

Perspectives of process-oriented approach development in cost management under digitalization conditions

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Abstract. The development of a process approach to cost management in a digital environment has great prospects. Firstly, the use of digital technologies allows for greater accuracy in cost accounting, which is particularly important for enterprises with large production volumes and numerous processes. Secondly, digitization enables the automation of many processes and reduces the human factor in cost management. Thirdly, digital technologies enable faster and more efficient data analysis and decision-making based on this data. One promising direction for the development of a process approach to cost management in enterprises is the use of blockchain technologies. Blockchain can provide transparency and security in storing and transmitting information about cost accounting between enterprises and their partners. This can be particularly important in areas where it is important to accurately track the origin and distribution of costs, such as in agriculture or food production. It is also worth noting that the development and use of artificial intelligence and machine learning can improve cost management processes and allow for faster and more accurate data analysis and decision-making. Overall, the development of a process approach to cost management in enterprises in a digital environment will continue, and its successful implementation will enable enterprises to optimize their costs, increase efficiency, and competitiveness in the market.

1 Introduction

In modern conditions, cost management in enterprises is becoming increasingly relevant due to growing competition and economic risks. The process approach to cost management is an effective tool in managing costs, as it allows organizing enterprise work in a more holistic and systematic way, optimizing costs, and increasing the efficiency of business processes. With the development of digital software products, opportunities for applying a process approach to cost management are significantly expanding.

The main goal of process cost management is to increase the efficiency of business processes and reduce enterprise costs. The main tasks of process cost management in the context of digitalization may include:

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1. Automating cost accounting: Using digital technologies to automate the process of cost accounting, which significantly reduces the likelihood of errors and speeds up data processing.

2. Cost analysis: Applying digital tools to analyze enterprise costs, which helps identify areas of excess spending and determine factors that affect cost levels.

3. Business process optimization: Digitalization enables optimization of business processes in the enterprise, simplifies them, reduces the amount of redundant operations and paperwork, which leads to cost reduction.

4. Risk management: Digital technologies improve risk management in the enterprise, helping to reduce potential financial losses and risks of non-compliance with legislative requirements.

5. Budget management: The use of digital tools for budget management in the enterprise enables rapid response to market changes and timely decision-making related to cost changes.

In recent years, the number of works devoted to optimizing the costs of business processes has significantly increased. For example, the article "Digitalization of Procurement in the Age of COVID-19: Impact on Cost Management" by Ramanathan Ramanathan and Raja Roy discusses the issue of digitalizing procurement processes and its impact on cost management in the context of the COVID-19 pandemic [1].

The article "Blockchain technology for cost management in supply chain management" by Ngoc Thi Huynh, Wenqing Wu, and Jiali Luo describes the use of blockchain technology for cost management in the supply chain [2].

The article "Towards agile cost management in construction projects: An exploratory study of contractors' experiences" by Oluwole Alfred Olatunji, Chimay J. Anumba, and Muhammad Mustapha describes the experience of using agile cost management methodologies in construction projects [3].

The article "Artificial Intelligence in Cost Management and Accounting" by Andreea Stoian, Alina Manta, and Florina Popa examines the use of artificial intelligence for cost management and accounting [4].

The article "Managing the Cost of Cybersecurity Risk: A Review and Research Agenda" by Kim-Kwang Raymond Choo, Tooska Dargahi, and Arash Azin describes methods for managing costs of cybersecurity risks and sets directions for further research in this area [5].

The article "Contemporary Approaches in Cost Management of Business Processes" by Ewelina Szafranska and Anna Kowalska discusses modern approaches to cost management of business processes and their impact on the financial performance of the enterprise [6].

This is just a brief literature review that addresses the issues of the development of the process approach to cost management. However, all the works confirm the effectiveness of the process model of cost management.

The emergence of a wide range of digital technologies is reflected in all areas of enterprise activity. In this regard, the aim of the paper is to consider and analyze the prospects for the development of the process approach to cost management in the conditions of digitalization.

2 Materials and Methods

This work provides a review of modern scientific literature on the topic of process-oriented cost management in the context of digitalization. The literature review covers aspects such as the use of digital technologies in cost management, the peculiarities of process-oriented cost management in the context of the digital economy, and the challenges associated with implementing digital technologies in cost management.

To justify the selection and application of a specific digital technology for process-oriented cost management, a mathematical model with a target function and constraints was developed. The target function of the model is to maximize the efficiency of cost

management in the enterprise, and the constraints include the availability, cost, and technical characteristics of the technology. Factors such as productivity improvement, cost reduction, and product quality improvement are used to evaluate the effectiveness of technology usage in the model.

3 Results

Since 2019, the National Project "Labor Productivity" has been implemented in Russia [7].

The key tools for modernizing the production processes of project participants were business process reengineering, followed by the implementation of a process management model and the principles of lean production.

Participation in the national project helps businesses to increase their revenue following labor productivity. From 2019 to 2021, more than 2,300 participant companies increased their added value by 383 billion rubles, showing a 24% increase in labor productivity (which is 5% higher than the performance of non-participating companies). During this time, the average efficiency indicators improved: production increased by 46%, stocks of unfinished production decreased by 36%, and product production time decreased by 35%.

As of February 1, 2023, more than 4,000 companies have participated in the project [8] (Fig. 1).

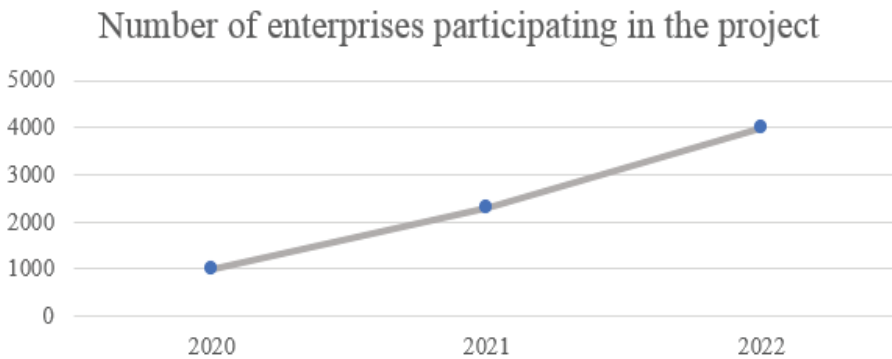


Fig. 1. Number of enterprises participating in the Labor Productivity project.

The key results for the companies became:

- increased labor productivity;
- reduction of production cycle duration;
- decrease in inventory turnover time;
- reduction in the size of unfinished production;
- growth in revenue;
- reduction in costs (Fig. 2) [8].

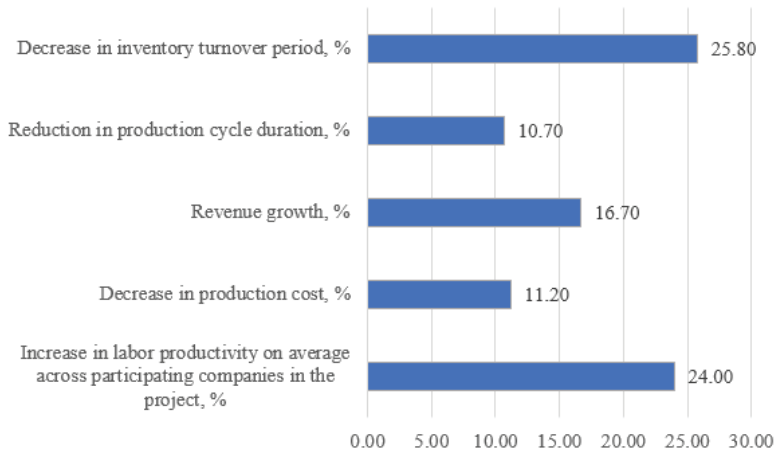


Fig. 2. Results of enterprises participating in the project "Labor productivity" (average value).

The national project continues to operate. The annual coverage of participants is about 1000 companies.

Some modern digital technologies that can be used to address the tasks of process-based cost management at the enterprise include:

1. Business Process Automation (BPA) systems for optimizing and automating business processes, reducing task completion time, and minimizing the risks of errors.

2. Project Management Systems (PMS) for managing and controlling project execution, optimizing project expenses, and improving the quality of their execution.

3. Internet of Things (IoT) for monitoring and managing production processes and equipment, which allows optimizing energy costs, reducing repair and maintenance costs of equipment.

4. Data Analytics for analyzing large volumes of data and identifying areas where costs can be reduced and business processes optimized.

5. Cloud Computing for improving data accessibility and security, reducing infrastructure costs, and providing scalability and flexibility in working with data.

6. Artificial Intelligence (AI) for optimizing business processes, automating tasks, analyzing data, and making decisions based on large volumes of data and machine learning algorithms.

7. Robotic Process Automation (RPA) for automating routine tasks and optimizing business processes.

8. Blockchain for ensuring the security and integrity of data and processes in the supply chain and cost management at the enterprise.

Combining these technologies can lead to even greater benefits in cost management. For example, utilizing IoT devices can provide real-time data collection and monitoring, which can then be analyzed using data analytics to identify areas for cost savings. BPA and RPA can be used to automate processes and reduce manual labor costs, while AI can be used for predictive analytics to anticipate and mitigate future cost overruns. Cloud computing can provide a scalable and cost-effective platform for storing and processing large amounts of data generated by these technologies. Finally, blockchain can be used for secure and transparent record-keeping of financial transactions and contracts. By strategically integrating these technologies, organizations can optimize their cost management processes and achieve greater efficiency and profitability.

To evaluate the feasibility of using a digital tool in cost management at an enterprise, a mathematical model with an objective function and constraints can be used. Mathematical

models such as linear programming or dynamic programming can be used to formalize the objective function. For example, the objective function can be optimized using the formula:

$$E = w_1 * P + w_2 * C + w_3 * Q \quad \square \quad \max$$

where P is the improvement in productivity, C is the reduction in production costs, Q is the improvement in product quality, and w₁, w₂, and w₃ are the coefficients of the importance of each parameter.

Constraints can be defined, for example, as constraints on the availability of technology, its cost, or its technical characteristics. Other constraints, such as those related to logistics, production cycle, and other factors, can also be used in the model.

4 Discussion

One example of using Business Process Automation (BPA) that led to cost reduction in an industrial enterprise is related to automating the warehouse management process. For many enterprises, warehouse management is a critical factor that can significantly impact production process efficiency and costs. However, manually managing a warehouse can be a very labor-intensive and resource-intensive process, especially considering the growth in production volume and complexity of logistics operations.

In this case, the industrial enterprise decided to apply Business Process Automation (BPA) to automate the warehouse management process. A special system was developed and implemented that allowed automating the entire warehouse management process - from receiving and shipping goods to tracking inventory levels and generating reports.

After implementing the warehouse management automation system, the industrial enterprise was able to reduce warehouse management costs by reducing the time required to perform logistics operations and improving inventory management accuracy, which reduced costs associated with product loss and the need to sort products. Thus, the implementation of BPA led to a reduction in warehouse management costs and increased production process efficiency at the enterprise [9].

One example of an industrial enterprise that uses project management systems (PMS) is Boeing. The company uses PMS software to manage and monitor project execution, optimize project expenses, and improve project quality. The company uses various PMS tools and systems such as Microsoft Project Server, Primavera P6, and Teamcenter, which enable it to effectively manage projects and achieve its goals [10].

The Internet of Things (IoT) allows for cost optimization, as IoT devices can collect and transmit data about production processes, equipment status, and other parameters that can impact the enterprise's expenses. This data can be used for decision-making and cost optimization.

For example, General Electric (GE) used IoT technologies to optimize costs at its production facilities. All equipment on the production lines was connected to the IoT network, allowing data to be collected about the operation of each device. This data was transmitted to a central system, where it was analyzed using machine learning algorithms. This allowed GE to identify problems with equipment operation and prevent breakdowns, reducing the costs of repairs and equipment replacement. In addition, GE was able to optimize production processes, reducing energy and other resource costs.

Thus, IoT technologies allow companies to collect and analyze data about their production processes, which helps them optimize costs and increase efficiency. One example of the use of blockchain technology in enterprise practice is Walmart, which implemented a blockchain system to improve supply chain management.

One example of a company that actively uses data analytics to analyze large volumes of data and identify areas for cost reduction and business process optimization is Walmart. Walmart uses big data and data analytics technologies to analyze data on its customers'

purchases in order to better understand their needs and offer more effective solutions. Additionally, the company uses data analysis to optimize logistics and inventory management, which helps reduce storage and transportation costs, speed up the delivery process, reduce losses, and reduce inventory on hand [11].

One example of companies that use cloud computing to reduce costs is Airbnb. Airbnb uses Amazon Web Services (AWS) to store and process vast amounts of data related to housing bookings and payments. The use of cloud technology allows Airbnb to scale its processes in line with the growing volume of business and reduces the time required to deploy new servers and applications. As a result, Airbnb has been able to reduce its IT infrastructure costs and focus on its core business of providing accommodation booking services [12].

Walmart uses AI to reduce costs in logistics, such as optimizing delivery routes and inventory management. They also use AI to improve the customer experience, such as personalizing product recommendations and optimizing pricing [13].

One example of a company using RPA to reduce costs is Deutsche Bank. They use RPA to automate routine operations such as processing loan applications and verifying compliance with the bank's internal policies. This has reduced processing time and decreased the number of errors [14].

Walmart has also used blockchain to track the supply of fresh products, such as meat and vegetables, from suppliers to end consumers. The blockchain system allows all participants in the supply chain to transparently track each stage of product movement, from the supplier to the sale of the product on the store shelf. This reduces the likelihood of errors and allows for quicker response to supply chain problems such as delays or lost goods.

The result of implementing the blockchain system has been increased efficiency in supply chain management and a reduction in manual control and administrative costs. In addition, thanks to the increased transparency of the supply chain, the costs associated with returns and compensation related to non-compliant products have decreased [15].

5 Discussion

In this research paper, we have examined several digital technologies that can be effectively utilized for implementing a process-based approach to cost management. Specifically, we have explored the benefits of Business Process Automation (BPA), Project Management Systems (PMS), Internet of Things (IoT), Data Analytics, Cloud Computing, Artificial Intelligence (AI), Robotic Process Automation (RPA), and Blockchain.

Our analysis has revealed that each of these technologies has unique advantages in terms of cost optimization and process efficiency. For example, BPA and PMS can help streamline business operations and minimize manual labor costs, while IoT and Data Analytics can provide valuable insights into production processes and identify areas for cost reduction. Cloud Computing and AI can significantly reduce infrastructure costs and improve decision-making, and RPA can automate repetitive tasks and reduce human error.

Furthermore, we have presented a mathematical model for justifying the implementation of these digital technologies based on their costs and benefits. By using this model, organizations can evaluate the cost-effectiveness of each technology and make informed decisions about which ones to adopt.

In conclusion, our study highlights the importance of leveraging digital technologies in cost management and process optimization. By adopting a process-based approach and using the right digital tools, organizations can achieve significant cost savings and improve their overall efficiency.

References

1. R. Ramanathan, R. Roy, Journal of Business Research **123**, 411-422 (2021) DOI: 10.1016/j.jbusres.2020.09.059
2. N.T. Huynh, W. Wu, J. Luo, International Journal of Production Economics **226**, 107547 (2020) DOI: 10.1016/j.ijpe.2019.107547
3. O.A. Olatunji, C.J. Anumba, M. Mustapha, International Journal of Project Management **37(8)**, 999-1013 (2019) DOI: 10.1016/j.ijproman.2019.07.007
4. A. Stoian, F. Manta, Procedia Manufacturing **32**, 119-124 (2019) DOI: 10.1016/j.promfg.2019.02.018
5. K.R. Choo, T. Dargahi, A. Azin, IEEE Transactions on Engineering Management **68(1)**, 13-25 (2020) DOI: 10.1109/TEM.2019.2940873
6. E. Szafranska, A. Kowalska, Journal of Corporate Accounting & Finance **32(5)**, 34-44, (2021) DOI: 10.1002/jcaf.22568
7. *National project "Labor Productivity"* (Ministry of Economic Development of the Russian Federation) URL: https://www.economy.gov.ru/material/directions/nacionalnyy_proekt_proizvoditelnost_truda/
8. *National project "Labor Productivity"*, URL: <https://xn--b1aedfedwqbdfbnzkf0oe.xn--p1ai/>
9. I.A. Naugolnova, 18th International Scientific Conference «Problems of Enterprise Development: Theory and Practice», The European Proceedings of Social & Behavioural Sciences, 554-561 (2019) DOI: 10.15405/epsbs.2020.04.71
10. N. Umashankar, S. Nijanthan, S. Siva, International Journal of Innovative Technology and Exploring Engineering (IJITEE) **8(6S2)**, 211-215, (2019) 10.35940/ijitee.L2595.0986S219
11. S. Khan, N. Khalid, A. Javaid, S.U. Javaid, Journal of Manufacturing Systems **59**, 310-327 (2021) 10.1016/j.jmsy.2021.02.011
12. M. Almosry, J. Grundy, A. Ibrahim, Egyptian Informatics Journal **17(3)**, 233-252 (2016) 10.1016/j.eij.2016.02.005
13. S.S. Kamble, A. Gunasekaran, Transportation Research Part E: Logistics and Transportation Review **114**, 343-361 (2018) 10.1016/j.tre.2018.04.002
14. C. Lacity, L. Willcocks, Robotic process automation delivers savings at Deutsche Bank, The Wall Street Journal (2017)
15. A.V. Shakshin, N.M. Nurtdinova, M.A. Yakovleva, Bulletin of Science and Practice **5**, 93-98 (2019) 10.5281/zenodo.346569