USE OF BIG DATA ANALYTICS FOR SMALL AND MEDIUM SIZED BUSINESSES

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Abstract

Small and medium sized business has an important place in the economy of all countries. In modern conditions of Industry 4.0 development, the introduction of big data analytics into the performance of small and medium-sized businesses can become the basis for sustainability growth of their functioning and their competitive advantages' development. However, the use of Big Data technology is not typical for small and medium enterprises. At the same time, the issues of big data analytics use by small and medium-sized businesses in the context of their resource and infrastructure constraints are poorly studied. The purpose of this article is to develop a conceptual model for the implementation of big data analytics in the activities of small and medium-sized businesses, taking into account their digitalization problems. The study was made on the basis of the Russian economy data. The analysis of the issues of big data analytics' use for small and medium-sized businesses was based on the methodology of system analysis with the identification of object, environment and project-process development subsystems. The novelty of research consists in the fact that the development model of the structure of big data use was carried out in accordance with the content of the main tasks that must be solved within data management life cycle. The results of the study showed that the main issues of the introduction of big data analytics in the activities of small and medium-sized businesses are associated with a lack of understanding of its benefits by entrepreneurs. Also significant problems are the lack of financial resources and the lack of qualified employees capable of strategic administration of these processes. Given these problems, the authors conclude that the model for use of big data analytics by small and medium-sized businesses should be based

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on the use of cloud software and analysis of projects with open source big data. The article suggests the structure of the model for big data use by small and medium-sized businesses. This paper contributes to the development of ideas about the directions of digitalization of small and medium-sized businesses in order to increase the sustainability of this economic sector in the context of Industry 4.0. Further research by the authors is connected with effectiveness evaluation of mechanisms and tools of government support made for digital business transformations.

1. INTRODUCTION

As the information society is emerging, digital technologies are becoming an inseparable component of business development, and big data analytics is becoming increasingly important as a new technology for creating business value (Oesterreich et al., 2022a). Big data-driven decision making is strength for many companies: identification of trends and patterns allows them to adjust quickly business models and make business decisions that increase their competitive position in the market. Big data is viewed by researchers as an asset for long-term strategic competitive advantage (Côrte-Real et al., 2017; Olabode et al., 2022; Shah, 2022), as an effective technology for hidden opportunities revealing and value creation (Del Vecchio et al., 2017). Big data analytics improve efficiency by minimizing risk and enhancing collaboration with stakeholders (Behl et al., 2022).

The value of big data for business is expressed in the efficiency growth of the firm, improvement of its business processes and the quality of customer service, as well as in the ability growth to innovate products and services (Grover et al., 2018). However, while large companies are actively using big data to create business value, small and medium-sized enterprises are much slower in adopting new digital technologies, risking

falling far behind the competitors. At the same time, it is not entirely clear what problems are restrain the use of big data for small and medium-sized companies and how they can be solved.

Small and medium-sized enterprises are an important part of the economy of each country, therefore, support of the processes of modern digital tools use to accelerate business growth is a relevant factor in the sustainability growth of the economic development in the context of Industry 4.0. The purpose of this study is to develop a conceptual model for the use of big data analytics in the operation of small and medium-sized businesses, taking into account their digitalization problems. The central issues of this study are as follows. How is the level of digitalization of small and medium-sized businesses in Russia characterized and to what extent does it correspond to global trends? What are the issues and challenges of digitalization of business processes for small and medium-sized businesses in Russia? What are the opportunities of solution of the issues under analysis? The novelty of the study consists in the development of a model for big data use in the activity of small and medium-sized businesses within tasks under analysis at certain stages of the life cycle of data management, while most of the papers studying the opportunitites of big data analytics use in the performance of small and

medium-sized businesses focus on technical aspects of digital technologies use without paying attention to the organizational and managerial constituent of the issue.

The structure of this study is presented as follows. In the first part, an overview of scientific sources on the issues of big data use in the performance of companies is presented for a better understanding of the subject field of the study. In the second part, we describe the chosen research methodology. The third part contains the results of the study that reveals the problems of big data analytics use in the practice of Russian small and medium-sized businesses, as well as the possibilities of their solution based on the developed model. In the end, the conclusion are drawn on the results of the study, as well as on their practical significance and limitations.

2. LITERATURE REVIEW

Most of the studies on the use of big data analytics by businesses is focused on its value and the conditions under which that value is generated. Some studies show that the use of big data analytics in decision making has a positive impact on firm performance (Brynjolfsson & McElheran, 2016). Other studies show that the role of big data analytics in creating business value is not so obvious (Božič, K., & Dimovski, V., 2019; Ghasemaghaei & Calic, 2020). Thus, in the study by Maroufkhani et al. (2023) it is indicated that digital transformations can significantly limit the possibilities of internationalization of companies due to the emergence of new security risks, influence of cultural factors, etc.

Controversial research findings on whether the use of big data analytics can provide competitive business advantage may be due to the fact that companies often challenge themselves to process all available data. As Mitrovic (2017) specifies, such an approach is not likely to bring the expected benefits to business. The accumulated big data will only increase the value of the business when it is segmented into blocks that allow solving specific problems of economic analysis.

Therefore, in recent years, research in the field of big data focuses on certain areas of their use, and also analyses the key elements of business analysis that are necessary to generate business value. At the same time, most of the studies is focused on technical aspects of technology use: data transfer rate (McAfee et al., 2012); diversity and structural heterogeneity of data (Gandomi & Haider, 2015); data volume, etc. Some researchers also pay attention to factors characterizing the industry (Zhu et al., 2021; Mitrofanova & Ivanova, 2022). For example, Ngo et al. (2020) analyze the possibilities of using predictive analytics in the work of enterprises in the construction industry. Wei and Qingna (2021) show a factor model for the development of cultural industry based on the use of big data technology. Al-Dmour et al. (2023) study the factors which determine the effectiveness of the use of big data analytics applications in banking.

In recent years, there have been more and more publications devoted to social aspects of introduction of a business intelligence system connected with human resources and the availability of necessary expertise to work with big data. In this regard, it can be noted that the biggest problem in the digital business transformation is that the company's management believes that the acquisition and installation of certain software is sufficient for digital business

transformation (Popova et al., 2022; Rejman Petrovic et al., 2022). At the same time, practically no attention is paid to the issues of provision of necessary conditions that ensure the opportunitiy of their effective use. Evidence of how managerial abilities and organizational culture influence the ability to create business value using business intelligence is presented in the papers of Oesterreich et al. (2022b) and Feliciano-Cestero et al., (2023). Studies of the influence of the human factor on the possibilities of big data analysis are reflected in the papers of Jaouadi (2022).

At the same time, there are considerably fewer studies exploring the possibilities of use of big data analytics in the work of small and medium-sized businesses. They are mainly devoted to areas' identification for use of big data analytics, as well as the identification of effects that arise from this.

For example, a study by Maroufkhani et al. (2020) shows the strongest impact of introduction of big data analytics in marketing and finance. Oubrahim et al. (2023) analyse the impact of big data technology use on the overall efficiency and sustainability of the supply chain. The opportunities of use of big data analytics in the industry of photo services for small and medium-sized businesses and its impact on the competitiveness of the company are presented in the paper of Medvedeva et al. (2022). The reasons that hinder the use of big data by small and medium-sized businesses, as well as the identification of ways to their elimination, are not paid sufficient attention.

In a systematic way, the main directions of research in the field of the use of big data analytics by business are presented in Table 1.

In general, the review of literature shows

Table 1. Directions of research in the field of business use of big data analytics

Area of research	Research methods and methodology	Main results	Scientists
Value of big data analytics for business	Correlative Empirical Research; content analysis	Understanding the role of big data analytics in creating business value. Determining the factors and conditions under which this value is formed.	Brynjolfsson & McElheran (2016) Ghasemaghaei & Calic (2020) Maroufkhani et al. (2020) Mitrovic (2017)
Directions for big data analytics use in business	Content analysis, descriptive statistics, predictive analytics methods	Study of the possibility of big data analytics' use in various industries and areas, as well as in various functional areas of business. Evaluation of the resulting effects.	Zhu et al. (2021) Oubrahim et al. (2023) Maroufkhani et al. (2020) Oubrahim et al. (2023) Zhu et al. (2021)
Social aspects of implementation of big data analytics in business	Meta-analysis of empirical data, descriptive statistics	Justification of the role of managerial abilities and organizational culture on the prospects of business value creation of use of big data analytics. Determination of employee competencies necessary for the effective use of big data analytics.	Feliciano-Cestero et al. (2023) Rejman-Petrovic et al. (2021) Oesterreich et al. (2022a).

that there are no papers devoted to the analysis of big data analytics in the operation of small and medium-sized businesses which would have the structure of this article.

3. RESEARCH METHODOLOGY

To solve the research issues, the authors used the following methodology. To analyze the level of digitalization of small and medium-sized businesses in Russia, we used data provided by the Federal State Statistics Service of Russia, which provides official information on the social, economic, environmental and demographic situation of the country. The authors also used the statistical collections "Indicators of Digital Economy" and "Digital Economy", made by the Russian Research University "Higher School of Economics" together with the Ministry of Digital Development, Communications and Mass Media of the Russian Federation. Descriptive analysis was used to analyse the data.

When identifying the problems of big data analytics' use in performance of small and medium-sized businesses, we used the methodology of system analysis suggested by Kleiner et al. (2022), according to which we focused on the characteristics of the object, environment and project-process development subsystems. We proceeded from the understanding that the object subsystem is determined by the elements that provide the possibility of using big data technology, determined by the availability of material and technical resources, as well as the financial possibilities of acquiring these resources. The environment subsystem is determined by the infrastructural characteristics of external and internal environment of the enterprise in terms of the possibility of big data technology introduction, solution of the problems of information security. The design and process subsystem is determined by the level of development of organizational and managerial mechanisms that contribute to the use of big data analytics at the enterprise.

In order to provide a comprehensive overview of the most significant issues and challenges in the use of big data analytics by business, the authors used content analysis of papers in this research area.

When describing the structure of the model for the use of big data analytics by small and medium-sized businesses, we proceeded from the content of the main tasks that need to be solved within the data management life cycle. When describing the parts of the model, the authors used considerations of the feasibility of cloud services use and open source projects, taking into account resource and infrastructure constraints for small businesses. This study included the following sequential steps (Figure 1).

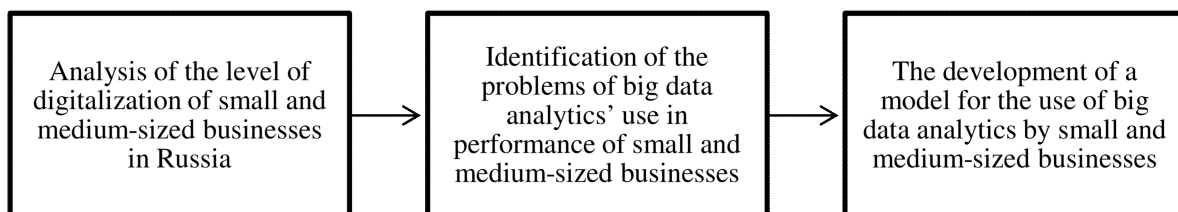At the first stage, we analyzed the level of digitalization of small and medium-sized

Figure 1. Stages of research problem solution

businesses in Russia in order to identify the opportunities for the use of big data technology. At the second stage, we identified the main problems of big data analytics' use in performance of small and medium-sized businesses. The next stage of the study was the development of a model for the use of big data analytics by small and medium-sized businesses, which were generated taking into account the problems mentioned above. In the end, the authors draw conclusions about the prospects for big data analytics use in performance of small and medium-sized businesses and the limitations of this study.

4. RESULTS AND DISCUSSION

4.1. Analysis of digitalization level of small and medium-sized businesses in Russia

The requirements of objective reality determine the introduction of digital technologies in the performance of businesses. Currently, researchers mention cloud services, RFID technologies, ERP systems, Internet of things, e-commerce, etc. as the basic digital technologies that contribute to the growth of business competitiveness (Novoseltseva & Rasskazova, 2020). Digitalization today is a natural process for companies aimed at development. However, small and medium-sized businesses in Russia lay significantly behind global trends in the digitalization.

The involvement of small and medium-sized businesses in digitalization processes is most often analyzed in terms of ICT use in business models.

The results of a study of the level of business digitalization in Russia, conducted in 2021 by Otkritie Bank together with Moscow School of Management Skolkovo and NAFI Research Center, show an overall increase in the business digitalization index (Figure 2). In 2020, compared to the
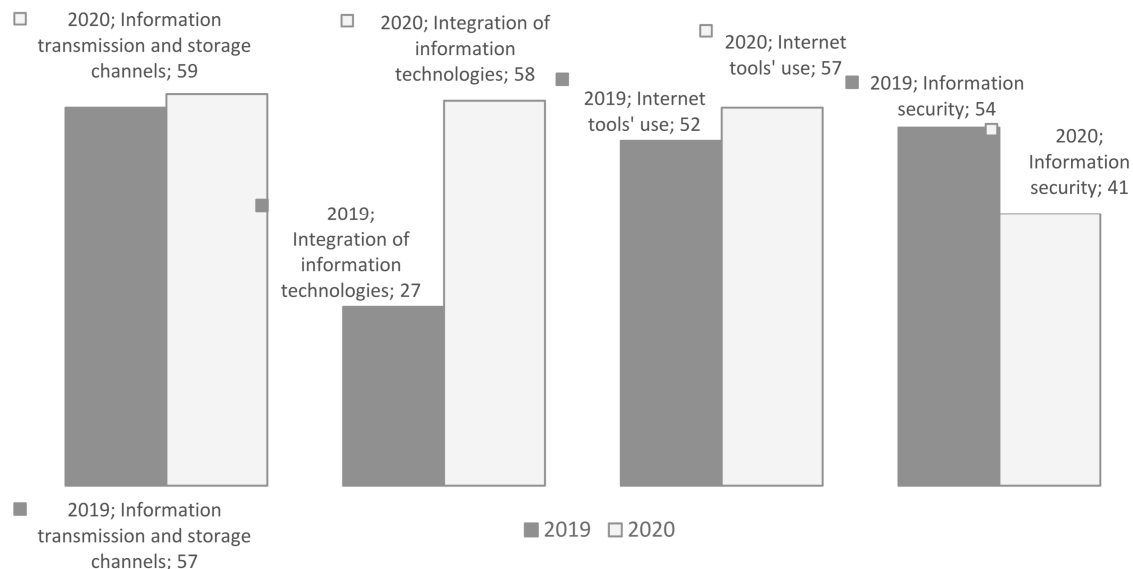

2020; Information transmission and storage channels; 59

2020; Integration of information technologies; 58

2020; Internet tools' use; 57

2019; Internet tools' use; 52

2019; Information security; 54

2020; Information security; 41

2019; Integration of information technologies; 27

2019; Information transmission and storage channels; 57

■ 2019 □ 2020

Figure 2. Indices of digitalization of small and medium-sized businesses in Russia on a scale from 0 to 100 (Business digitalization index, 2021)

previous year, the number of companies with a low level of digitalization decreased by almost 2 times, which is largely due to the response to the challenges of the coronavirus pandemic and the need to adapt business to new economic realities (Mitrofanova et al., 2022; Turgel et al., 2022).

In 2021, about 70% of small and medium-sized businesses in Russia assessed their level of digitalization as an average one; 18–21% as a high one and 8–13% as a low one. The share of companies using cloud solutions and storage increased to 63% (from 52% in 2020); online systems for organizing teamwork increased up to 24% (from 15% in 2020); corporate messengers grew up to 39% (from 24% in 2020); technologies based on machine learning increased up to 17% (from 8% in 2020). In 2021, the share of companies that have full-fledged corporate websites and promote their business on social networks has grown (70%), as well as the share of companies that prefer a hybrid document flow (57%).

At the same time, with the growth of the overall level of digitalization of Russian businesses, the use of Big Data technology is a rarity for small and medium-sized enterprises. Only 11% of the enterprises used big data services in 2021 (versus 5% in 2020). Even among large companies in Russia, only 20% use Big Data, 36% have pilot projects, and 27% are not interested in this technology at all. At the same time, the main consumers of big data technology in Russia are banks, mobile phone company and large retailers (Zav'yalova & Vylegzhanina, 2020). Also, big data technologies are gradually being used in management systems of integrated water resources management systems for digital modeling of ecosystems of various water bodies.

For comparison, in world practice, business intelligence tools and big data technologies are used by about 46% of small enterprises and more than 55% of large companies (Financesonline, 2022). At the same time, there are significant differences in the level of big data use in various sectors of the economy. For example, in retail, 62% of small business merchants use big data analytics (Small Business Gets Big.., 2022). In the Russian practice of the industries where big data analytics is most in demand are finance, telecommunications and retail. At the same time, in recent years, there has been a gradual increase in demand from the industrial sector of the economy for business intelligence tools.

Big Data Analytics' Challenges for small and medium sized businesses. The digitalization of business processes opens up new opportunities and prospects for competitiveness growth for small and medium-sized businesses. Along with this, new issues and challenges arise which are associated with the use of digital technologies, and it can be represented in the context of individual development subsystems.

Issues of the object of development subsystem. The main challenges of big data analytics' use in the activities of small and medium-sized businesses are connected with the fact that there are significant financial barriers to their use. The high cost of the necessary IT infrastructure makes the entry threshold for small and medium-sized businesses into big data analytics very high. This encourages governments to start special business support programs. For example, in Russia, within the federal project "Digital Technologies" of the national program "Digital Economy of the Russian Federation", small and medium-sized

businesses with an annual income of up to 2 billion rubles and the number of employees less 250 people may be given the opportunity to purchase SaaS solutions from Russian developers at a 50% discount (Mitrofanova et al., 2020; RFDIT, 2022). In addition, given that small companies do not need big data analytics all the time, but periodically, to solve this problem for working with Big Data, Vimpelcom, Yandex, and others offer to rent servers (your own server costs 1.5–2 million rubles, services in the cloud make up 100–200 thousand rubles).

However, the solution of this problem is complicated by the high level of digital inequality in the Russian regions. So, if in the central part of Russia the connection and use of the Internet costs about 5 thousand rubles per month, then in Kamchatka Krai and Yakutia Republic the cost of the Internet with a connection in the first month is 64 thousand rubles and subsequent months makes about 30 thousand rubles (Shuvalova, 2021).

Issues of environmental development subsystem. From the point of view of the readiness of the environment subsystem for the use of big data technologies by small and medium-sized businesses, an important issue is the underdevelopment of the outsourcing, management consulting and business analytical services.

Most of the consulting services used by SMEs are used at the operation, for example, they are used in accounting. The services provided by large consulting companies do not meet the needs and financial opportunities of small and medium-sized businesses, while the study by Moonen et al. (2019) demonstrates that small and medium businesses should outsource and consult in those areas of big data analytics where their knowledge and resources are limited.

Another problem of the environment development subsystem for the use of big data in the operation of small and medium-sized businesses is the underdevelopment of the market for the corresponding software. Despite the fact that big data analytics companies have been actively targeting small and medium-sized businesses in recent years, the solutions they offer are either potentially useful, but very complex and require a lot of experience, or very simple and inefficient.

An equally significant issue for small and medium-sized businesses (even in countries with high information security) is data security. Microsoft Windows Server 2003, the main platform used by small and medium businesses around the world, is very vulnerable to intrusions and Internet attacks, since Microsoft stopped regular support for this software back in mid-2015. In the UK in 2020, 33% of small businesses reported experiencing cyberattacks at least once a week, according to research by Hiscox (2022). At the same time, enterprises require a high level of data protection and confidentiality. If we focus on the current data protection rules in the EU (Council of Europe 2014), then we should notice their complexity and difficulty of understanding for non-professionals. In addition, many small and medium-sized firms are unable to pay the costs required to maintain all security regulations.

Issues of the design and process development subsystem. The most important issue of big data analytics use in the operation of small and medium-sized businesses is the underdevelopment of the project-process development subsystem in the enterprise, which is expressed in the lack of understanding by management of the benefits and opportunities of business

analytics. Thus, an analysis of the demand for digital technologies conducted by IDC together with Hitachi Vantara shows that Russian entrepreneurs believe that big data technologies are the most effective for banking and marketing. 23.5% say that the use of big data is unlikely to change anything in the company's activities, but a new high profile department will appear. 68% believe that the need for big data analytics is determined by the size of the company [HABR, 2020]. SMBs often feel that big data is of little interest because it is locally focused and they don't need to know the characteristics of the market in other regions.

The lack of understanding of the value of big data for business leads to the situation when in the organizational hierarchy of small and medium-sized businesses there is often no function of strategic administration. Accordingly, the management of these companies is not able to identify new business trends. Moreover, workers in SMEs typically lack the competencies required to process advanced big data analytics. Moreover, workers in SMEs typically lack the competencies required to process advanced big data analytics. Even with the right software, employees are unable to interpret the data in a quality manner, and there is a growing shortage of qualified data analysts in the labor market. Despite the fact that work with big data ranks first in the list of professions, the number of people employed in the field of ICT in Russia in 2020 was 2.5% of the total number of employed people (Abdrakhmanova et al., 2022). For comparison, in Germany this figure makes up 4.9%, in Finland it is 7.6%.

L. Sanochkin, a researcher from AIRI (Artificial Intelligence Research Institute), the largest organization in Russia engaged in developments in artificial intelligence, notice that the following skills are needed to work with big data (Table 2).

Compared to large businesses, the requirements for big data skills for SMEs will be higher. This is due to the fact that in large firms, individual skills in big data analytics use can be divided among specialists. Small and medium-sized businesses require a diverse work experience and the presence of all skills. However, as the previously mentioned study conducted by Otkritie Bank together with Moscow School of Management Skolkovo and NAFI analytical center showed, only 12% of entrepreneurs find it necessary to train all company employees in digital skills. At the same time, 90% say that they would not like to invest in this activity, believing that this is the task of the government and development institutions. The share of companies that did not conduct trainings for their employees in the use of digital technologies was 75%.

However, despite the fact that experts believe that the economic segment of small and medium-sized businesses in Russia is ready for digital transformation, many entrepreneurs do not understand the benefits

Table 2. Hard and soft skills for working with big data (Skillfactory, 2022)

Hard expertise	Soft expertise
-fundamental mathematical training	-translation from the language of business into the language of mathematical modeling
-programming	
-knowledge of machine learning models and algorithms	-teamwork
-database services	-knowledge of English
-understanding how Deep Learning works	

of big data analytics use in their performance. Digitalization, first of all, is understood by them as a transfer to the online format of the processes associated with sales and communication. At the same time, the main reasons hindering the use of analytical tools in their operation are the lack of financial resources and the lack of qualified employees capable of strategic administration of these processes (Ugryumova et al., 2022).

4.2. Big Data Analytics' Usage Pattern for small and medium sized businesses

To understand the basic structure of the big data usage model, we will start with the main tasks that need to be solved as part of the data management life cycle. The characteristics of the tasks at the main stages of the data management life cycle are presented in Table 3.

According to the tasks under analysis, the structure of the big data usage pattern should include the following elements: management security; hardware and network infrastructure; data integration, including blocks of data storage, analysis, processing and visualization.

The use of big data should be carried out within established security standards and provide opportunities to improve the quality of management and coordination of work, as well as productivity growth of employees

based on effective resource and workload planning. The hardware and network infrastructure is presented by devices that meet the basic requirements for computing power and memory used by ICT. Data integration is a technology that supports the processes of storing, processing, analyzing and visualizing data.

Block "Data storage", in turn, includes two components. The first is file systems, which divide and distribute files into specific blocks and provide storage, error handling, scalability, reliability, and availability. For example, the Google file system and the Hadoop distributed file system. The second component, databases, provides high-performance access and querying of data in heterogeneous formats. The mainstream technology for big data warehousing today is NoSQL databases, which have flexible modes, simple and easy copy support, simple APIs, and maximum consistency and support for large amounts of data.

The Data Processing block requires the use of special methods that ensure the interactivity and continuity of this process in real time. A typical example of software at this level is MapReduce 46, a simple and powerful programming model that allows parallel and distributed processing of large datasets in a distributed environment.

The Data Analysis block includes analytical tools and libraries that support the processes of description, forecasting,

Table 3. Data management tasks at different stages of the life cycle

Life cycle stage	Task characteristics
Data collection	Need for rapid data collection
Data processing and storage	Organization of data presented in different formats with different access protocols. Definition of communication relationships between data.
Data analysis	Construction of query mechanisms and data search algorithms that can work with unstructured heterogeneous data that have complex relationships with each other
Data usage	Ability to test quickly the hypotheses and present the results of the analysis in a form that is easy to interpret

statistical analysis, and machine learning. Analysis tools can range from declarative languages (like SQL) to procedural languages (like Pig). In addition, this block includes libraries and systems that support operations with external resources for the most popular data mining and machine learning libraries (R, MATLAB, Mahout and MLLib).

The Data Visualization block provides results in a form that is easy to interpret. Obviously, the presented model of big data use is quite complex from financial and managerial points of view. However, it can be adjusted to the environment of small and medium-sized businesses through the use of cloud software and open source big data analytics projects.

As you know, cloud services are an economical way to create a data infrastructure, and the modern market offers many solutions in this area. The leaders in providing cloud infrastructure services are Amazon Web Services, Microsoft Azure and Google Cloud DataLab. The main features of cloud services for small and medium businesses are presented in Table 4.

Open source projects are free software that users can improve by adding functionality or fixing bugs. In addition, as an open source software developer, an entrepreneur gets the opportunity to use a quality infrastructure to launch their projects. Possible open source projects that can be used to work with big data include the following:

-platforms and tools for big data analysis – Hadoop;

-databases – PostgreSQL, MySQL, MSSQL, InterBase;

-business intelligence tools - BIRT, ClicData, Jedox, Tableau Public, MapReduce;

-data mining tools - Apache Mahout, DataMelt, ELKI, Knime;

big data file systems and programming languages - Gluster, Hadoop Distributed File System, Pig, ECL, Hive;

-security and resource management – Yarn, Gulp, Volo.

The model suggested by the authors for the use of big data analytics by small and medium-sized businesses may look as follows (Figure 3).

Although the use of cloud services and open source projects can solve the problems of introduction of big data analytics in the operation of small and medium-sized businesses, the following potential issues should be taken into consideration.

First, it is the provision of the security of data which is located in external storage systems. From a technical point of view, it is possible to implement mixed solutions by means of use of encryption and anonymity. However, these solutions may not always be used. Secondly, these are issues of choosing analytical products in accordance with the

Table 4. Opportunities of cloud services for small and medium sized business

Services	Provided opportunities	Advantages
Software Services	Access to software hosted on third party servers	Reduced software ownership and maintenance costs
Platform Services	Creation of an environment in which the operating system, server hardware and network infrastructure are managed by the service provider	The user controls only the functions that are of interest for them
Infrastructure Services	Provision of a highly automated and highly scalable pool of computing resources complemented by cloud storage and networking capabilities	The user does not buy the equipment but purchases the service it provides

level of digital maturity of the company, the existing skills of its employees. Of course, the choice of specific products should be determined by these factors. Third, it is balancing the cost and performance of big data analytics use. The high functionality of digital products implies significant costs for their installation and maintenance. With a limited company budget, choosing the most appropriate product configuration is very complicated. This difficulty can only be solved by attracting qualified specialists.

Thus, the problem of introduction of big data analytics into the activities of small and medium-sized businesses is complicated, diverse and covers various technological, infrastructural, organizational, managerial and other aspects. Despite the fact that the introduction of big data analytics involves, first of all, engineering, technical and technological solutions, as the results of the study show, the need for state support for the digitalization of small and medium-sized businesses is also obvious. It seems that the implementation of regional projects "Digital Technologies" within national project "Digital Economy of the Russian Federation" can be the first step for businesses in the projects for the implementation of big data analytics.

The theoretical significance of the study is expressed in combination of the concept of open innovation and the opportunities of big data analytics to obtain additional advantages for digital business development. Along with this, the authors' findings provide some managerial implications. Companies should ensure a balance between the object, environment and project-process subsystems of digital development. At the same time, in the context of existing resource and infrastructure constraints, one should focus on the use of cloud services and open source programs. The practical significance consists in the use of the suggested recommendations to develop an organizational and managerial mechanism for digital transformations of small and medium-sized businesses by the state.

5. CONCLUSIONS

In this article, the authors determined that, despite the general increase in the level of digitalization of small and medium-sized
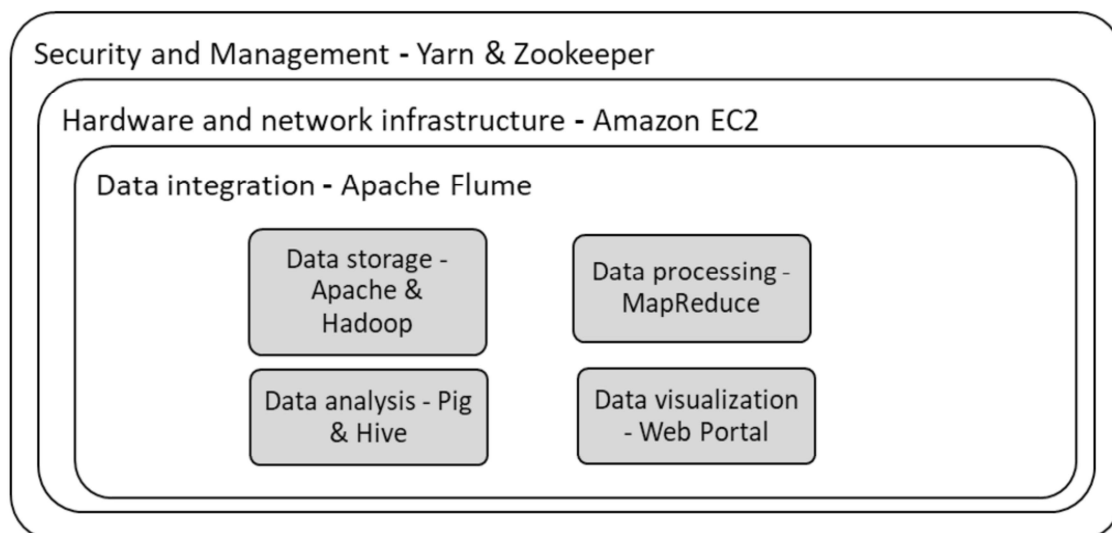

Figure 3. Model structure for the use of big data by small and medium-sized businesses

businesses in Russia, in terms of the use of big data analytics, it lags far behind global trends. The use of Big Data technology is rare for small and medium enterprises. It is most in demand in the financial sector, telecommunications and retail, but in recent years there has been an increase in demand for business intelligence tools from industrial enterprises. The authors came to the conclusion that the main issues and challenges of digitalization of business processes in Russian business are connected with a number of systemic problems covering various aspects: management models, technological and infrastructure factors, underdevelopment of the big data market, lack of financial resources, etc.

Despite the fact that in recent years scientists and practitioners have significantly increased the attention of scientists and practitioners to the possibilities of use of big data analytics by small and medium-sized businesses, most researchers focus on technological aspects of value creation, as well as on the role of the human factor in the solution of problems of effective big data use. In contrast to these studies, the authors of this article focused on the organizational and managerial component of the problem of use of business intelligence systems by small and medium-sized businesses and developed its model based on the use of cloud technologies and open source programs.

The authors are aware that the conclusions were drawn on the analysis of the situation that developed in the Russian economy regarding the possibilities of big data analytics use in the operation of small and medium-sized businesses. It can be assumed that similar problems exist in other emerging economies, but further research is needed to confirm this conclusion and this is the limitation of the study.

The study revealed an obvious need to develop mechanisms for state support of business digitalization processes. The authors believe that it is important to take into account the existing significant digital divide in the development of individual Russian regions; this aspect of the problem will be developed in following studies of the authors. In particular, the authors intend to study the role of the national project "Digital Economy of the Russian Federation" and the regional projects helping to realize it in the regions of the Russian Federation in solution of the problems of economic security improvement in the regions.

Acknowledgments

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УПОТРЕБА АНАЛИТИКЕ ВЕЛИКИХ ПОДАТАКА У МАЛИМ И СРЕДЊИМ ПРЕДУЗЕЋИМА

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Извод

Мала и средња предузећа заузимају значајно место у привреди свих земаља. У савременим условима развоја индустрије 4.0, увођење аналитике великих података у перформансе малих и средњих предузећа може постати основа за одрживи раст њиховог функционисања и развој њихових конкурентских предности. Међутим, употреба Биг Дата технологије није типична за мала и средња предузећа. Истовремено, питања аналитике великих података коју користе мала и средња предузећа у контексту њихових ресурсних и инфраструктурних ограничења су слабо проучена. Сврха овог чланка је да се развије концептуални модел за имплементацију аналитике великих података у делатности малих и средњих предузећа, узимајући у обзир проблеме њихове дигитализације. Студија је направљена на основу података о руској економији. Анализа проблематике употребе аналитике великих података за мала и средња предузећа заснована је на методологији системске анализе са идентификацијом објеката, окружења и развојних подсистема пројекта и процеса. Новина истраживања састоји се у томе што је развојни модел структуре коришћења великих података спроведен у складу са садржајем главних задатака који се морају решити у животном циклусу управљања подацима. Резултати студије су показали да су главна питања увођења аналитике великих података у активности малих и средњих предузећа повезана са неразумевањем њених предности од стране предузетника. Значајни проблеми су и недостатак финансијских средстава и недостатак квалификованих кадрова способних за стратешко управљање овим процесима. С обзиром на ове проблеме, аутори закључују да би модел за коришћење аналитике великих података од стране малих и средњих предузећа требало да се заснива на коришћењу софтвера у облаку и анализи пројеката са великим подацима отвореног кода. Чланак предлаже структуру модела за коришћење великих података од стране малих и средњих предузећа. Овај рад доприноси развоју идеја о правцима дигитализације малих и средњих предузећа у циљу повећања одрживости овог привредног сектора у контексту Индустрије 4.0. Даља истраживања аутора повезана су са проценом ефективности механизама и алата државне подршке за трансформацију дигиталног пословања.

Кључне речи: мала и средња предузећа, велики подаци, способност анализе великих података, аналитика података, модел коришћења великих података

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