Advances in Economics, Business and Management Research, volume 128
International Scientific Conference "Far East Con" (ISCFEC 2020)

Transformation of Technologies to Improve the Efficiency of Business Processes in the Digital Economy

V V Isaychenkova[1], A V Novikova[1], P V Novikov[1]

[1]Bryansk State Technical University, Bryansk, Russia

E-mail: avnovikova2010@gmail.com

Abstract. The article is devoted to the study of modern aspects of digitalization in the field of business process management. A conceptual scheme for the digitalization of business systems proposed. A set of indicators to assess the effectiveness of the implementation of business processes of economic entities developed.

1. Introduction

The digital economy is one of the most relevant trends actively supported by enterprises and Russian government. The active development of information technologies ensures the achievement of the fourth technical revolution – the Industry 4.0 [1]. The digital economy is no longer perceived as a possible development scenario, and virtual reality is becoming a part of the real world. Digitalization involves the introduction of new technologies in all spheres of life and production. Russia, according to the Networked Readiness Index (NRI) of the World economic forum, ranks 41st in the world in terms of readiness for the digital economy. The government of the country has recently often stressed the importance of Russia's development in the context of the Industrial revolution 4.0 [2]. Big data, artificial intelligence, blockchain, the Internet of things (IoT), cloud computing, intelligent information technology – these are the tools for the development of the future economy [3].

The world's leading economies are actively implementing a variety of programs that create the infrastructure of the new economy. Thus, such projects as "Digital road", "Digital transport", "Smart road", "Intelligent transport systems" and "Digital railway"are implemented in the transport systems of the Eurasian economic Union and the UK [4]. The investors of these projects are the governments of different countries, and their influence on the development of transport and information spheres directly affects the work of various industries. In the US, this approach is called "Industrial Renaissance", in China – "Production 2025" or "Internet plus", in Germany – "Industry 4.0" or "Industrial revolution 4.0", in France – "Creative industry" or "industry of the future". There are similar programs in Korea and Japan.

The development of Big Data technologies is changing the approach to data collection and analysis. Today, the concept of Data Lake is gaining popularity in the market — an innovative data storage of various formats, as well as a set of tools for their processing [5]. Data Lake for supply chain management is the ability to use a large amount of data in the construction of various models, which allows you to solve completely different tasks: from more detailed planning and forecasting of sales and production to modeling and testing hypotheses. This approach allows us to collect data "on demand", and not under a specific business request. Due to the fact that the data is always "at hand" companies have the opportunity to test any hypothesis in just a few hours. While in the absence of

Data Lake, this process can take anywhere from a week to several months, depending on the business request [6].

The first step is to determine the list of sources from which to collect data. Their choice depends on the specifics of the company. So, if we are talking about the B2C sector, in which the client is the final buyer, companies are interested in using external sources, including data from social networks, for example. In the B2B sector, priority sources will be different. Thus, in recent years, companies in the market are becoming more open and data from accounting systems of partner companies can be used as sources. For example, in the interaction of the distributor-manufacturer, the latter can get more detailed data on sales and product balances from distributors and on their basis to predict the volume of purchases and production, more correctly plan promotions and discounts for buyers.

Once we have determined the sources, they are collected directly in Data Lake. One of the advantages of this approach is the ability to collect completely heterogeneous data: it can be both internal and external open sources (audio and video files, data from social networks, contact center data, and so on). In addition, if we are talking about companies with a branch structure, data Lake allows you to centralize data and get a single database of analytical queries. In this way, a large amount of historical data can also be collected, which often play a key role in the accuracy of the model when modeling supply chains. So, in one of our projects we had to make a forecast of sales of transportation services. This took into account the weight of the goods and the direction of transport. During the project, we were faced with the fact that in historical data, which were stored in the internal sources of the company, the weight of goods in some cases was with packaging, and in some – without. But it was impossible to track in which flights the goods were transported with packaging. Why is this situation? It's simple: in the past, this information was not so important when planning, so it was not recorded. That is why the collection of all possible data is so important now. In the ever-changing "picture" of business it is extremely difficult to predict what kind of information will play an important role in the future.

The next step is to select the pool of tasks to be solved. For example, a company needs to predict the demand for a particular product. In order to get a correct report, it is necessary to take into account data on weather conditions, holidays, exchange rates and much more.

The fourth step is the direct construction of the model. Most likely, each task will have its own model. The last stage – its adjustment to obtain the desired result. Thus, when building a model, it may be necessary to expand the source pool. For example, when planning production, replenishment, and distribution, the amount of storage space, including geolocation data, will be an important factor.

The solution of tasks on digitalization of business processes is achieved with the help of products from leading IT companies and OpenSource solutions [7]. For example, to build simulation models, you can use GLPK — a tool based on open code, which is a software package designed to solve large-scale linear programming, mixed integer programming and other related problems. It is a set of routines written in ANSI C and organized as a called library. If we talk about the creation of Data Lake, it is often built on the basis of the hadoop ecosystem. Today in Russia there are two distributions of Hadoop based on open Source — HortonWorks and Arenadata [8]. The Cloudera distribution is also available, but it includes a set of proprietary components that are the private property of the authors or copyright holders. The advantage of OpenSource distributions is that the company is not "tied" to the solution provider and, if necessary, can make a replacement with minimal effort. In addition, the customer can deploy such solutions both in its own it infrastructure and in a third-party cloud.

Thus, the integration of Big Data technologies into business processes opens up new opportunities for their automation and development [9]. Digitalization of business opens the way to innovative ways of enterprise development. In particular, cloud technologies allow several teams to work on one project at the same time and effectively use the company's resources. Using the strategy of Mobile First, the company receives and monetizes mobile traffic, which has already caught up with traffic from stationary devices, and ready-made solutions allow you to save time on solving problems [10]. Various applications, extensions and connectors optimize the work of the company and require minimal time for their implementation and adaptation.

The benefits of digitalization are confirmed by the forecasts of leading scientists and analysts. Thus, according to McKinsey, the international consulting company, the following sources of Russia's gross national product growth appear:

– optimization of production and logistics operations (up to 4.0 trillion. RUB);

– improving the efficiency of the labor market (up to 3 trillion. RUB);

– increase the productivity of fixed assets (up to 1.9 trillion. RUB);

– improving the efficiency of research and development and product development (up to 0.6 trillion. RUB) [11].

The achievement of such economic indicators is impossible without the active interaction of industry, the state and IT companies [12].

In Russia, the development of the digital economy is actively considered at the government level. In 2017, the national program "Digital economy of the Russian Federation" was developed and accepted. The program consideres the goals, objectives, tools, aspects of technical, personnel, information support of digitalization of the country [13]. One of the most important areas of the program is the creation of information infrastructure and the development of the following technologies: big data; Neurotechnology and artificial intelligence; distributed registry systems; quantum technologies; new manufacturing technologies; the industrial Internet; the components of robotics and sensor technology; wireless technology; the technology of virtual and augmented realities [14], [15].

The national programme "Digital economy" will require a cost of $ 3.5 trillion, 2 trillion roubles of this amount, over the 2018-2024 years to spend the Federal budget. The remaining funds are extra-budgetary sources. Of the 2 trillion rubles of Federal funds, 820 billion (about 117 billion a year) were previously provided for the Informatization of state bodies. The planned expenditures relate only to the Federal budget and extra-budgetary sources, but do not include regional expenditures.

2. Methods

The development of the digital economy largely depends on the willingness of companies to introduce new business models using technologies for collecting, storing, processing, searching, transmitting and presenting data in electronic form. In Russia in 2016, 85.7% of business sector organizations had access to the Internet, with a speed higher than 30 Mbit/s — 25.6%. Two-thirds used the network to interact with partners, while online sales through websites or EDI systems were carried out by 12.6% of organizations, online purchases — 16.7%. The low level of representation on the Internet (websites have 43.4% of organizations, and only 8.5% support versions adapted for mobile devices) constrains digital interaction of business.

The process of digitalization of the world economy has been going on for several years. It is much cheaper to improve the processes of data generation, processing and use if the enterprise has a technological base – this is the problem of many enterprises. In Russia, the latest information technologies are used mainly by large companies that have sufficient opportunities for investment in software and hardware systems. In this regard, while industry leaders use current developments and enter new stages of development, less successful organizations are forced to radically update their technologies, often changing a significant part of the existing system of business processes. The increase in data volume necessitates the provision of production with appropriate collection and analysis systems, and global sales of such products are projected to increase by almost half to $203 billion over the next two years.

In such an environment, enterprises need to identify their needs in different areas of big data. For example, to work with big data it is necessary to use the following techniques and methods of analysis:

– data mining;

– crowdsourcing;

– data mixing and integration;

– machine learning;

– artificial neural network;

– pattern recognition;
– predictive Analytics;
– simulation modeling;
– spatial analysis;
– statistical analysis;
– visualization of analytical data.

As part of the use of big data, the following technologies are used:

– NoSQL (a number of approaches aimed at implementing database stores that have significant differences from the models used in traditional relational databases with access to data by means of the SQL language. Applies to databases that attempt to solve scalability and availability problems through atomicity) and data consistency);

– MapReduce (Google's distributed computing model, as well as its implementation, used for parallel processing of large amounts of information. Programs that use the MapReduce implementation are automatically parallelized and executed on a cluster of many interconnected computers. This allows programmers even without experience with parallel and distributed systems to easily use the resources of large distributed systems);

– Data Lake - is a system or storage of data stored in its natural format, usually object blocks or files;

– Hadoop (an open source project run by the Apache Software Foundation) is used for reliable, scalable, and distributed computing, but can also be used as a General-purpose file storage that can accommodate petabytes of data) [16];

– R (language for statistical processing);

– hardware solutions (Oracle, Teradata, DAS, Greenplum).

Mostly, enterprises tend not to use qualified IT-specialists necessary for the implementation and implementation of Big Data analysis. Most enterprises, large and small, outsource these tasks. With big data becoming an increasingly important tool for businesses of all sizes, the market is flooded with companies capable of providing state-of-the-art analytical capabilities. There are large technology consultants such as IBM and HP, as well as small businesses designed exclusively to analyze this data, such as Birst and GoodData. There are literally hundreds of different big data firms, and each of them offers a variety of analytical services.

3. Results and discussion

For enterprises, the most important aspect of digitalization is to improve the efficiency of business processes. Thus, the most common digitization tool can be considered the use of Big data [17].

In Russia, big data is actively used by large companies. For example, Magnitogorsk iron and steel works in 2016. implemented Big data to optimize production costs. With the help of the service from Yandex Data Factory, data processing is carried out on the initial composition and weight of materials, requirements for the content of chemical elements in the finished product. The service then provides recommendations for changing the elements of the production process. The result of the implementation was an average savings of 5% or 275 million rubles per year.

Gazprom Neft uses big data to determine the causes of equipment failure. The supplier of the hardware and software complex was the American company Teradata. During the implementation of the project, the causes of equipment failure after power failure were analyzed on the basis of data on 1649 wells in the amount of more than 200 million records. As a result of the project, preventive measures have been introduced [18].

One of the first to turn to big data Surgutneftegas – back in 2012, the company switched to SAP HANA — data platform and applications "in-memory" for doing business in real time. The enterprise managed to automate the production, pricing online, providing professionals with the most current information. The implementation of the platform resulted in a significant reduction in transaction processing time and operating costs [19]. Based on the study of Russian and foreign experience, the

authors propose the following scheme of effective implementation of aspects of the digital economy, taking into account the strategic development of the enterprise (see Fig. 1).

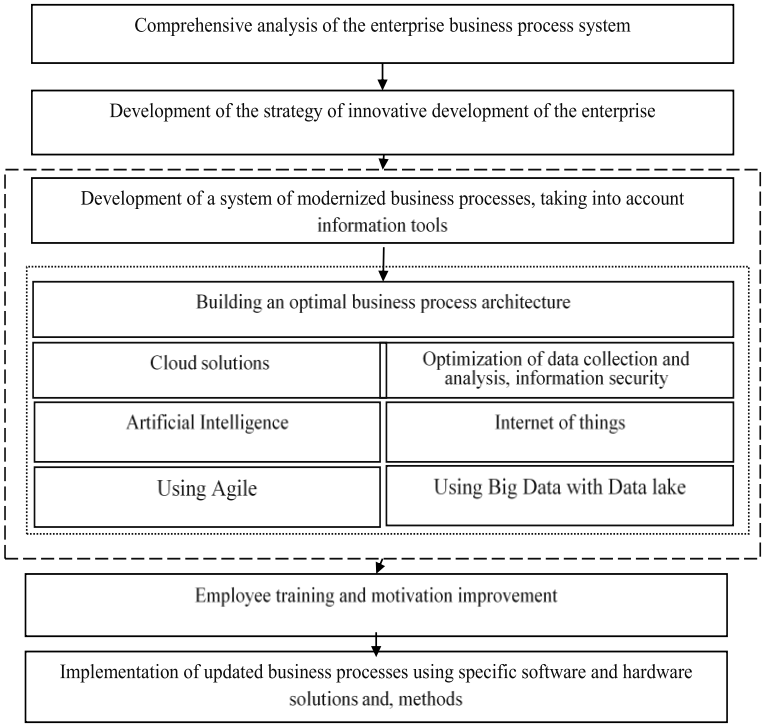

Figure1. Conceptual scheme of digitization of business systems.

At the first stage, the authors suggest using a set of indicators combined into 5 blocks for a comprehensive assessment of the effectiveness of the implementation of the enterprise's business process system.

Block 1 - personnel component: the rate of turnover at the reception; turnover rate for retirement; personnel turnover rate; dynamics of average annual output.

Block 2 - production component: update rate; retirement rate; the growth rate of fixed assets; coefficients of wear and shelf life of fixed assets; capital productivity; capital intensity; material return; consumption of materials; the proportion of material costs in the cost of production.

Block 3 - the financial component: the coefficient of car ownership; coefficients of absolute, urgent and current liquidity; return on assets; return on equity; share of borrowed funds in the total amount of sources.

Block 4 - technological component: equipment progressiveness ratio; equipment upgrade ratio.

Block 5 - informational component: the proportion of workers who have access to relevant information; the share of jobs provided with modern computer equipment and software; the share of innovation processes in the overall system of enterprise processes; the proportion of employees involved in the development and implementation of innovations.

In practice, it is proved that the use of big data is most effective for the following aspects of enterprises:

– predictive modeling in production and financial activities [20];

– reducing the cost of collecting, storing and processing information through the use of outsourcing cloud technologies;

– effective design and modernization of business processes taking into account all possible losses [21];

– optimization of transactions with counterparties;

– analysis of marketing and sales information, changing the structure of sales in order to achieve maximum revenue.

4. Conclusion

In the near future, the most competitive companies will be those that actively use the elements of digitalization. A large amount of data generated and processed in the course of financial and economic activities requires the introduction of new information technologies that use the principles of customer focus.

References

[1] Masood T, Egger J 2019 Augmented reality in support of Industry 4.0 Implementation challenges and success factors *Robotics and Computer-Integrated Manufacturing* **58** 181-195
[2] Rajput S, Singh S P 2019 Connecting circular economy and industry 4.0 *International Journal of Information Management* **49** 98-113
[3] Kettunen P, Mäkitalo N 2019 Future smart energy software houses *European Journal of Futures Research* **7(1)** 1
[4] Diez-Olivan A, Del Ser J, Galar D, Sierra B 2019 Data fusion and machine learning for industrial prognosis: Trends and perspectives towards Industry 4.0 Information Fusion 50 92-111
[5] Kaatz C, Brock C, Figura L 2019 Are you still online or are you already mobile? Predicting the path to successful conversions across different devices *Journal of Retailing and Consumer Services* **50** 10-21
[6] Senyo P K, Liu K, Effah J 2019 Digital business ecosystem: Literature review and a framework for future research *International Journal of Information Management* **47** 52-64
[7] Cenamor J, Parida V, Wincent J 2019 How entrepreneurial SMEs compete through digital platforms: The roles of digital platform capability, network capability and ambidexterity *Journal of Business Research* **100** 196-206
[8] Shaw S 2017 Hadoop technology *Internet of Things and Data Analytics Handbook* 383-397
[9] Liu Q, Zou X 2019 Research on trust mechanism of cooperation innovation with big data processing based on blockchain *Eurasip Journal on Wireless Communications and Networking* **26**
[10] Fahmfam G, Hamidi H 2019 Factors affecting the development and management of smart city approach using a combination of big data and the internet of things and cloud computing technologies *Iranian Journal of Information Processing Management* **34(2)** 557-584
[11] Kornilov D A, Yashina N I, Yashin S N, Pronchatova-Rubtsova N N, Vinnikova I S 2019 Diagnosing changes in financial and economic indicators of the EU countries and the Russian federation in crisis *Journal of Advanced Research in Law and Economics* **9(4)** 1302-1311
[12] Mishakov V Y, Beketova O N, Bykov V M, Krasnyaskaya O V, Vitushkina M G 2019 Management technologies to adapt modern principles of industrial enterprise' management *Journal of Advanced Research in Law and Economics* **9(4)** 1377-1381
[13] Bogoviz A V, Alekseev A, Akopova E, Przhedetskaya N, Ragulina J 2019 Formation of remote education as a means of restoration of Russian recessive regions' economy *International Journal of Educational Management* **33(3)** 438-445
[14] Ergunova O, Skuratov A, Pozdeeva O, Kindaev A Y 2019 Opportunities and emerging trends for digitalization of Russian economy IOP Conference Se*ries: Materials Science and Engineering* 483(1) **012115**
[15] 2017 Designing virtualization-aware and automatic topology detection schemes for accelerating hadoop on SR-IOV-enabled clouds Proceedings of the International Conference on Cloud Computing Technology and Science CloudCom **7830678** 152-159
[16] Merla P, Liang Y 2018 Data analysis using hadoop MapReduce environment Proceedings -2017 IEEE International Conference on Big Data, Big Data 2017 4783-4785

[17] Jain P, Gyanchandani M, Khare N 2019 Enhanced Secured Map Reduce layer for Big Data privacy and security *Journal of Big Data* 6(1) **30**
[18] Deberdieva E M, Vechkasova M V, Golikava H S, Borisova A A, Lysenko A F 2019 Experience in the management of business processes with the use of digital technologies by Russian companies of a petrochemical complex IOP Conference *Series: Materials Science and Engineering* 483(1) **012066**
[19] Zacarias M, Martins P V, Gonçalves A 2017 An Agile Business Process and Practice Meta-model Procedia Computer Science **121** 170-177
[20] Tsvetkov V A, Gurinovich A G, Afanasiev I V, Anastasov M S, Nikolaevna V M, Churin V 2017 Effective management of a company's economic security: 21st century challenges *International Journal of Civil Engineering and Technology* **10(2)** 1810-1820
[21] Tsikin A 2019 Development of Russian economy's self-sufficiency in the face of global challenges *Advances in Intelligent Systems and Computing* **726** 1013-1025