

*Ustenko S.V., Doctor of Economic Sciences,
Professor, Kyiv National Economic University
named after Vadym Hetman,
Makushchenko O.O., Master's Degree
Student, Kyiv National Economic University
named after Vadym Hetman*

INFORMATION CONTROL SYSTEM FOR BUSINESS ANALYTICS OF A SMALL ENTERPRISE

Today, our world is teeming with technology, having replaced manual labor and significantly enhancing our lives. Technology permeates every aspect of our existence, from simple gadgets like watches to complex computer systems and from household appliances like refrigerators to intricate server networks. We've grown accustomed to leveraging technology for tasks ranging from cooking and communication to entertainment and problem-solving. However, the perception of technology's value varies among individuals and across different fields, with some embracing it more readily than others. Yet, regardless of differing perspectives, technology remains a versatile tool capable of simplifying processes across various domains.

Among the many domains where technology intersects with our lives, the realm of work stands out as particularly significant. We spend a considerable portion of our time engaged in work, making it a prime area for technology integration. Within this sphere, the business sector, especially the role of analytics in small businesses, warrants closer examination.

In contemporary times, business intelligence has evolved into an indispensable component of organizations of all sizes and shapes. Information control systems play a crucial role, especially in small enterprises, enhancing efficiency, refining decision-making processes, and fostering business growth. However, small enterprises often overlook the importance of such systems, leading to several challenges, including resource constraints and a lack of awareness regarding their significance. This monograph aims to address these gaps by exploring the prerequisites, different types, and practical implications of business intelligence systems in the context of small businesses, shedding light on their benefits, challenges, strategies, and impact in today's digital age.

An overview of business intelligence in small businesses. An overview of business intelligence in small businesses reveals its essence as the organization's ability to make informed decisions and

drive effective business development. A business intelligence information control system employs statistical analysis, predictive modeling, and data visualization techniques to investigate and interpret complex business data, identifying patterns, trends, correlations, and other relevant information crucial for strategic and operational decision-making. As defined by the Journal of Business Analytics, it is «a systematic thought process that uses qualitative, quantitative, and statistical computational tools and techniques to analyze data to gain insights to inform and support decision-making» [1]. We can say that the definition itself is quite voluminous, different authors interpret its aspects in different ways, but fundamentally, nothing changes – processing volumes of data and information using various methods to obtain valuable, practical, and useful information for further usage.

One of the key reasons why business intelligence is so important is its potential to improve decision-making processes. Traditionally, decisions have been made based on intuition and subjective judgment by individuals who, within their capabilities and knowledge, may unintentionally make wrong decisions. The business environment is becoming more complex each day and what was once the standard has become outdated, so relying on the decisions of responsible persons is no longer enough. The decisions of such persons should be made based on data, which will allow organizations to receive the necessary information in real-time and also to make more informed decisions. This approach is not new and it is still effective, especially in the time of active development of IT and AI. It is worth noting that according to Gartner research, 95 % of all decisions will be at least partially automated by 2025.

In addition, such a toolkit allows companies to quickly identify trends and patterns, helping them to stay ahead of competitors, as B. Dmytryshyn and M. Borovoy emphasize in their article. As they point out, «it is necessary to identify the facts of mismanagement, unproductive losses, and unjustified investments» [2]. In other words, not only examines how consumers and the market behave but also internal business procedures to find opportunities that could be hidden and dangers that could arise. For example, by analyzing data, companies can identify changes in the market, adapt their products or services to these changes, or move to another segment where there is less pressure from competitors.

Business intelligence tools also contribute to innovation in enterprises. Economic development can be considered cyclical, which is a general form of movement of the economy and the economy as a whole. This implies a change in the revolutionary and evolutionary stages of economic development, and economic progress and expresses

the uneven functioning of various elements: fluctuations in business activity and a fall in market conditions, alternation of extensive and intensive types of economic growth [3].

Analytics tools affect operational efficiency. For example, in inventory management, when a lack of raw materials or data can lead to downtime, causing losses and loss of market position. By using statistical data, companies can predict this in advance, resulting in more efficient resource allocation, higher conversion rates, and ROI.

Business intelligence allows organizations to reduce risks and avoid potential threats. It is especially useful in risk management, optimization of business processes, implementation of innovative ideas, and process reengineering, as O. Guseva points out in her article [4].

Business intelligence information systems are gradually being implemented, which creates additional workplaces. This is not a direct benefit for the companies that use them but contributes to the development of the economy as a whole. That's why organizations are actively looking for people with the right skills – analysts.

However, no matter how attractive and wonderful the benefits of business intelligence information control systems look, many small businesses face challenges in implementing such solutions. These obstacles not only hinder the development of small businesses but can cause the nation's economy to grow more slowly. Since «a vital component of any healthy market economy is the active development of the small and medium-sized enterprise sector, which plays a crucial role in creating new workplaces, promotes economic growth and innovative development», as noted by the authors of the «Problems and Prospects for the Development of Small and Medium-Sized Business» [5].

Among the problems faced by small businesses, probably the most essential is the lack of resources, mainly limited financial resources, which are the main equivalent of all others, including hired labor, etc. Since the implementation of information control systems of business intelligence requires significant investments in technological infrastructure, software licenses, and qualified personnel or training of existing ones, these limitations often lead to a dilemma between cheap funds, credit, and business efficiency, which often leads to mediocre competitiveness.

The next problem, which is a consequence of the first one, is how to obtain the experience and skills that are necessary to implement and manage such a system. This is reflected in the ability to hire data analysts and system developers who have enough skills to meet the needs of a particular enterprise, while more qualified specialists are poorly retained by the enterprise due to lack of salary, or skills, or cannot be hired with the available funds.

A significant problem that small and even medium-sized enterprises often face is data quality. This problem generally emerges due to «temporary» or «alternative» solutions used by the enterprise. This leads to decentralized and poorly coordinated data sources and insufficient data management policies. Important data is typically dispersed across two or more systems, which makes integration and efficient analysis challenging.

Implementation always changes workflows, methods, ways, and rules for making and approving decisions. In turn, small businesses face resistance to change from employees who are «good» at traditional manual processes or don't possess the requisite digital literacy.

After a business intelligence information control system is put into place, scalability issues can occasionally occur as the number of consumers of enterprise can quickly increase due to new opportunities, which ultimately means there will be more data to deal with and could lower system performance or cause the infrastructure to become unable to handle the expanding volume of data and users.

Comparison of popular systems. The framework of a business intelligence information control system can currently be fitted by multiple similar systems. Despite their apparent similarity, these seemingly identical systems can differ greatly from one another in terms of not just the tasks they can carry out but also how well-suited each system is for a specific sector, what benefits and drawbacks each system has, and how widely used or highly specialized it is. In their writings, Vyganyailo S.M. and Viunenko O.B. discuss such systems, noting that they are separated not only by functionalities but also by the kinds of activities they carry out and the intent behind their use [6].

Some of the popular systems that have the appropriate functionality include the two leading systems Tableau and Power BI and two contenders Looker Studio and Domo. The functioning of these two groups is rather wide and not restricted to any particular field or analysis potential.

Tableau is a data visualization tool by Salesforce Inc. that helps to transform various information into different charts and graphs using interactive dashboards. Tableau is one of the leading and popular products that is simple, fast, and easy to use.

Among the advantages of Tableau:

- the most diverse data visualization capabilities of any vendor on the market, including graphs, panels, charts, tables, spheres, and many others, all linked together for easy and quick navigation;
- a very simple interface that is understandable without any technical knowledge;

- The multi-platform solution allows the use of the program not only on a computer but also on mobile devices, both platforms have very reliable user support to solve any problems.

Among the disadvantages of Tableau:

- Despite its ease of use, for more complex tasks or data representations, knowledge of SQL is required. The data presentation section can only convert text and digital data into graphical data, thus you will need to construct data queries for sophisticated queries and manually choose the data;

- When reports or views are stored in a new version, the previous versions vanish and cannot be retrieved, which causes issues with version control and the loss of historical data;

- The lack of automated report updating requires you to restart queries to build them every time, which wastes time.

Power BI is a set of software services that work within the Microsoft platform to transform a variety of data into visually appealing graphs and understandable tabular representations, where the sources can be any storage options, from local tables to huge services.

Among the advantages of Power BI:

- The biggest advantage of the service is the ability to connect, import, and analyze data from many different sources. The service allows you to connect and use data from Excel, XML, JSON, Facebook, data-cloud, Google Analytics, and many other formats and cloud services without much effort;

- Integration capabilities allow you to use the results of the analysis in many popular services without intermediate transformations, and also have an API that allows you to integrate the results directly into your website or email;

- Power BI is a set of software services that allows you to choose the most suitable option. The options include a free version with limited functionality, a SaaS version, an enterprise version, a mobile version, a server version, and a cloud version.

Among the disadvantages of Power BI:

- Complexity in usage causes issues with accessibility and comprehension; using the full capability of the complex programs demands specific skills in dealing with data and data models, without which it will be exceedingly difficult to utilize a system;

- The need for customization and the rather unintuitive interface requires some time to understand what is on the screen.

Looker Studio is a free cloud-based tool as part of the Google platform for transforming data into informative dashboards and reports.

Looker Studio provides not only tools for transforming data but also for analyzing it.

Among the advantages of Looker Studio:

- The main advantage is that it is a free service, although there is a paid version, which offers a fairly high level of data modeling, processing, and transformation. The toolkit includes functions for drill-down, filtering, transformation, report generation, etc;
- Because it is cloud-based, it can be utilized without the need for physical infrastructure and offers data security features including row-level protection, access control, backup and recovery capabilities, and interaction with other tools;
- Looker Studio provides an extensible platform that allows you to create custom data applications and embed Looker into other systems, offering APIs and SDKs for creating custom data and integrating features.

Among the disadvantages of Looker Studio:

- Fairly limited in comparison to others, which often makes the data difficult to understand;
- Data integration can be a problem when using sources that do not have an additional connector, such as local databases or data warehouses;
- The analysis and processing functionality is also limited, and it may not be suitable for the demands of medium-sized and larger enterprises, since it does not handle big volumes of data efficiently.

Domo analytics is a cloud analytics platform designed for large enterprises and small businesses. It has a wide range of features related to security, management, dashboard, reporting, and data analysis requirements.

Among the advantages of Domo:

- Domo is a cloud-based technology, so it's quick and easy to set up and start using for business intelligence management;
- The service supports a wide range of cloud technologies, making it simple to include them in the workflow;
- is an easy-to-use service that does not require special technical skills to get started.

Among the disadvantages of Domo:

- Occasional problems when working with large amounts of data caused by a significant load on computing resources service, as its functionality makes it appropriate even for large organizations with a high flow of information;
- Questionable user support is a concern for customers, as even minutes of downtime in a business bring significant losses;

- Service gives functionality under the paid plan; thus, to obtain complete functionality, you have to pick the costliest option.

These systems appear to be the same at first look, yet there are significant differences. In certain aspects, each system outperforms the other, while in others it falls far short. Looker Studio is the most affordable option, but it has limitations in terms of how data is connected to the system, analyzed, and presented. Services such as Tableau have the best data presentation, and Domo or Power BI have connectivity that is far ahead, but in some cases, Domo and Power BI are very expensive.

Information control system of business analysis for small enterprises. According to the definition by O. Guida, «an information control system is a set of tools, methods, and performers that provide the necessary and sufficient information for the implementation of all activities of the management process» [7]. In general, several types of such systems are common in practice, namely: decision support systems and information control systems. The business intelligence information control system, in turn, belongs to the first category, although it may partially include the functions of the second, such as comparing two alternatives as a result of data analysis for different periods or by different categories.

Such a system should have the capabilities necessary for a small business to collect, store, organize, analyze, and deliver data and information in a way that supports and improves business decision-making. This, in turn, includes the technologies, processes, methodologies, and tools used to structure and utilize data for analytical purposes.

The system and its components can look like this (Fig. 1).

The data collection component is responsible for obtaining data from various internal and external sources, such as databases, data warehouses, etc. Data collection may often involve integration with other systems to ensure the accuracy, reliability, relevance, and timeliness of the data.

Databases, data warehouses, and cloud storage are examples of storage components.

Data systematization and harmonization is an essential part that involves converting data from many sources and formats into a single form. These technologies enable users to communicate with many databases, systems, and applications, resulting in a unified view of the information being stored.

Data governance is the set of rules, processes, and standards that control data quality, access, security, and conformity. Establishing a

strong governance framework is vital for ensuring data integrity and producing more reliable analytical outputs.

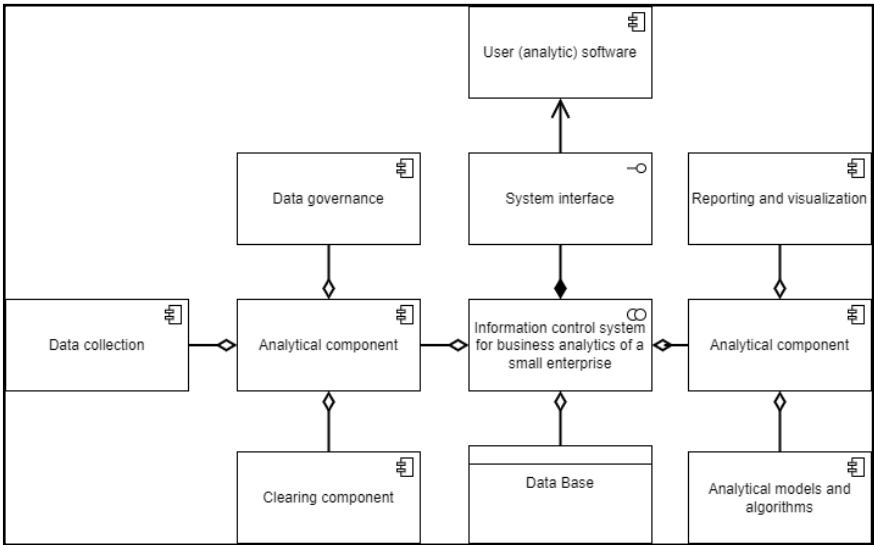


Figure 1. Graphical interpretation of system components

Source: developed by the authors

The cleaning component is required to remove any existing faulty data before it can be processed. This normally consists of cleansing, data validation, and sorting information that comes in. Proper data preparation procedures assist in optimizing this process and provide users with trustworthy and standardized data.

The system is built on analytical models and algorithms that provide meaningful information and results. Statistical analysis, machine learning, artificial intelligence, prescriptive, predictive, and descriptive analytics algorithms, among others, are examples of such techniques. These approaches and algorithms play a role in the development of prediction models, pattern recognition, and data-driven decision-making.

Displaying information in a relevant and visually appealing manner serves as essential for business users to successfully evaluate and comprehend data. Reporting and visualization methods make it simpler for people to understand data and exchange information by providing interactive dashboards, charts, graphs, and reports.

The user interface serves as a means of interaction between the system and the analyst and is responsible for the interaction with the end-user.

In general, small enterprises are quite limited in their capital, unlike large ones, so they usually use more affordable, universal, and less functional solutions when choosing any IT product. As noted by M.A. Saensus and G.S. Karnaukhova, «the low price of information technology equipment and ease of access to service are the most important criteria when choosing it» [8]. Thus, the system should be affordable, ensuring that the cost of implementation and maintenance is low-cost, so cloud-based solutions or open source are often a good choice, providing extensive features at a low price.

Small businesses often grow rapidly, especially when implementing solutions such as business intelligence management systems. To keep up with the expanding volume of data, the system must be scalable. As the organization expands, the system will gradually evolve without requiring big financial investments for expansion.

Small firms often do not have specialist teams or IT departments that can quickly understand the software, thus the system should be easy to use and accessible. The user interface should be straightforward, with minimum training necessary to operate effectively with the system. This will allow users to swiftly adapt the system's functionalities to current business processes.

The ability to integrate with different sources is a necessity for small businesses to consolidate data from different sources and make it possible to use the system's functionality, as small businesses often have many different solutions for each task.

The security of processed data is a key feature for all sizes and forms of business, so appropriate data protection standards, data and storage requirements, as well as backup, and protection against external and internal threats, should be used to ensure system reliability and trust.

Based on the characteristics discussed, we can identify several requirements that small businesses need:

- the system must be able to process large amounts of data and store it securely, use indexing and search functions to make data retrieval simple and efficient;
- the system should provide several analytical tools, such as predictive modeling, data mining, and statistical analysis, to identify prospects based on the collected data;
- the ability to generate on-demand reports and perform ad hoc queries is essential for small businesses that often need to evaluate specific scenarios or respond to immediate business requests, so an

information control system should include a comprehensive reporting engine that allows users to retrieve and present data in real-time;

- the system should provide fast response times and the ability to process requests without significant delays;

- small businesses need to protect their data from unforeseen events such as system failures, so the system must have backup mechanisms to create copies of the data.

When implementing business intelligence information control systems, small enterprises emphasize their business processes. According to V.A. Tigareva and I.V. Stankevich, «the basis of all existing scientific views on the selection of indicators for assessing business processes of enterprises and organizations is the qualitative and quantitative approaches to the analysis of the object of study» [9].

Business intelligence tools and methods. Business intelligence tools and techniques refer to a wide range of technologies, methodologies, and software tools that help businesses discover, interpret, and present data in a meaningful way. They are designed to facilitate data analysis and make it accessible to users without advanced technical skills or in-depth knowledge of statistics.

It is important to understand that not everyone classifies tools and methods in business intelligence systems in the same way. Gartner identifies a set of business intelligence software tools as data warehousing tools, operational analytical processing systems, information and analytical systems, data mining tools, and query and report generation tools [10]. Capterra differentiates several categories, such as data visualization software, decision support software, analytical software, data mining software, web analytics software, risk management software, etc.

Using Garthner's magic square for 2023, we can see a comparison of such tools (Fig. 2).

Each of the platforms is assessed by Gartner using 12 criteria for 2023, along with two axes of vision completeness criteria. These criteria consider indicators such as product strategy, marketing strategy, sales strategy, vertical/industry strategy, innovation, geographic strategy, and so on.

All tools are organized into 4 squares.

Leaders demonstrate a clear understanding of key product capabilities and a commitment to customer success which is demanded by buyers in this market.

Contenders are well-positioned to succeed in the market, although they may be limited by specific use cases, technical environments, or application areas.



Figure 2. Gartner Magic Quadrant

Source: [11]

Visionaries have a clear or differentiated vision of their product, usually narrowly focused services that excel in one type of analysis or task, but struggle with more general ones.

Niche companies specialize in a certain sector or in satisfying the needs of specific cloud-stack consumers, but positions outside their specialization are weakening.

From this square, we can say that there are only 3 in leader and all of them are quite expensive for small businesses, among the narrowly focused tools there are already 9, but as noted earlier, small businesses often need wider functionality. There are still contenders and niche tools that are better suited for small enterprises.

Among the techniques used for the implementation of business intelligence information control systems, there are four categories or kinds of analytics:

- Descriptive analytics – according to the definition provided by E. Okpaku, «is the evaluation of past data to better understand company trends, which involves the effective use of a variety of historical data to create comparisons. The most commonly reported financial data, such as year-over-year price adjustments, month-over-month sales growth, number of users, or total revenue per subscriber, are products of descriptive analytics that show what happened in a company over some time» [12];

- Predictive analytics – in the article «How artificial intelligence will change the future of marketing», it is described as a branch of analytics that uses input data, statistical combinations, and machine learning to predict the probability of a certain event or group of events, forecast future trends or outcomes using available data with the ultimate goal of improving corporate performance [13];

- Prescriptive analytics – by D.B. Mishra, S. Naqvi, A. Gunasekaran, and V. Dutta can be described as an advanced approach to the use of advanced processes and tools for data analysis that uses complex mathematical and logical algorithms to provide recommendations, identify opportunities for optimizing processes and solutions [14];

- Diagnostic analytics is «a section of analytics that aims to answer the question ‘Why did this happen? By using diagnostic analytics, companies can gain insight into the causes of patterns they notice in their data. Diagnostic analytics can include a variety of methods, including data mining and data analysis. To investigate the root cause of trends, companies may need to examine additional data sources, potentially including external data», as M. Holliday says [15].

Each type of analytics or category of methods serves a specific purpose and can be used in conjunction with others to acquire an in-depth knowledge of the present scenario using the data that is currently available.

All 4 categories are actively used in business intelligence information control systems. Large businesses tend to employ predictive and prescriptive analytics since they have access to enormous quantities of historical data and operate in several industries. For instance, in February 2023, the Starbucks coffee chain introduced a new line of coffee called «Oleato», which included olive oil. Unfortunately, the series failed as a result of an improper product mix, which cost the network money since customers decided against

purchasing the line because of its adverse effects. Even though the product resulted in losses for a company of this size, they were insignificant in comparison to a small enterprise, where similar investments would have a considerable budget impact. Consequently, small enterprises attempt to utilize each of these categories, each of which is in charge of a different component and has a different complexity. (Fig. 3).

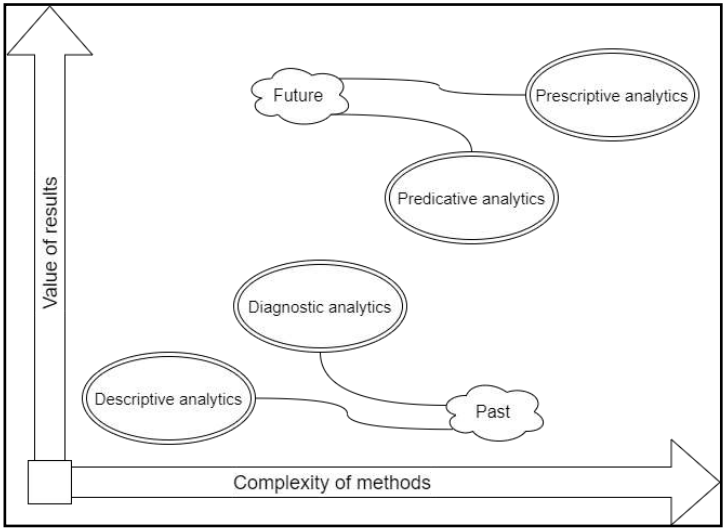


Figure 3. Categories of analytics methods

Source: developed by the authors

It is simple to understand the relationships between these categories based on the way they are shown. The relationship between complexity and effectiveness is linear; that is, from bottom to top, the value of the results produced by these approaches grows as the methods' complexity increases from left to right. It is also clear that each category of analytics or set of techniques provides information on the analysis of the past, such as product sales numbers, or anticipated future, such as individuals wanting to buy a specific type of product.

Descriptive analytics is a statistical interpretation used to analyze historical data and identify patterns and relationships between them. Descriptive analytics tries to describe an event, phenomenon, or outcome, which helps to understand the implications of past events and provides businesses with an ideal basis for tracking trends. The primary

purpose of the approaches in this category is to answer the question «What happened?».

The advantages of this category of methods include the following:

- Historical understanding of the processed data allows businesses to look at the accumulated indicators and information from a retrospective perspective, which can help to see patterns, trends, and anomalies and in turn can help to make more accurate and correct decisions;

- Visual representation uses various techniques and formats of data output, such as charts, graphs, and tables, to help make enormous amounts of information more understandable. Such representations can be made use of to communicate key choices and ideas to stakeholders;

- Descriptive methods are simple to learn and apply, therefore they are frequently employed by non-technical workers like accountants. Furthermore, systems that make use of this kind of method frequently offer templates, because little or no experience is required to use the systems.

- The availability of hindsight is often used in conjunction with other groups of methods, usually to compare past and current KPIs, which facilitates monitoring of business performance;

- By identifying trends, patterns, and anomalies in historical data using descriptive analytics, companies can develop future strategies based on information and improve business processes without additional analysis.

The disadvantages of this category of methods include the following:

- Descriptive methods focus on analyzing and extracting value from historical data and do not provide predictive information. Although these methods allow us to see patterns, trends, and anomalies they cannot provide an understanding of whether they will remain or not;

- Descriptive approaches give data as-is, frequently without explanation for why data occurred or why trends or anomalies have emerged. Because context is absent, these approaches limit the company's understanding of the reasons for particular cases and demand the application of further methods;

- The category of descriptive methods often relies on structured data, which does not always provide a complete picture of events. The fact that these methodologies involve the extraction of unstructured, subjective, or qualitative data, further hinders one's understanding of significant elements that may have an impact on performance.

The main popularity of these methods in recent years has been driven by the development of Big Data technologies and the availability

of these technologies, due to their implementation in cloud computing, which is usually more scalable and cost-effective in terms of infrastructure for enterprises. In addition, the development of cloud computing and the integration of more extensive and innovative data visualization tools have made descriptive analytics easier to use, allowing any individual or business to analyze data independently and enabling the use of descriptive methods by individuals without significant technical skills and knowledge.

Due to their popularity and many advantages, small businesses have gained a few benefits:

- Descriptive analytics provides small businesses with the ability to analyze data without the need for large specialized resources, which in turn allows them to get results at a lower cost than larger competitors who typically lack of functionality of these methods;

- Descriptive category techniques assist in breaking down small businesses' clients based on many different things, such as demographics or age, which eventually gives enough possibilities to understand their preferences and target audience behaviors and helps them to respond to the market better;

- Small businesses gain insight into their internal operations, identifying bottlenecks, and inefficient areas that need to be improved, which, in comparison with the availability and low costs, allows them to maintain a sufficient level of competitive efficiency.

Diagnostic analytics is characterized by methods such as drill-down, data discovery, data analysis, and correlations, which are used to identify behaviors, trends, and patterns to find out why certain events occurred and what led to the actual results. The primary purpose of the approaches in this category is to answer the question «Why did this happen?».

The advantages of this category of methods include the following:

- The ability to identify the causes of certain events or issues that have come up as a result of the company's operations. By evaluating and researching data from multiple sources, companies may establish what aspects affected the actual outcome as well as the main reasons why things had taken place the way they did. Diagnostic methods are important for creating solutions to recurrent problems and refining existing organizational strategies by identifying the causation;

- A deep understanding of the root causes provides the basis and opportunities for developing more informed and data-supported decisions to optimize business processes, decision-making efficiency, plans, etc.;

- Based on the investigated historical data, diagnostic analytics methods allow organizations to keep an eye on fluctuations in key

financial indicators, identify the origins of these changes, assess current progress against previously defined goals, and augment descriptive analytics approaches;

- Methods of the diagnostic category are excellent for risk management, as they help to identify risks in advance and make decisions to prevent them before they occur. These methods are especially valuable in the short term, as they help to avoid most losses.

The disadvantages of this category of methods include the following:

- Diagnostic analytics approaches primarily rely on historical data that may not always precisely reflect current or future situations, which limits their use in dynamic and unstable business environments;

- Methods of this category of analytics require a deep understanding of data analysis tools and methodologies, which makes them less accessible for widespread use due to the skills of those who will utilize them;

- The process of data manipulation takes much longer than descriptive methods and requires more technical resources and specialized knowledge;

- Diagnostic methods require high-quality integrated data to obtain accurate results, so the requirements for data are somewhat higher than for descriptive methods.

Diagnostic analytics has become even more popular in recent years. This is primarily because of the rapid advancement of technology and the gradual digitization of business processes. The public now has wider access to diagnostic analytics methods thanks to the development of cloud solutions. However, particularly among small businesses has increased less than that of descriptive analytics methods due to the latter's greater complexity in analyzing «past» data and situations.

Due to the gained popularity and several advantages, small businesses have gained several advantages when using systems with diagnostic data analysis methods, such as:

- systems and tools for diagnostic analysis have become cheaper and more accessible to businesses with limited budgets compared to the previous decade;

- The availability of systems with diagnostic analytics has allowed small businesses to identify gaps and causes of these gaps in their operations, which has improved operational efficiency and using preventive methods in risk management;

- Diagnostic analytics may assist small firms in understanding the causes for fluctuations in client base patterns, changes in the market,

and their revenue, allowing them to better adjust to the various scenarios;

- Understanding the causes behind certain events makes it simpler for small enterprises to join niche markets and achieve their business objectives and goals.

Predictive analytics uses statistics, data, and modeling techniques to predict the future, including various key indicators, trends, causes, and possible scenarios for the unfolding of events. Predictive analytics approaches use past and present data to uncover the future development and probability of specific occurrences, which aids in determining if something is beneficial or not. The primary purpose of methods in this category is to answer the question «What can happen in the future?».

Advantages of this category of methods include the following:

- Predicting future events is the main reason why this category is very popular, especially among large business players, as it provides an opportunity to predict the behavior of their target audience, market volatility, competitors' actions, etc. The analysis of many indicators, including but not limited to behavioral patterns, decisions of responsible persons, and investor sentiment, provides a solid understanding of the possible consequences of implementing certain decisions;

- Predictive analytics methods greatly improve operational efficiency in many areas, providing greater opportunities than descriptive and diagnostic methods;

- Effective risk assessment, management, and forecasting of occurrence and possibilities help to avoid fraud, business downtime, and significant losses by implementing preventive measures to avoid or at least mitigate risks;

- Predictive approaches, as opposed to descriptive and diagnostic data analysis, assist in the formation of more targeted strategies and plans. Adopt these methods in business operations to cover as many elements as possible at reduced costs and maximize the realization of benefits;

- With a highly accurate prediction of future events, chief executives may plan and cover potential niches on time, greatly surpassing their competition by designing better-performing strategies.

The disadvantages of this category of methods include the following:

- The quality of the data has a tremendous impact on the outcome. Models and neural networks utilized in the predictive techniques category might produce incorrect and misleading conclusions based on how outdated or biased the input data is;

- Predictive analytical techniques employ far larger amounts of data than descriptive and diagnostic methods, which causes issues with information gathering, storage, and processing in terms of privacy and safety. This occasionally creates concerns from stakeholders, imposing additional expenditures of funds to assure reliability as well as security through process validation of predictive models;

- Some prediction models and methodologies, such as deep learning algorithms, are exceptionally difficult for humans to fully understand and explain. This affects comprehending the cause-and-effect links as well as the model's predictions. If the results cannot be interpreted, there may be doubt on the part of responsible personnel, which leads to serious difficulties in making choices.

- Forecast models are based on historical data and assumptions that past patterns and relationships will continue. However, market dynamics, customer behavior, and external factors may change over time, making forecasts less accurate or outdated and requiring that new trends should be taken into account by regularly updating such models;

- Developing, managing, and maintaining effective predictive models is often resource intensive, especially in terms of highly skilled personnel, computing power, and data infrastructure, making it very difficult to implement and maintain for businesses with limited resources.

Predictive analytics has become an innovation in the modern world, revolutionizing the approach to decision-making and stimulating the growth of many areas and industries. Advanced information analysis methodologies, machine learning algorithms, and quickly expanding artificial intelligence-enabled organizations to get an in-depth understanding of cause-and-effect links, resulting in an innovative approach to traditional management and decision-making.

It can be said that all new ideas and achievements start with discovery and innovation in the hope of creating a viable idea where predictive analytics guides the process, trying to answer exactly when, where, how, and why a certain innovation will improve the current idea or concept. However, working with innovations is inherently unpredictable, and therefore often the results are disruptive or unviable, where it is very difficult to rely on intuition alone, and as a rule, it is simply impossible to analyze the data. As a solution to the problem, predictive analytics methods in information control systems are used, which, first and foremost, allow for gathering information before the idea becomes a reality, and second, allow for accurate information extrapolation, resulting in a variety of potential changes. Companies will quickly discover where the difficulties will be, what their nature

will be, whether they can be overcome, and how they are going to be overcome. At this point, anyone can see the value of such technologies, which allow testing an idea with relatively small investments rather than blindly introducing innovation and praying it will have success; while such seemingly absurd ideas have achieved significant success, failure would result in catastrophic losses.

By being innovative when using systems with such methods, small businesses can gain advantages:

- Predictive analytics can precisely determine customer preferences and improve their experience on a small scale, making it useful for small businesses;
- Because of the minimal number of business processes that must be adjusted, small companies may swiftly adapt to their niche without spending substantial time and financial expenditures. This helps easily differentiate the company, especially in crowded markets;
- Reducing risk when implementing new business processes and ideas using predictive analytics methods is a significant advantage for small businesses, as they usually operate on a limited budget when any cost is critical.

Prescriptive analytics provides an advanced approach to data analysis that uses sophisticated mathematical algorithms and technology to provide practical recommendations for decision-making and is the fourth category of methods. Prescriptive analytics is closely related to all other categories and is often used as the final stage of any analysis, as the primary purpose of this category is to answer the question «What should be done next?» where the logical continuation is «to achieve the goal».

The advantages of this category of methods include the following:

- Gives proactive decision-making based on a thorough awareness of future possible situations. Prescriptive methods provide an integrated understanding of all possible scenarios by analyzing both historical and hypothetical data, as well as a combination of different factors;
- The ability to observe the complete chain of events helps companies develop far more effective tactics, as companies can identify the cause-and-effect links and what potential actions can lead to them.
- As a basis for innovation, prescriptive analytics allows for quick analysis of several situations at once, adaptation to new circumstances, and providing the most optimal solution, considering certain needs and goals;
- The maximum degree of risk management and operational planning is achieved when companies have a way to anticipate not only the best but also the worst cases and the routes leading there.

The disadvantages of this category of methods include the following:

- Implementation of prescriptive analytics requires significant financial and technical knowledge, as it involves complex mathematical modeling for the needs of the enterprise, development of algorithms and integration with existing systems, hiring entire teams of highly qualified specialists or cooperation with outsourced experts;

- To provide reliable results, prescriptive analytics methods need extraordinary volumes of data, which can be very costly for small and medium-sized businesses;

- The main problem with such analytics methods is that they rely on historical data and learn from it, so they can rarely provide real-time information, as it takes a certain amount of time from receiving the most recent data to being able to get results based on it.

Small enterprises can still benefit from using such technologies, despite their drawbacks and questionable availability:

- Prescriptive analytics methods are best suited for innovative development, so the use of such methods in small businesses can significantly increase competitive advantage, as more successful ideas will be implemented;

- Benefits in risk management and prevention for company operations, with the budget serving as one of the most crucial metrics for small enterprises.

Innovative approaches to system implementation. It can be clearly stated that at present, in the period of rapid development of information technology, better and more innovative approaches to the implementation of information control systems for business intelligence of small enterprises can significantly change not only the benefits and success of the introduction of entrepreneurship but also realize more appropriate ways and methods of introducing such systems into the work of a small enterprise.

The approaches to implementation may vary depending on specific needs, but they all have one thing in common, as R. Ode and R. Aivu write: «Data collection and data processing leads to new knowledge, and the result is new knowledge that has a positive impact on innovative business development» [16]. Such systems and methods are found in the space between gathering data and learning new things.

One of the simplest and most innovative approaches for small businesses is cloud-based solutions. With the cloud-based approach, computing services can be offered via the Internet, and data is stored, processed, and managed remotely with minimal need for business infrastructure.

Among the main advantages of the approach:

- The primary benefit of the cloud method is its accessibility, which, in contrast to alternative solutions, allows users to access the system from nearly any place on Earth with Internet connectivity, regardless of device;

- Cloud-based systems are usually well scalable and quickly adapted by enterprises to their requirements due to the absence of the need for physical devices, and additional investment into the volume of leased data storage, and computing power, which are usually much cheaper than physical counterparts;

- Most, if not all, cloud platforms include several safety measures for their services, resulting in rather dependable methods for encrypting, copying, and restoring data. This is partially because, under such systems, the risk is passed to an external organization that offers data storage or processing services;

- The last advantage would be a decrease in bureaucratic work associated with information management and processing. Small businesses frequently don't have the resources to implement work policies and principles; most operate under less complex and less successful policies, so the cloud approach also addresses this issue, as the leased resources in the systems have their own set of rules, which are typically far more advanced to what a small business can afford.

Among the disadvantages are the following:

- The transition to cloud solutions is quite difficult and requires attention because when choosing such a solution, enterprises want to move everything to the cloud problems with this transition begin to arise: partial loss of data, loss of processing functions, and long and careful planning of the migration process;

- Training employees to work with the new system will require time and money, and although this is one of the cheaper solutions, it is not free.

SaaS or software as a service or software lease is another approach to system implementation. This strategy requires the system to be implemented as a service that small businesses will pay for. Rather than buying the complete software product or any of its components, specific features or the system will be purchased for a predetermined amount of time, during which the business will be able to utilize the system to its maximum scale as per the terms of service, get the most recent updates, and concentrate on other important aspects of the business.

Among the main advantages of the approach:

- Because renting a system or its components is generally affordable, companies may pay for just a portion of the system they use

or for a set length of time without having to make big initial financial expenditures;

- By partially paying for the system, the use of solutions based on this approach allows companies to scale if necessary by switching between tariffs and services received at any time without almost any other changes;

- With the SaaS model, nearly all technical issues and malfunctions are handled by the service provider, who typically offers all the assistance required for any issue related to their product;

- SaaS are easy to learn, as they provide detailed instructions on how to operate and do not require significant customization.

Among the disadvantages are the following:

- Most SaaS are off-the-box solutions, so they are sometimes limited in their ability to be customized to meet specific enterprise needs;

- This approach's modularity frequently prevents companies from accessing specific components or features without having to pay for the tariff plan that includes them.

The uniqueness of this method originates from the fact that, while «modularity» is a negative aspect, depending on the number and distribution of these modules, certain systems allow the creation of a plan that is most beneficial to a small business. Innovative SaaS services utilize a variety of analytics methods, including machine learning and artificial intelligence, to automate the majority of regular activities. This method allows firms to constantly adjust their information control systems without costly disruptions or re-implementation, while also providing integration with other critical business tools.

One of the approaches that has gained popularity is the concept of mobile-oriented solutions. This approach is focused on portable devices such as smartphones, tablets, and laptops, ensuring accessibility, efficiency, and convenience of business processes on these devices. This approach is also driven by the dependence on portable devices in both personal and professional settings.

Among the main advantages of the approach:

- Small businesses often have problems with physical infrastructure, which makes any investment in their hardware very expensive, so the mobile-first approach is often based on cloud-based solutions to ensure accessibility from any device with Internet access;

- A mobile-first approach is used to implement solutions that can provide easy access to important information, ensure uninterrupted communication, and simplify routine tasks. This also includes multi-platform solutions for such systems that are not limited to laptops or tablets;

- Multi-factor authentication, secure data transfer protocols, and remote wipe capabilities in case of device loss or theft help protect confidential business information.

Among the disadvantages are the following:

- The main problem with a mobile approach is the capability of the device from which the system is accessed. The capabilities and size of the screen and hardware may make a significant difference in the efficiency of usage on a smartphone, tablet, and laptop;

- Small interfaces in this approach typically place extra limits on the interface while developing the system, which might cause challenges when using and displaying system data.

Being innovative in implementing information control systems with a mobile-first approach can revolutionize the way small businesses work and operate, thanks to the ability to use the system on any device and adapt it to specific needs.

A centralized approach involves gathering data through integration and automation. The technique is not new in IT, but it enables diverse systems, storage, and technologies to be brought together. Integration tools, such as application programming interfaces, guarantee that data flows smoothly across multiple software programs, minimizing duplicate entries and decreasing human error, whilst automation eliminates all or part of time-consuming and repetitive operations.

Among the main advantages of the approach:

- Data centralization helps to ensure data integrity by eliminating inconsistencies that can arise from storing data in multiple locations, which provides opportunities to identify and correct errors;

- A centralized approach allows for efficient resource allocation and eliminates unnecessary duplication, freeing up space and optimizing data processing time;

- Centralization of data provides better security control and monitoring by working with a single source of data.

Among the disadvantages are the following:

- The centralized approach involves significant financial investments in the development and implementation of the system, including hardware, training, etc;

- Centralized systems may require significant changes to business processes and staff, which can lead to complex and time-consuming development and implementation plans;

- A centralized system may stop the functioning of a company in the case of issues, but it also becomes a potentially tempting target for attackers since it stores all information in one location.

Conclusions

Business intelligence information control systems are important tools for small businesses, providing functionality for analyzing and interpreting data to make informed decisions supported by data. However, small businesses often face many challenges and have specific needs when it comes to implementing such systems.

One of the common problems for small businesses is limited resources, both in terms of finance and technical and human resources. It is often impossible or extremely difficult for small businesses to allocate funds towards an IT solution or to hire qualified staff, to create or implement such systems, and then to maintain and adapt them. Another problem is the experience of operation and implementation, which is often lacking, so small businesses face excessive costs due to staff training, solving problems with integration with existing systems, and introducing an information culture of doing business. Therefore, as a solution, small businesses need to prioritize and focus on key items: during implementation, gradually investing only in the necessary parts of the systems, abandoning the currently ineffective ones, thinking over and creating appropriate staff training plans for working with innovations, develop an effective change management strategy to engage employees and increase the acceptance of the implemented system.

In terms of requirements, small businesses typically need systems that are affordable, accessible, easy to implement and use, require minimal maintenance, and offer gradual scalability as the enterprise grows. It is worth mentioning that, in addition to the fundamental requirements, system flexibility will be a significant advantage, easing the development and usage process.

When considering the factors that influence the choice of business intelligence management systems, organizational requirements, scalability, integration capabilities, data processing, and analytical capabilities are important, and they are especially important for small enterprises since they help them to determine whether a certain system is a good option and whether it can be used within their constraints.

To analyze data effectively, different systems support or offer different categories of analytics methods for small businesses. Descriptive methods allow businesses to understand situations that have already occurred without the need for specialized knowledge or experience. Diagnostic methods provide an understanding of why certain situations occurred that led to the current state of the enterprise, allowing you to obtain the factors that influenced the activity. The

predictive category of methods will allow you to predict future trends, market behavior, customers, and the success of small business ideas, and prescriptive analytics will allow you to choose the best results and achieve them. It can be said that even the simplest systems can significantly increase the efficiency of small businesses and provide a comprehensive understanding in all aspects: from making simple decisions and conducting business to building long-term strategies and implementing innovative ideas, while more advanced solutions will allow you to understand the whole picture of events in detail.

When designing and implementing such systems, one or more approaches can be used, as each approach realizes certain advantages and has its drawbacks, using several of them at once can lead to comprehensive and reliable solutions, but at the same time can significantly complicate these processes. The cloud approach is particularly well suited to many other approaches, providing the basis for many systems that may not be able to purchase their own hardware and computing resources. SaaS makes it possible to differentiate one complex information control system into several components or modules, providing more attractive opportunities for small businesses due to the lower cost and the ability to select individual parts. The mobile-oriented approach will allow the system to be used on different devices, although it has limitations due to the performance of these devices. At the same time, a centralized approach will create a single system for the entire enterprise.

References

1. Power, D.J., Heavin, C., McDermott, J., & Daly, M. (2018). Defining business analytics: An empirical approach. *Journal of Business Analytics*, 1(1), 40–53.
2. Dmitrishin B., & Borovoy M. (2020). Business analytics and its role in managing the competitiveness of the enterprise. *Central Ukrainian Scientific Bulletin*. [https://economics.kntu.kr.ua/pdf/5\(38\)/24.pdf](https://economics.kntu.kr.ua/pdf/5(38)/24.pdf).
3. Rashydivna D.A. (2012). Application of theories of cyclicity and competitive advantages for forecasting directions of innovative development. *Marketing and Management of Innovations*, 4, 270–279.
4. Guseva, O., & Legominova, S. (2018). Digitalization as a tool for improving business processes and their optimization. *Economics. Management. Business*, 1, 33–37.
5. Luchyk S.D., Selezneva O.M., Borovyk T.M., Ursakiy Y.A., Woodward V.V., Palamarek K.V., Ryleev S.V., Kovalevych D.A., Chornovol A.O., Moshkovska O.A., Mustets I.V., Chubai V.M., Stolyar L.G., Luchyk V.E., Romanovska O.L., Danilyuk I.P., Bagriy K.L. & Godnyuk I.V.

(2021). *Problems and Prospects of Small and Medium-Sized Business Development: Monograph*, 20–31.

6. Vyhanyailo S.M. & Viunenko O.B. (2021). Trends in the development of information technologies in business analysis. *Informatics, Computer Science, and Automation*, 51–55.

7. Guida O. & Shinger N. (2015). Information and management systems. *Collection of Abstracts of the VIII All-Ukrainian Student Scientific and Technical Conference «Natural Sciences and Humanities. Topical Issues»*, 1, 73.

8. Saiensus, M., & Karnaukhova, A. (2017). Aspects of implementation of information technologies in small businesses. *Scientific Economic Journal «Intellect XXI»*, 2, 267–272.

9. Tigareva V.A., & Stankevich I.V. (2016). Analysis of existing approaches and methods for evaluating business processes of enterprises and organizations. *Bulletin of the KrNU Named After M. Ostrogradsky. Management, Marketing, and Personnel Management*, 1(3), 114–122.

10. Business tools. (2023). *Gartner*. <https://www.gartner.com/en/documents/8241192>.

11. Magic quadrant for analytics and business intelligence platforms. (2023). *Gartner*. <https://www.gartner.com/en/documents/4247699>.

12. Opakku E. (2023). Descriptive analytics: Meaning, examples & steps, simplified!!! (2023). *Business Yield*. <https://businessyield.com/business-planning/descriptive-analytics/>

13. Davenport, T., Guha, A., Grewal, D., & Bressgott, T. (2019). How artificial intelligence will change the future of marketing. *Journal of the Academy of Marketing Science*, 48(1), 24–42.

14. Bhatt, D., Naqvi, S., Gunasekaran, A., & Dutta, V. (2023). Prescriptive analytics applications in sustainable operations research: Conceptual framework and future research challenges. *Annals of Operations Research*.

15. Holliday, M. (2021). What is diagnostic analytics? How it works and examples. *Oracle NetSuite*. <https://www.netsuite.com/portal/resource/articles/data-warehouse/diagnostic-analytics.shtml>

16. Ode, E., & Ayavoo, R. (2020). The mediating role of knowledge application in the relationship between knowledge management practices and firm innovation. *Journal of Innovation & Knowledge*, 5(3), 210–218.