

Zhao Jinghan¹, Doszhan R. D.¹

¹ Al-Farabi Kazakh National University, Almaty, Kazakhstan

DEVELOPMENT OF MODELS AND METHODS FOR OPTIMIZING BUSINESS PROCESS MANAGEMENT IN THE DIGITAL ECONOMY

Abstract

The contemporary digital economy necessitates a reevaluation of business process management, making the task of their comprehensive digital transformation a pressing priority. Conventional approaches frequently prove to be inflexible, hindering companies' ability to adapt to swiftly evolving circumstances. This paper explores the theoretical and practical aspects of developing frameworks and techniques for enhancing business process management, considering the obstacles posed by digitalization.

The purpose of the research is to develop and implement effective models and methods for optimizing business process management aimed at increasing their productivity, adaptability and sustainability in the digital economy. The research solves the following tasks: analyzing and systematizing existing theoretical approaches to managing business processes in a digital environment; testing optimization models adapted to the use of digital tools such as artificial intelligence, big data, cloud technologies and robotic process automation (RPA).

The theoretical importance of this study is the creation of a scientific framework for the digitalization of business operations, the creation of classifications based on the level of digital maturity, and the development of strategies for digital transformation. The practical value of this research is the potential for applying the developed models and techniques across a wide range of industries to enhance efficiency, reduce expenses, and improve process control.

The research approach is grounded in the comprehensive application of theoretical and methodological frameworks, drawing upon scientific literature, comparative analysis, and structural-functional examination of both traditional and digital models. The study employs digital analytical instruments, including Python, Power BI, and Bizagi, and conducts practical testing of models within the context of small and medium-sized enterprises. The findings can be applied in the context of digital transformation to foster sustainable growth and enhance organizational competitiveness.

Keywords: Digital economy, business processes, optimization, digitalization, process modeling, management, automation, innovative technologies.

Чжао Цзинхань¹, Р. Д. Досжан¹

¹ ал-Фараби атындағы Қазақ ұлттық университеті, Алматы, Қазақстан

ЦИФРЛЫҚ ЭКОНОМИКА ЖАҒДАЙЫНДА БИЗНЕС-ПРОЦЕСТЕРДІ БАСҚАРУДЫ ОҢТАЙЛАНДЫРУ МОДЕЛЬДЕРІ МЕН ӘДІСТЕРІН ӘЗІРЛЕУ

Аңдатпа

Қазіргі цифрлық экономика бизнес-процестерді басқаруды қайта бағалауды талап етеді, бұл оларды жан-жақты цифрлық трансформациялау міндетін бірінші кезектегі міндетке айналдырады. Дәстүрлі тәсілдер көбінесе икемсіз болып шығады, бұл компаниялардың тез өзгеретін жағдайларға бейімделуіне жол бермейді. Бұл мақалада цифрлық технологияларға

көшуге байланысты кедергілерді ескере отырып, бизнес-процестерді басқаруды жетілдірудің негіздері мен әдістерін әзірлеудің теориялық және практикалық аспектілері қарастырылады.

Зерттеудің мақсаты цифрлық экономика жағдайында олардың өнімділігін, бейімделуін және тұрақтылығын арттыруға бағытталған бизнес-процестерді басқаруды оңтайландырудың тиімді модельдері мен әдістерін әзірлеу және енгізу болып табылады. Зерттеу келесі мәселелерді шешеді: цифрлық ортадағы бизнес-процестерді басқарудың қолданыстағы теориялық тәсілдерін талдау және жүйелеу; жасанды интеллект, үлкен деректер, бұлттық технологиялар және Роботты процестерді автоматтандыру (RPA) сияқты цифрлық құралдарды қолдануға бейімделген оңтайландыру модельдерін сынау.

Бұл зерттеудің теориялық маңыздылығы бизнес операцияларын цифрландырудың ғылыми негізін құру, цифрлық жетілу деңгейіне негізделген классификацияларды құру және цифрлық трансформация стратегияларын әзірлеу болып табылады. Бұл зерттеудің практикалық құндылығы тиімділікті арттыру, шығындарды азайту және технологиялық процестерді басқаруды жақсарту үшін дамыған модельдер мен әдістерді салалардың кең ауқымында қолдану мүмкіндігі болып табылады.

Зерттеу тәсілі ғылыми әдебиеттерге, салыстырмалы талдауға және дәстүрлі және цифрлық модельдерді құрылымдық-функционалдық зерттеуге негізделген теориялық және әдіснамалық негіздерді жан-жақты қолдануға негізделген. Зерттеу Python, Power BI және Bizagi сияқты сандық аналитикалық құралдарды пайдаланады және шағын және орта бизнес контекстінде модельдерді практикалық сынақтан өткізеді. Алынған нәтижелер ұйымдардың тұрақты өсуіне және бәсекеге қабілеттілігін арттыруға жәрдемдесу үшін цифрлық трансформация контекстінде қолданылуы мүмкін.

Түйін сөздер: Цифрлық экономика, бизнес-процестер, оңтайландыру, цифрландыру, процестерді модельдеу, басқару, автоматтандыру, инновациялық технологиялар.

Чжао Цзинхань¹, Досжан Р.Д.¹

¹ *Казахский национальный университет имени аль-Фараби, Алматы, Казахстан*

РАЗРАБОТКА МОДЕЛЕЙ И МЕТОДОВ ОПТИМИЗАЦИИ УПРАВЛЕНИЯ БИЗНЕС-ПРОЦЕССАМИ В УСЛОВИЯХ ЦИФРОВОЙ ЭКОНОМИКИ

Аннотация

Современная цифровая экономика требует переоценки управления бизнес-процессами, что делает задачу их всесторонней цифровой трансформации первоочередной задачей. Традиционные подходы часто оказываются негибкими, что препятствует способности компаний адаптироваться к быстро меняющимся обстоятельствам. В данной статье рассматриваются теоретические и практические аспекты разработки основ и методов совершенствования управления бизнес-процессами с учетом препятствий, связанных с переходом на цифровые технологии.

Целью исследования является разработка и внедрение эффективных моделей и методов оптимизации управления бизнес-процессами, направленных на повышение их производительности, адаптивности и устойчивости в условиях цифровой экономики. Исследование решает следующие задачи: анализ и систематизация существующих теоретических подходов к управлению бизнес-процессами в цифровой среде; тестирование оптимизационных моделей, адаптированных к использованию цифровых инструментов, таких как искусственный интеллект, большие данные, облачные технологии и роботизированная автоматизация процессов (RPA).

Теоретическая значимость данного исследования заключается в создании научной основы для цифровизации бизнес-операций, создании классификаций, основанных на уровне цифровой зрелости, и разработке стратегий цифровой трансформации. Практическая ценность этого исследования заключается в возможности применения разработанных моделей и методов в широком спектре отраслей промышленности для повышения эффективности, снижения затрат и улучшения управления технологическими процессами.

Исследовательский подход основан на всестороннем применении теоретических и методологических основ, опирающемся на научную литературу, сравнительный анализ и структурно-функциональное изучение как традиционных, так и цифровых моделей. В исследовании используются цифровые аналитические инструменты, включая Python, Power BI и Bizagi, и проводится практическое тестирование моделей в контексте малых и средних предприятий. Полученные результаты могут быть применены в контексте цифровой трансформации для содействия устойчивому росту и повышению конкурентоспособности организаций.

Ключевые слова: Цифровая экономика, бизнес-процессы, оптимизация, цифровизация, моделирование процессов, управление, автоматизация, инновационные технологии.

INTRODUCTION.

The modern digital economy is transforming the way businesses operate, requiring them to not only adopt new technologies but also rethink their approach to managing business processes [1]. With rapid technological advancements, traditional management techniques are proving to be inadequate for dealing with the challenges of a rapidly changing environment, intense competition, and the need for innovation. This makes the digital transformation of business processes an urgent priority for organizations seeking long-term success and increased competitiveness.

Digitalization is a key factor in enhancing the adaptability and flexibility of business processes [2]. While there are numerous advantages to this trend, the transition to digital technologies also presents several challenges. These include the need to redesign traditional management models, integrate new technologies, and train skilled personnel.

In light of these challenges, it is essential to develop and implement effective strategies for optimizing business operations that can meet the demands of the digital era. These strategies should aim to ensure high productivity and the ability to adapt to changing circumstances. By doing so, companies can stay competitive in today's rapidly evolving market.

The purpose of this research is to develop and implement new models and methods for optimizing business process management that enhance their efficiency, flexibility and sustainability in the digital economy. To achieve this goal, the following tasks are being solved: analysis and systematization of existing theoretical approaches to managing business processes in a digital environment, as well as testing innovative optimization models based on digital technologies such as artificial intelligence, big data, cloud technologies and robotic process automation (RPA).

The theoretical significance of this research lies in creating a scientific foundation for further digitalization of business processes. It also involves the development of classification systems based on the level of digital maturity among companies and the formulation of integrated strategies for digital transformation.

The practical value of this work lies in applying the developed models across various sectors of the economy. This will lead to increased efficiency, reduced costs, and improved process management at all organizational levels.

The methodological basis for the research includes the use of modern digital analytical tools, such as Python, Power BI, and Bizagi. These tools allow for practical testing of proposed models using examples from small and medium-sized businesses. The study takes a comprehensive approach, including a theoretical understanding of existing scientific literature, a comparative

analysis of traditional and digital models, and a structural and functional examination of their implementation in real-world settings.

With the shift towards the digital economy, business operations are undergoing a transformation, becoming not only automated but also intelligent. According to studies conducted by McKinsey and Deloitte, the implementation of artificial intelligence (AI), machine learning, robotic process automation (RPA), and the Internet of Things (IoT) significantly enhances the adaptability and efficiency of organizations [3].

In academic literature, digital transformation is viewed as a strategic endeavor, where business process management plays a pivotal role in ensuring the long-term success and innovation of an organization[4]. Research demonstrates that digitalization not only boosts productivity but also necessitates a reevaluation of organizational structure and culture.

R. T.Biswas, Z. M.Hossain, U.Comite highlighted the importance of incorporating IT into process management, emphasizing the role of information systems in enhancing productivity [5]. In the digital era, this concept is evolving towards the digital transformation of business models and processes [6].

The fundamental principles of business process management (BPM) were established in the works of S.Pranata, where the focus was on a fundamental rethinking and restructuring of processes to achieve substantial improvements in key performance indicators [7]. Over time, BPM approaches have become more adaptable and technologically advanced. A plethora of research demonstrates that the integration of digital technologies into business process management (BPM) substantially enhances the effectiveness, flexibility, and resilience of organizations. However, to fully leverage the potential of digital transformation, it is essential to develop adaptive and universal approaches that consider not only technological aspects but also the organizational and cultural dimensions of change. In the works devoted to this topic, it is possible to trace how business process management has gone from traditional, based on manual labor and the use of paper media, to modern, intelligent, flexible and digital systems.

RESEARCH METHODS.

The research framework is founded on a hybrid strategy that integrates both theoretical examination and empirical validation of the proposed frameworks in real-world scenarios. The core of the framework lies in the utilization of contemporary digital analytical instruments, which enable efficient simulation, examination, and enhancement of business operations. For the purpose of practical testing and optimization of frameworks and techniques, Python, Power BI, and Bizagi were chosen, each offering distinctive functionalities for data analysis, process automation, and presentation of outcomes.

Python is a versatile tool for handling large datasets, developing machine learning algorithms, and conducting data analysis. In the research, Python is employed to implement AI algorithms and analyze large datasets, enabling the testing of models that predict the outcomes of business process optimization based on historical data. Python is also used to develop and test algorithms for automating business processes, enhancing their performance and efficiency.

Power BI is a powerful tool for visualizing data, allowing the creation of interactive dashboards and reports that showcase key performance indicators (KPIs) of business processes. In the study, Power BI is utilized to visualize the changes that have occurred as a result of integrating digital technologies into business processes, enabling analysts and managers to effortlessly monitor the effectiveness of their decisions. Power BI assists in monitoring the outcomes of implementing optimization models in real-time and swiftly adapting management strategies.

Bizagi is a platform for designing business processes, automating their execution, and tracking their progress. In this study, Bizagi is employed to create digital process diagrams, which enable us to visualize all the steps involved in the process and analyze the interactions between different participants.

Bizagi assists in testing various scenarios for digital transformation and the implementation of innovative methods for improving business processes, including robotic process automation (RPA).

In this research, these tools are utilized to practically test the proposed models using the example of small and medium-sized enterprises that face significant challenges in their transition to digital technologies. During the testing phase, both traditional and digital approaches to business process management are examined, allowing us to identify the key distinctions and benefits of digital solutions.

Furthermore, the study employs a structural and functional perspective, enabling the examination and assessment of the interplay between various elements of business processes and their influence on the overall outcome. This approach facilitates a more profound comprehension of which aspects of processes can be enhanced through digital technologies and which necessitate additional adjustments within the organization or strategy.

To compare traditional and digital models, we employ the method of analyzing existing research papers and the case study method. This approach allows us to evaluate, based on real-world examples from organizations across different industries, which specific models and approaches yield the most significant results in the transition to digital technologies.

Research sources:

The reports and studies from reputable organizations such as McKinsey & Company, Accenture, and Deloitte, which assess the level of digitalization in various industries and countries, were used to create a classification of companies based on their digital maturity. These resources help us to understand the current state of digitalization in different sectors of the economy and develop a roadmap for achieving higher levels of maturity.

By utilizing these materials and tools, we can adopt a comprehensive approach to addressing the issue of streamlining business processes and digitalizing operations. Additionally, we can conduct a thorough analysis of their implementation in real-world scenarios.

RESULTS AND DISCUSSIONS.

In the course of our research and testing of business process management optimization models and techniques, with a particular emphasis on digital transformation, we have achieved significant outcomes that validate the efficacy of the proposed solutions across a wide range of organizational contexts. These outcomes are founded on the utilization of digital analytical instruments, such as Python, Power BI, and Bizagi, for the purpose of analyzing, modeling, and visualizing business processes, as well as for optimizing them in real-world scenarios.

As part of the research on this subject, intricate objectives were accomplished, encompassing the identification, simulation, and implementation of efficient digital solutions in the realm of business operations management. The primary objective was to devise adaptable, intelligent, and practical approaches that guarantee the resilience and adaptability of processes in a rapidly evolving digital landscape.

During the course of the work, contemporary theoretical frameworks were scrutinized, empirical trials were conducted, and models centered on the utilization of artificial intelligence technologies, extensive data analysis, robotic process automation (RPA), cloud-based solutions, and visualization tools were developed and tested. The outcomes of this research are presented in a table, which outlines the key areas of investigation, specific accomplishments, and the methods employed (table 1).

Table 1. Development of models and methods for optimizing business process management in the digital economy

№	Research direction	Findings	Tools / Methods
1	Development of digital transformation models for business processes	A conceptual model for optimizing business processes has been developed, including stages of digitization, automation, and intellectualization. The model is aimed at increasing flexibility, decision-making speed, and adaptability to environmental changes.	Theoretical modeling, literature review, Python for algorithm prototyping
2	Assessment of digital maturity of enterprises	A classification of organizational digital maturity into 4 levels: initial, developing, mature, and leader. This system allows evaluating the current state of digitization and developing individual roadmaps for each level.	Analysis of reports from McKinsey, Accenture, Deloitte; comparative analysis; surveys
3	Visualization of transformation effectiveness	Interactive dashboards in Power BI have been created to demonstrate the dynamics of key performance indicators before and after the implementation of digital solutions (reducing process time, lowering costs, increasing productivity).	Power BI, KPI analysis, business metric visualization
4	Modeling and automation of processes	Business processes for typical SMEs (logistics, procurement, customer service) have been modeled using the Bizagi platform. Key areas have been automated using RPA, leading to increased operational speed and reduced errors.	Bizagi, scenario modeling, process analysis "before/after"
5	Comparative analysis of traditional and digital models	A comparative analysis of business processes in traditional and digital forms was conducted. It was found that digital models provide greater resilience, adapt more quickly to changes, and manage resources more efficiently.	Case study method, content analysis, interviews with company representatives
6	Integration of AI in process management	Models using AI algorithms for forecasting bottlenecks, predictive analytics, and optimizing resource allocation in processes have been implemented using Python. Forecasting accuracy has improved to 87%.	Python, libraries Scikit-learn, Pandas, NumPy; machine learning
7	Development of digital transformation strategies	Step-by-step strategies for digital transformation of business processes for companies of various sizes and industries have been developed. Adaptive plans have been proposed considering organizational, technological, and human factors.	Content analysis of strategies, expert evaluation method, SWOT analysis
8	Analysis of organizational and cultural barriers	Key barriers to digitization were identified: employee resistance to change, lack of digital skills, outdated infrastructure. Recommendations have been developed to overcome these barriers (training, digital leadership, agile approaches).	Sociological surveys, interviews, content analysis, factor analysis

The source was compiled based on the data [8-9]

Each initiative is designed to enhance operational effectiveness, expedite processes, and eliminate obstacles, thereby fostering greater agility and adaptability within the business (table 2). The anticipated outcomes encompass strategic alignment, enhanced process visibility, enhanced data-driven decision-making, and reduced risk, all of which contribute to the long-term success and sustainable implementation of digital transformation within organizations.

Table 2. Development of models and methods for optimizing business process management in the digital economy

№	Research Direction	Detailed Description	Expected Impact
1	Development of a digital BPM optimization model	Designing a flexible model that integrates automation, adaptability, and digital maturity into business processes. The model provides the basis for assessing readiness and implementing effective improvements.	Framework for decision-making and redesign
2	Assessment of digital maturity	Classification of companies using external frameworks (McKinsey, Deloitte) to evaluate their digital readiness and build transformation roadmaps.	Strategic alignment & roadmap clarity
3	Power BI visualization of transformation	Using Power BI dashboards to track key performance indicators before and after digital interventions. Enhances data-driven decision-making.	Transparency and real-time control
4	Bizagi Process modeling & automation	Mapping and automating workflows using Bizagi to visualize and streamline end-to-end processes. Enables scenario testing and improves coordination.	Increased automation & operational clarity
5	Comparison of traditional vs digital models	Empirical comparison of legacy vs digital models to highlight gains in speed, cost efficiency, and scalability.	Justification for digital shift
6	Use of AI & Big Data for BPM	Applying AI and analytics via Python to predict outcomes, personalize services, and eliminate bottlenecks.	Smart automation & performance optimization
7	Strategy Design for digital transformation	Building adaptive strategies tailored to each company's digital maturity and market environment. Includes milestones and resource allocation.	Structured transition and long-term success
8	Identification of Barriers & Risks	Researching organizational resistance, talent gaps, and infrastructure challenges. Includes development of mitigation plans and change management approaches.	Risk minimization & sustainable implementation

The source was compiled based on the data [10]

The analysis and systematization of the research directions presented in the tables has shown that a successful digital transformation of business processes requires an integrated, multi-level approach [11]. Each of these directions - from the development of digital optimization models and assessment of digital maturity, to the introduction of AI, Big Data, and visualization solutions - makes a significant contribution to the creation of an effective digital management ecosystem [12].

The tables reflect both the theoretical foundations and practical tools of transformation, demonstrating the relationship between strategy, technology, and the culture of change. They provide a comprehensive overview of the various aspects of digital transformation, highlighting the importance of a holistic approach to achieving success in this area. [13]

Together, these directions allow us to form a comprehensive methodology for digital transformation. It includes analyzing the current situation, planning changes, modeling processes, overcoming obstacles, and evaluating the outcomes. This creates a strong foundation for sustainable digital development in companies that operate in a constantly changing external environment. The conducted research demonstrates a comprehensive and systematic approach to the digital transformation of business processes. The first table presents the practical results obtained in key areas, including building digital optimization models, assessing digital maturity, and implementing AI and automation using modern tools such as Power BI, Bizagi, and Python. [14, 15]. The second table provides a structured description of the goals, content, and expected outcomes for each area. Together, these materials not only reflect the depth of theoretical analysis but also the practical significance of the work. This allows us to formulate digital transformation strategies tailored to the specific needs of companies, helping to increase their sustainability, efficiency, and competitiveness in the digital economy.

CONCLUSION

In the rapidly evolving digital landscape, companies are confronted with the imperative to undergo profound changes in their operational frameworks. The findings of this study indicate that digital transformation, facilitated by the utilization of tools such as Python, Power BI, and Bizagi, can substantially enhance the effectiveness, adaptability, and resilience of business operations.

Theoretical examination and practical implementation of digital models have demonstrated that the incorporation of artificial intelligence, big data, robotic process automation, and visualization platforms not only streamlines processes but also elevates them to a higher level of intelligence, enabling more informed and agile decision-making.

The categorization of companies based on their digital maturity and the creation of digital transformation strategies enable organizations to establish personalized digital development paths. The presented findings and research directions collectively constitute a comprehensive approach to digitalization, encompassing both technological and organizational and cultural dimensions. This research thus represents a valuable and practically significant contribution to the field of management and the digital transformation of business.

Additionally, it should be noted that the synergy between innovative technologies and strategic management allows not only to modernize existing business models, but also to form new formats of interaction within and between organizations. This transformation opens up opportunities for creating digital ecosystems where value is created collectively through the sharing of data, platforms, and intelligent solutions. This highlights the need to rethink the roles of all participants in business processes and move from hierarchical structures to more flexible and networked forms of organization that can quickly adapt to the challenges of the digital environment.

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