, provides information about financial transactions, including the time, place, and amount of purchase. This information helps identify trends, identify popular products, and optimize sales processes. Comprehensive analysis of customer and transactional data allows you to increase the effectiveness of marketing strategies and improve overall business performance.

User activity logs are an important source of data for business analytics, as they contain information about users' interactions with systems, websites, and applications. These logs record data such as user login and logout times, IP addresses, session durations, actions performed, features used, and possible system errors. Log file analytics can help identify anomalies in system operations, analyze user behavior, optimize interfaces, and improve the overall user experience. Log files also help identify potential security threats, such as unauthorized access or hacking attempts. Regular log analysis ensures the stability, security, and efficiency of a company's digital systems.

External data sources include:

- Market data and industry reports.
- Social media and online platforms.
- Public databases (government statistical reports, open data).
- Competitor and supplier data.

Market data and industry reports are an important source of information for business intelligence, as they provide up-to-date information on the state of the market, key trends, the competitive environment and potential development opportunities. Industry reports usually contain analytical data,

forecasts, performance indices and recommendations for businesses. Market data covers aspects such as sales volumes, consumer demographics, customer satisfaction levels and market shares of competitors. Using this data allows companies to better understand their strengths and weaknesses, identify new niches and adapt strategies to changing market conditions. Using business intelligence tools to analyze market data helps to make informed strategic decisions, increase competitiveness and ensure sustainable business growth.

Social networks and online platforms are powerful sources of data for business analytics due to the huge amount of information generated by users every day. Data from social networks such as Facebook, Instagram, Twitter, LinkedIn includes demographic information, user preferences, reactions to content, engagement levels, and audience sentiment. Online platforms such as marketplaces (Amazon, eBay) and classifieds services (OLX, Rozetka) provide data on transactions, customer reviews, price dynamics, and product popularity. Social media analytics helps identify trends, understand the needs of the target audience, and measure the effectiveness of marketing campaigns. Data from online platforms allows you to assess the competitiveness of products and services, forecast demand, and optimize business processes. Combining data from social networks and online platforms provides a deep understanding of consumer behavior and helps make strategically important decisions.

Public databases (state statistical reports, open data) are an important resource for business analytics, as they contain verified, accessible and often regularly updated information. State statistical reports cover a wide range of data, including demographic indicators, employment levels, macroeconomic indicators, consumer price indices and foreign trade data. These data provide an objective assessment of the economic situation and allow for forecasts of further market development. Open data, in turn, represents public access to information provided by government agencies, non-governmental organizations or scientific institutions. These data can cover information on infrastructure, energy, transport, the environment and other critically important areas. Business analysts use these resources to build models, identify trends, assess risks and support strategic decisions. Analysis of data from public databases allows for an objective view of market conditions, socio-economic processes and global challenges that affect the activities of companies.

Competitor and supplier data is an important component of business intelligence, as it provides key information for making strategic and tactical decisions. Competitor data includes information about their products, pricing policies, marketing strategies, customer satisfaction levels, financial indicators, and market share. This data can be obtained from public reports, industry research, social media, customer reviews, and analytics platforms. Their analysis allows you to identify the strengths and weaknesses of competitors, predict their actions, and build effective counterstrategies.

Supplier data includes information about supplier reliability, delivery times, quality of goods and services, pricing policy and contract terms. Analytics of

this data allows enterprises to minimize risks associated with supply chain disruptions, as well as optimize costs and ensure operational stability.

Integrated analysis of competitor and supplier data provides companies with the opportunity to quickly respond to changes in the market situation, improve their competitive position and increase the overall efficiency of business processes.

In business analytics, the following types of data are distinguished:

- Structured data: tables, databases.
- Unstructured data: texts, audio, video.
- Semi-structured data: XML, JSON.
- Real-time data: data streams from sensors, online transactions.

Structured data is data that has a well-defined structure and is stored in formats that allow for easy searching, sorting, and analysis. It is typically organized in tables, where each row represents a single record and each column represents a specific attribute of that record. The main examples of structured data are databases, Excel spreadsheets, CSV files, and data from ERP and CRM systems. Structured data allows for quick filtering, aggregation, and other operations due to its clear organization. It is the foundation for business intelligence because it can be easily integrated into analytical tools such as SQL, Power BI, or Tableau. Using structured data allows companies to get specific answers to business queries, build reports, and identify patterns in operational activities.

Unstructured data is data that does not have a clear structure or fixed format, which makes it difficult to analyze using traditional data processing methods. These include texts (e.g., emails, social media posts, PDF documents), audio recordings (support calls, podcasts), video files (webinar recordings, YouTube video content), and images. The main problem with unstructured data is its volume, diversity, and complexity of interpretation. Modern technologies such as natural language processing (NLP), computer vision, as well as machine learning and artificial intelligence algorithms are used to process such data. Analyzing unstructured data allows you to obtain valuable information, for example, about customer sentiment, trends in user behavior, and key factors influencing consumer decisions. Successful management of unstructured data provides a competitive advantage and improves the effectiveness of business strategies.

Semi-structured data is data that does not have a strict structure, as in structured data, but is not completely chaotic, as in unstructured data. It contains certain labels or tags to organize the information, which allows for partial automation of its processing. The main formats of semi-structured data are XML (Extensible Markup Language) and JSON (JavaScript Object Notation).

XML - is a text-based format for storing and transmitting data that uses tags to define the structure of information. It is often used to exchange data between different applications and platforms.

JSON - It is a lightweight data exchange format that is often used in web applications and APIs. JSON has a simple syntax, which makes it convenient for working with modern interfaces and analytics systems.

Semi-structured data is often used in data integration systems, web services, mobile applications, and the Internet of Things (IoT). It allows you to store large amounts of information in a flexible format that is easy to transfer and process using specialized tools such as SQL, Python, or special libraries for working with XML and JSON (for example, pandas or xml.etree in Python).

Real-time data is information that is generated, processed, and available for analysis almost instantly after it is created. Such data comes from a variety of sources, including sensors, mobile devices, online transactions, and other digital systems.

Real-time data sources:

- IoT (Internet of Things) sensors - devices that record physical parameters (temperature, humidity, movement) and transmit them in digital format.
- Online transactions - data on operations carried out through electronic payment systems.
- Server log files - registration of events and user actions on websites and applications in real time.
- Social networks - news feeds, comments, reactions and other user activity.

The features of real-time data are as follows: large volume of information, high speed of receipt, variability and dynamism, application of real-time data.

For example, financial services - instant detection of fraudulent transactions, marketing - prompt adjustment of advertising campaigns, logistics - real-time route optimization, production - monitoring of equipment operation and rapid response to malfunctions.

Real-time data analysis provides the ability to instantly respond to changes, which allows you to increase the efficiency of business processes and make more informed management decisions.

The following data collection methods are distinguished:

- Questionnaires and surveys.
 - Automated monitoring systems.
 - API integration for obtaining data from other platforms.
 - Web scraping and data parsing.
- Comparative characteristics of data collection methods are presented in Table 4.

There are the following data processing methods: data cleaning from errors and duplicates, data normalization and transformation, use of ETL processes (Extract, Transform, Load), machine learning algorithms for data preparation. Comparative characteristics of data processing methods are presented in Table 5.

Table 5 clearly demonstrates the advantages and limitations of each data processing method and helps to choose the optimal approach depending on the goals of business analytics.

There are the following data visualization methods: building charts and graphs, dashboards for monitoring key indicators, geographic data maps, interactive reports (Power BI, Tableau). A comparative description of data visualization methods is presented in Table 6.

Table 4

Comparative characteristics of data collection methods

Data collection method	Advantages	Disadvantages	Areas of application
Questionnaires and surveys	Ease of implementation, ability to get specific answers from the audience	Subjective responses, limited sample size	Marketing research, service evaluation
Automated monitoring systems	High collection speed, minimal human intervention	High implementation cost, dependence on technical resources	Production processes, equipment control
API integration	Instant data transfer, easy integration between platforms	API limitations, dependence on the stability of external services	CRM, ERP, financial analysis analytics
Web scraping and data parsing	Large volume of data, automation of collection	Legal restrictions, need for complex algorithms	Market monitoring, competitor analysis

Source: compiled by the authors based on [8]

Table 5

Comparative characteristics of data processing methods

Data processing method	Advantages	Disadvantages	Areas of application
Cleaning data from errors and duplicates	Improving data accuracy, eliminating duplicates	High time and resource consumption	Preparation of analytical reports, improvement of data quality
Data normalization and transformation	Unification of formats, facilitating integration and analysis	Possibility of losing some important information	Integrating data from various sources, preparing for analysis
Using ETL processes (Extract, Transform, Load)	Process automation, efficient data storage and processing	High demands on infrastructure and resources star border	Large databases, analytical platforms
Machine learning algorithms for data preparation	Detection of hidden patterns, scalability	High complexity of implementation, need for qualified specialists	Predictive analysis, intelligent analytics

Source: compiled by the authors based on [8]

Table 6

Comparative characteristics of data visualization methods

Data visualization method	Advantages	Disadvantages	Areas of application
Construction of diagrams and graphs	Visual presentation of data, ease of perception	Limited ability to drill down, difficulty interpreting large amounts of data	Analytical reports, presentations, comparative analysis
Dashboards for monitoring key indicators	Quick access to key metrics, interactivity	High design requirements, need for regular data updates	Business analytics, performance management
Geographic data maps	Visualization of geographic trends, efficiency for territorial analysis	Dependence on the accuracy of geodata, complexity in construction	Logistics, marketing campaigns, regional analysis
Interactive reports (Power BI, Tableau)	Dynamic data analysis, deep dive capability	High cost of licenses, need for qualified specialists	Strategic analysis, corporate analytics

Source: compiled by the authors based on [8]

Table 6 demonstrates the features of each visualization method, allowing you to choose the optimal tool depending on the business intelligence tasks.

Data quality problems are challenges that arise due to deficiencies in the accuracy, completeness, consistency, relevance, and availability of data used for analysis, decision-making, or process automation. The main data quality problems are:

- Data incompleteness - missing important values.
- Data inaccuracy - errors as a result of input.
- Data instability - outdated or incorrect data.
- Data incompatibility - different formats and standards.

Methods for solving data quality problems:

- Automated data cleaning.
- Use of data exchange standards and protocols.
- Data verification and validation.
- Regular data auditing.

Analysis of Table 7 shows that data quality issues have a significant impact on the effectiveness of business intelligence. Their solution requires the implementation of systematic approaches to data cleansing, validation and standardization. Regular auditing and modern technologies can reduce the risks associated with poor-quality data and provide accurate, reliable analytical conclusions for strategic management.

Data analysis is a key stage in the strategic decision-making process. Modern analysis methods include:

- Descriptive analysis: identifying key trends.
- Diagnostic analysis: explaining the causes of certain events.

- Predictive analysis: predicting future scenarios.
- Attribution analysis: recommendations for optimizing decisions.

Table 7

**Comparative characteristics of data quality problems
and methods for solving the problem**

Data quality problem	Problem description	Solution methods	Examples	Source of information
Data incompleteness	Lack of important values, making full analysis impossible	Automated data cleaning, regular completeness checks	Lack of data about the client's address in the CRM system	Wang, R. Y., & Strong, D. M. (1996) [10]
Data inaccuracy	Errors that occur during manual data entry or due to system failure	Data verification and validation	Incorrect date format in financial reports	Redman, T. C. (1998) [11]
Data instability	Data that is outdated or no longer relevant	Regular data audit, automatic update	Using old product prices in reports	Pipino, L. L., Lee, Y. W., & Wang, R. Y. (2002) [12]
Data incompatibility	Different data formats and standards, making their integration difficult	Using data exchange standards and protocols	XML data not supported by the analytics tool	Batini, C., Cappiello, C., Francalanci, C., & Maurino, A. (2009) [13]

Source: compiled by the authors

Descriptive analysis is an analytics method used to summarize and interpret large amounts of data to identify common patterns, trends, and characteristics. The main goal of descriptive analysis is to present data in a clear and understandable way using tables, charts, and graphs. This approach allows a business to get an overview of the current state of affairs and draw initial conclusions before deeper analytical research.

Examples of using descriptive analysis: analyzing quarterly sales to identify the most popular products; studying the demographic characteristics of customers by age, gender, or place of residence; evaluating the effectiveness of marketing campaigns by comparing indicators before and after their implementation.

Tools for descriptive analysis: Excel and Google Sheets for basic statistics and visualization; Tableau and Power BI for interactive reports. Python (pandas and matplotlib libraries) to automate big data analysis.

Diagnostic analysis is a data analysis method that focuses on identifying and explaining the causes of certain events or anomalies in data. The goal of diagnostic analysis is not only to identify what happened, but also to find out

why it happened. This approach is an important step after descriptive analysis, as it allows you to better understand the context and background of events.

The main tools for diagnostic analysis: BI analytical tools (Tableau, Power BI); SQL for deep database analysis; Python and R for detecting patterns in data.

Examples of diagnostic analysis applications are: identifying the reasons for a decrease in sales in a certain period; analyzing the reasons for an increase in production costs; identifying factors that influenced unsuccessful marketing campaigns.

The advantages of diagnostic analysis are: deep understanding of cause-and-effect relationships, the ability to identify hidden dependencies, increasing the effectiveness of strategic decisions. The limitations of diagnostic analysis are: requires high-quality and complete data, can be resource-intensive and time-consuming.

Diagnostic analysis provides a basis for further actions, such as predictive and attribution analysis, and allows management to make more informed decisions.

Predictive analytics is a data analysis method that uses statistical models and machine learning algorithms to predict future events or trends based on historical data. The goal of predictive analytics is not only to predict possible scenarios, but also to provide informed recommendations for making strategic decisions.

The main tools for predictive analytics are: Python (pandas, scikit-learn, Prophet libraries), R (forecast, caret packages), BI tools (Power BI, Tableau), machine learning algorithms (linear regression, decision trees, neural networks).

Predictive analytics is used to forecast demand for goods and services, assess the probability of customer churn, predict a company's financial performance, and model the impact of marketing campaigns on sales.

The advantages of predictive analysis are: the ability to make proactive decisions, identify potential risks, optimize resources and investments.

The limitations of predictive analysis are: high dependence on the quality and completeness of data, the need for significant computing resources, the complexity of building models for dynamic markets.

Predictive analysis allows companies to act ahead, adapting strategies to future changes and minimizing possible risks.

Attribution analysis is an analytics method that goes beyond descriptive, diagnostic, and predictive analytics to provide specific recommendations for optimizing decisions. It uses scenario modeling, optimization algorithms, and machine learning techniques to determine the best possible actions in specific situations.

The main goal of attribution analysis is to provide recommendations on what actions should be taken to achieve the desired outcome, identify optimal strategies to minimize risks, and maximize profits.

Tools for attribution analysis: Python (scipy, pulp libraries), R (lpSolve, optimx packages), BI systems (Tableau, Power BI), decision support systems (DSS – Decision Support Systems).

Examples of the application of attribution analysis are: optimization of logistics routes to reduce transportation costs, determination of the ideal pricing strategy to increase margins, recommendations for personalized marketing campaigns based on customer behavior.

Advantages of attribution analysis: increasing the efficiency of operational and strategic decisions, the ability to automate decision-making in real time, reducing the human factor in complex decision-making processes.

Limitations of attribution analysis: high requirements for computing resources, dependence on the quality of the source data, difficulty in building accurate models for dynamic conditions.

Attribution analysis is the highest level of analytics, allowing organizations not only to understand the past and predict the future, but also to actively influence results thanks to accurate and practical recommendations.

Identifying growth opportunities is the process of identifying potential business opportunities through data analysis. This process involves studying market trends, customer behavior, operational efficiency, and the competitive landscape. Using advanced analytics tools, companies can uncover hidden patterns, predict future market needs, and identify segments with high growth potential.

Key steps in identifying growth opportunities:

- Identifying growing market segments and promising niches.
- Studying customer needs and behavior to create value propositions.
- Identifying competitors' strengths and weaknesses.
- Implementing new technologies and business models.

Identifying growth opportunities allows companies to adapt to changing market conditions, increase competitiveness and ensure sustainable development.

Risk minimization is a strategic approach that involves identifying, analyzing and reducing possible threats to the business through data analysis. Business analytics allows you to identify potential risks at an early stage and provide mechanisms for their neutralization or mitigation. This process includes analyzing historical data, modeling possible scenarios and assessing their impact on the organization.

Key tools for risk mitigation: predictive modeling, machine learning algorithms, BI platforms for risk analytics.

Resource optimization is a strategic approach to maximizing the efficient use of a company's physical, financial, and human resources through data and analytics. Resource optimization helps companies minimize costs, increase productivity, and achieve strategic goals.

Key aspects of resource optimization:

- Cost analysis, forecasting of financial flows, budget optimization.
- Improvement of work processes, automation of routine tasks.
- Planning of work schedules, definition of key roles and competencies.
- Optimization of delivery routes, minimization of inventory and transportation costs.

Resource optimization is a key factor in the long-term success of the company, allowing to ensure stable growth and competitiveness in the market.

Supporting innovation and organizational agility is a strategic process that ensures a company's ability to adapt to change, implement new technologies and business models, and maintain sustainable development in dynamic market conditions. With data analytics, companies can identify new opportunities, test innovative ideas, and quickly adapt to market challenges.

Key aspects of supporting innovation and agility:

- Identifying promising technologies and business practices.
- The ability to quickly respond to changes in the internal and external environment.
- Stimulating creativity and willingness to experiment among employees.
- Using modern solutions such as machine learning, artificial intelligence and process automation.

Supporting innovation and agility in the organization allows a business to not only respond to changes, but also actively shape market trends, ensuring long-term success.

Thus, the role of data in business analytics is multifaceted, and effective use of data requires a comprehensive approach to its collection, processing, analysis and visualization.

7.1.3. Strategic Thinking in the Context of Business Analytics

Modern strategic management is impossible to imagine without the use of business analytics, which provides leaders and managers with relevant data for making informed decisions. Business analytics is a tool that allows you to transform large amounts of data into understandable analytical conclusions that serve as the basis for strategic decisions. It helps not only to identify trends and patterns, but also to predict possible scenarios. Thus, business analytics becomes an integral part of strategic management, providing synergy between technology, data and management experience.

Strategic thinking is a cognitive process that allows an individual or organization to see the big picture, predict possible scenarios, analyze complex situations, and make informed decisions to achieve long-term goals.

The main characteristics of strategic thinking:

1. Systematicity - the ability to see the situation as part of a larger system, to understand the relationships between its elements.
2. Foresight - orientation to the future, the ability to predict possible development scenarios and their consequences.
3. Flexibility - the ability to adapt to new conditions and adjust the strategy in accordance with changes.
4. Innovation - the ability to find non-standard solutions and approaches to achieving goals.
5. Analytical skills - the ability to analyze large amounts of information and draw the right conclusions.
6. Prioritization - focusing on key aspects and eliminating less important tasks.

The following stages of strategic thinking are distinguished:

1. Defining the goal and vision of the future. A clear understanding of the end result.
2. Analysis of the current situation. SWOT analysis (strengths and weaknesses, opportunities and threats).
3. Strategy planning. Developing an action plan to achieve the set goals.
4. Strategy implementation. Implementing the developed solutions.
5. Evaluation and correction. Monitoring results and making adjustments if necessary.

The formation of strategic goals requires a deep understanding of both the internal environment of the organization and the external factors that influence it. Business analytics provides tools for collecting, processing and analyzing data, which allows you to formulate clear, achievable and measurable strategic goals. It is important not only to identify current problems, but also to be able to predict future challenges. With the help of business analytics, managers can identify key performance indicators (KPIs), determine priority areas of development and assess potential risks.

Analytical thinking is one of the most important skills of a modern leader. It allows you to critically evaluate information, identify hidden patterns and make informed conclusions. Managers who have analytical thinking can more effectively use business intelligence tools to achieve strategic goals. They are able to integrate data into management processes, adapt strategies to dynamic market conditions and make decisions based on objective facts, not intuition.

Examples of successful applications of business analytics in strategic decision-making include:

- Using business analytics to optimize supply chains and personalized recommendations, which will allow a company to improve operational efficiency and increase profits.
- Predicting the popularity of content, which allows optimizing investments in new projects.
- Optimizing marketing campaigns and targeted audience targeting, which will ensure high efficiency of advertising strategies.

In general, business analytics allows companies to achieve strategic goals, increase competitiveness and adapt to a dynamic market.

Strategic thinking in the context of business analytics is a key factor in success in the modern business environment. The relationship between business analytics and strategic management provides organizations with the opportunity to effectively adapt to change, make informed decisions and achieve long-term goals. The development of analytical thinking among managers and leaders is a prerequisite for the successful implementation of business analytics in strategic management.

7.1.4. Synergy of Technology, Data And Strategic Thinking

In today's business environment, the synergy of technology, data, and strategic thinking is a key factor in the success of organizations. Technology provides tools for collecting, processing, and analyzing large amounts of

data, data provides the basis for making informed decisions, and strategic thinking directs these tools to achieve long-term goals.

Let's formalize a model of effective interaction between technology, data, and strategic thinking in the context of business analytics.

Let's define the main components of the model:

T – Technology – tools and platforms for data processing.

D – Data – volume, quality, and availability of information for analysis.

S – Strategy – the ability to make decisions based on analytics.

BA – Business Analytics – the result of integrating technology, data, and strategic thinking.

Let's formalize the relationship between the components of the model. The synergy model can be represented as a function:

$$BA = f(T, D, S),$$

where: f is a function describing the integration of technology, data, and strategic thinking.

Let us define a functional dependency and assume that the dependency is multiplicative, since the absence of any of the components nullifies the synergy effect:

$$BA = k * T^\alpha * D^\beta * S^\gamma,$$

where: k – synergy coefficient (shows the efficiency of integration of components).

α, β, γ – weighting coefficients showing the contribution of each component to the overall result ($\alpha + \beta + \gamma = 1$).

Increasing technological potential (T) leads to more efficient data processing. Qualitative data (D) ensures the accuracy and reliability of analytical conclusions. Strategic thinking (S) ensures the correct application of the obtained analytical results for decision-making.

To achieve maximum efficiency of business analytics, it is necessary to optimize the values of components T, D and S so that:

$\partial BA / \partial T > 0$ – the partial derivative of BA with respect to T is positive. That is, when T increases, the value of BA also increases.

$\partial BA / \partial D > 0$ – the change in BA with respect to variable D is also positive.

$\partial BA / \partial S > 0$ – the change in BA with respect to variable S is positive.

That is, improving any of the three factors will lead to an increase in the efficiency of business analytics.

Indicators for measuring each component can be:

T – the number of implemented technologies, the level of automation, the speed of data processing.

D – completeness, accuracy, relevance of data.

S – the speed of decision-making, the correspondence of decisions to strategic goals.

This model reflects the synergistic nature of the interaction between technologies, data and strategic thinking, where the balanced development of all components ensures maximum efficiency of business analytics. Technological solutions (e.g., artificial intelligence, machine learning, analytical platforms) are combined with management approaches and strategic vision of management.

The key elements of the model are:

- Technology infrastructure – ensuring access to advanced technologies and their effective use.
- Data as an asset – creating a data culture where information is a strategic asset.
- Strategic leadership – defining clear goals that can be achieved through analytics.
- Process integration – combining all elements into a single system to ensure continuous analysis and adaptation.

Conclusions

Business analytics allows businesses to predict trends, assess risks, and make better-informed decisions. The practical use of business analytics requires skilled analysts who can interpret data and implement results into business processes.

Successful integration of business analytics into corporate culture requires creating an environment where data and analytics are an integral part of daily operations and strategic planning. All this requires the development of analytical skills among employees, leaders should support initiatives to implement analytics, and transparently share the results of analytical research. Corporate culture should support innovation and encourage experimentation to maximize the potential of business analytics.

Organizations face a number of challenges when implementing analytical approaches:

- technological barriers - high cost of implementing and maintaining analytical systems;
- cultural barriers - resistance to change from employees;
- lack of qualified personnel - insufficient number of specialists in the field of analytics.

However, the opportunities provided by the synergy of technology, data, and strategic thinking in the field of business analytics outweigh these challenges. Organizations that successfully integrate technology, data, and strategic thinking can gain significant competitive advantages, improve business process efficiency, and ensure sustainable development.

An important condition for success is the continuous improvement of analytical approaches, investment in staff training, and the creation of a transparent corporate culture focused on data and results.

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