DOI:10.59787/2413-5488-2026-55-3-137-147

[1]**Aziza Zhunusbekova**, [2]**Samal Askarkyzy***, [3]**Bakhyt Alipova**

[1] Abai Kazakh National Pedagogical University, Almaty, Republic of Kazakhstan
[2] Kazakh National University of Arts named after K. Baiseitova, Astana, Republic of Kazakhstan
[3] University of Kentucky, Kentucky, USA

AI ALGORITHMS FOR OPTIMIZING UNIVERSITY RESOURCE MANAGEMENT

Abstract. This article examines the potential of AI algorithms for optimizing university resource management in the context of the digital transformation of higher education. Modern approaches to the intellectualization of management processes, based on the use of optimization algorithms and machine learning methods, are analyzed. Attention is paid to heuristic and meta-heuristic approaches such as genetic algorithms, particle swarm modeling, and ant colony modeling, which are used to allocate educational, scientific, and human resources at universities. The research methodology includes a combination of complementary scientific methods: analysis of scientific publications and regulations, a comparative analytical approach, algorithmic modeling and optimization methods, statistical data processing, and conceptual modeling. The empirical basis of the study is data from 11 universities located in the cities of Astana and Almaty. The results demonstrate the significant potential of using AI algorithms to improve the efficiency of university resource management. The use of intelligent analysis and optimization methods enables more informed management decisions, promotes the rational allocation of educational, research, and human resources, and improves the quality of educational activities in the context of the digitalization of higher education.

Keywords: artificial intelligence, optimization algorithms, university resource management, digital transformation of education, genetic algorithms, particle swarm optimization, ant colony optimization.

Introduction

The Republic of Kazakhstan is consistently advancing in the sphere of digital transformation and the integration of artificial intelligence (AI) technologies. The country is gradually transitioning from isolated pilot projects toward a comprehensive system of state regulation and the widespread adoption of AI-based solutions. This strategic direction was officially formalized through Resolution №592 of the Government of the Republic of Kazakhstan adopted in 2024, which approved the Concept for the Development of Artificial Intelligence for the period 2024–2029. The Concept is a strategic document aimed at forming a national AI ecosystem through the development of infrastructure, data, human capital, and legal regulation, which should ensure the implementation of technologies in the economy and public administration. A special emphasis is placed on education, which envisages the large-scale training of specialists, the integration of AI into curricula, and the creation of a research environment based on universities, including access to international educational platforms and the development of initiatives such as AI- Sana (Government of the Republic of Kazakhstan, 2024). A significant step in this direction was the adoption of the Law «On Artificial Intelligence», which entered into force on January 18, 2026, demonstrating the formation of a regulatory framework for regulating the development and use of AI technologies (Republic of Kazakhstan, 2025). Furthermore, the institutional development of the industry is ensured by the creation of a specialized government agency – the Ministry of Artificial Intelligence and Digital Development of the Republic of Kazakhstan – overseeing issues of digital development and artificial intelligence (Republic of Kazakhstan, 2025).

The declaration of 2026 as the Year of Digitalization and Artificial Intelligence underscores the strategic importance of this sector for the country's socioeconomic development (President of the Republic of Kazakhstan, 2026). At the same time, technological infrastructure is actively developing: computing power based on GPU clusters is being implemented, and a national AI platform is being formed, providing access to government data and creating the conditions for the development of the concept of «sovereign artificial intelligence». The creation of this platform is aimed at developing an integrated AI development ecosystem, digitalizing data processing processes, and improving public administration mechanisms. Its implementation

is aimed at improving the quality of public services and strengthening Kazakhstan's competitiveness in the global artificial intelligence space. The practical application of AI already covers such areas as healthcare, transportation, and security (National Information Technologies JSC).

Particular attention is being paid to training personnel and developing human capital. Artificial intelligence programs are being implemented in the education system, including the adaptation of international educational practices, and national standards for integrating AI into higher education are being developed. These initiatives are aimed at training specialists capable of effectively applying digital technologies in various sectors of the economy, including higher education. By the end of 2025, more than 900,000 citizens had completed training, acquiring basic and applied competencies for work and study in the context of the rapid implementation of AI (Ministry of Digital Development, Innovations and Aerospace Industry of the Republic of Kazakhstan, 2026). These changes have also affected school education: starting in the 2025–2026 academic year, elements of artificial intelligence have been introduced into the subjects «Digital Literacy» and «Computer Science». Online Day of AI courses have been developed for secondary school students, and specialized professional development courses are available for teachers (Ministry of Education of the Republic of Kazakhstan, 2025). The Alem.ai center, opened in 2024, is a national platform for the development of artificial intelligence, focused on education, research, and innovation, bringing together pupils, entrepreneurs, and scientists. The project envisages the annual training of up to 1,000 specialists, the launch of 100 start-ups, support for 10 research initiatives, and the involvement of up to 10,000 participants by 2030, which is aimed at creating a sustainable AI ecosystem in Kazakhstan (Astana Hub, 2026). Creation of the AI SilkNet center – a national platform for predictive analytics and technological foresight – is aimed at developing scientific research, forming a unified forecasting system and strengthening interaction between the state, science and industry, which reflects the transition to development management based on data and intelligent technologies (Ministry of Digital Development, Innovations and Aerospace Industry of the Republic of Kazakhstan, 2026).

According to the Government AI Readiness Index 2025 prepared by Oxford Insights, Kazakhstan ranked 60th out of 195 countries, reflecting the continued development of its national AI ecosystem. The country demonstrates a high level of readiness for the implementation of artificial intelligence in public administration, particularly in the area of digital government services, as evidenced by its results in the Public Sector Adoption. The achieved results are due to the development of digital infrastructure, the institutional framework, and strategic state policy in the field of AI. At the same time, Kazakhstan's further progress is associated with the need to strengthen the commercialization of technologies, develop the private sector, and expand the practical application of AI in the economy (Ministry of Digital Development, Innovations and Aerospace Industry of the Republic of Kazakhstan, 2025). The achieved level of development of digital infrastructure and institutional readiness for the implementation of artificial intelligence in the Republic of Kazakhstan creates the preconditions for its active use at the level of educational organizations. In this context, the use of AI algorithms for optimizing university resource management, ensuring increased efficiency in the use of material, human, and information resources, as well as ensuring the sustainable development of the educational organization in the context of digital transformation, is of particular importance.

Literature Review

Currently, a large number of organizations across various sectors are implementing or are interested in implementing artificial intelligence (AI) technologies (Füller et al., 2022). Industries such as telecommunications, engineering, financial services, customer service, healthcare, pharmaceuticals, and educational institutions are at the forefront of AI tool adoption (Perifanis & Kitsios, 2023). The original goal of AI was to develop computer programs with capabilities similar to human intelligence. AI methods recreate the thought process and its outcome in an even more modest form (Dai et al., 2020). The rapid pace of digitalization, and in particular the adoption of AI, are changing the face of organizations. AI has changed the way organizations operate and has become part of corporate strategy. Universities today operate in a data-driven environment, where decision-making is increasingly based on the analysis of large amounts of information. At the same time, the further evolution of digital management involves not only the accumulation and analysis of data but also the use of intelligent tools for its processing, ensuring a higher level of management efficiency. In this context, the need to rethink traditional models of educational management is growing. As Daniela notes, the concept of «smart pedagogy» is being shaped by the challenges of the big data

era and the intellectualization of the educational environment. Established management practices and classical approaches to organizing the educational process are gradually losing their relevance, as they do not fully meet the increasingly complex needs of students and the demands of modern society, characterized by highly dynamic change.

The next stage of this transformation is the transition to the intellectualization of management processes. In the era of 5.0, characterized by the intensive development of information and communication technologies, artificial intelligence is becoming a key tool for technological and socioeconomic transformation. In the field of educational organization management, artificial intelligence technologies create the preconditions for improving the validity of management decisions, optimizing organizational processes, and enhancing the quality of educational activities. Optimizing the use of artificial intelligence technologies in education management opens up significant opportunities for improving institutional efficiency. At the same time, the effective allocation of academic, scientific, and personnel resources remains one of the central challenges in higher education management. The quality of educational services, research productivity, and the competitive position of a university largely depend on how effectively these resources are managed. At the same time, the complex internal structure of universities together with rapidly changing external conditions significantly complicate the process of achieving optimal resource allocation, turning it into a multifaceted management task.

Under the conditions of ongoing digitalization, methods of optimization driven by artificial intelligence technologies are becoming increasingly relevant, which creates a demand for the continuous improvement and adaptation of approaches to their integration into educational environments. Such approaches involve the use of the professional potential of specialized university divisions, including academic writing centers, the emergence of new positions related to AI support within university libraries, as well as institutional governance strategies designed to encourage innovative practices in the implementation of AI technologies in teaching and learning processes.

The development of digital educational resources (study materials, teaching aids, and practical AI examples) that facilitate the updating of course content is crucial, as is supporting the professional development of faculty through training, internships, and flexible teaching load distribution. An additional element is the expansion of university libraries' resource base through the acquisition of specialized publications and databases, which together ensures more effective management of the educational institution's material, human, and information resources.

According to the Law of the Republic of Kazakhstan «On Artificial Intelligence» dated November 17, 2025 №230-VIII LRK, artificial intelligence is the ability of systems to reproduce the cognitive functions inherent in humans, providing results comparable to or superior to the results of their intellectual activity (Republic of Kazakhstan, 2025). According to Tambe et al., artificial intelligence (AI) is an important driver of technological progress, influencing the labor market, which requires understanding its impact on scientific research (Tambe et al., 2019). With the expanding use of artificial intelligence technologies, the potential for job losses arises, as a result of persistent social inequality, as well as improved quality of work and the emergence of new forms of employment. In this regard, artificial intelligence is becoming a key factor in the transformation of human resource management systems (Ng et al., 2025). At a practical level, these changes manifest themselves in the use of intelligent algorithms to optimize management processes and resource allocation in organizations, including educational institutions.

Intelligent optimization algorithms, including genetic algorithms (GAs), particle swarm optimization (PSO), and ant colony optimization (ACO), can be applied to solving resource allocation problems for various types of universities. These algorithms are capable of handling complex, nonlinear, and multi-criteria models, making them suitable tools for resource management under conditions of high uncertainty. One of the priority areas for using such algorithms is optimizing the use of educational resources. This includes assigning instructors to subjects, creating class schedules, and assigning classrooms. The use of intelligent methods makes it possible to increase the consistency of the appointment of teachers, taking into account their professional specialization, the requirements of educational programs and the educational demand of students, as well as minimize conflicts in the schedule and increase student satisfaction. In particular, genetic algorithms can be used to optimize the assignment of instructors to courses. This model generates a set of possible solutions, which are evaluated against specified criteria – qualification, teaching load, and demand for the

discipline. Then, using selection, crossover, and mutation mechanisms, an evolutionary search is performed, resulting in an optimal or near-optimal assignment.

An equally significant application of optimization algorithms is scientific resource management. This includes distributing funding for scientific projects, assigning research tasks to research teams, and efficiently utilizing scientific infrastructure. Intelligent methods enable projects to be ranked by strategic importance, expected scientific impact, and feasibility, ensuring the informed allocation of resources. Thus, a particle swarm algorithm can be used to optimize the allocation of research funding. In this approach, potential solutions are modeled as particles in a multidimensional search space, and their positions are adjusted based on individual and global best results. This allows the system to gradually converge toward the optimal allocation of funds, taking into account multiple criteria.

In addition, artificial intelligence algorithms can be used to manage the university's human resources. It includes the processes of personnel selection, forecasting staff turnover, planning professional development. The use of intelligent models makes it possible to identify the most promising candidates, predict personnel risks and form effective employee development programs, which contributes to increasing organizational stability and staff satisfaction. According to Xu's research, models based on artificial intelligence algorithms provide more accurate and objective assessment of educational processes compared to traditional analysis methods. The use of optimization algorithms based on artificial intelligence allows for the development of more scientifically based and objective models for assessing the quality of teaching, increasing the reliability and validity of the results (Xu, 2025).

Various machine learning methods can be used to develop such models, including artificial neural networks (ANN), support vector machines (SVM), and decision trees (DT). These algorithms are able to identify complex, non–linear relationships between a variety of factors affecting the quality of teaching, including student reviews, professional characteristics of the teacher, the content and complexity of the course, as well as the educational outcomes of students. One possible approach is to build a model based on a multilayer feedforward neural network. The input layer can include a set of indicators characterizing teaching quality: student grades, teacher qualifications, subject characteristics, student academic performance, and other relevant parameters. Hidden layers enable the identification of complex relationships and patterns between these variables, while the output layer generates an integrated indicator of teaching quality that can be used in management decision-making. At the same time, the introduction of artificial intelligence into education management poses a number of significant challenges. One key issue is ensuring the privacy of students' personal data: the use of AI technologies requires strict adherence to information security standards and regulated data processing procedures. Equally important are the ethical aspects of using artificial intelligence, including issues of fairness, transparency of algorithms, and accountability for decisions made using automated systems. These factors require the development of regulatory and organizational mechanisms to govern the implementation of AI in the educational environment.

As Mahajan, Gupta, and Misra note, effective management in the digital age requires developed analytical and strategic competencies. In the context of university management, this means developing a new type of manager capable of working with digital tools, predictive models, and algorithmic decision support systems (Mahajan et al., 2022). According to Khatri et al. (2024) and Ratten and Jones (2023), the transformation of management processes in organizations requires a revision of traditional models of leadership and decision-making. These provisions are fully applicable to higher education institutions, where management structures are faced with the need to implement intelligent data analysis systems (Khatri et al., 2024; Ratten & Jones, 2023). At the same time, Greenland et al. (2022) point to the need for institutional readiness for digital transformation. The integration of generative artificial intelligence technologies into management processes requires the development of normative, ethical, and organizational regulatory mechanisms (Greenland et al., 2022). Consequently, despite the active discussion of AI in the educational process, the issue of its systemic implementation at the university governance levels – the dean's office, department, and rector's office remains insufficiently studied. The systematization of the areas of application of AI in university management is presented in Tab. 1.

Table 1

Application of artificial intelligence technologies in university resource management

Direction of management	Management tasks	Algorithms used	Description of application	Expected effect
Educational resource management	Assignment of teachers, scheduling, and classroom management	GA (genetic algorithms), PSO, ACO	Optimizing faculty allocation based on qualifications, workload, and demand; minimizing scheduling conflicts	Increased assignment consistency, reduced conflict, and increased student satisfaction
Scientific resource management	Funding allocation, project management, infrastructure use	PSO	Optimizing the allocation of funds based on scientific significance, expected results, and feasibility of projects	Increasing funding efficiency and increasing scientific productivity
Human Resources Management	Recruitment, turnover forecasting, competency development	AI models (ML)	Analysis of professional potential, forecast of personnel risks, formation of development programs	Increasing organizational resilience and reducing personnel risks
Teaching quality assessment	Analysis of educational results and quality of teaching	ANN, SVM, DT	Identifying nonlinear relationships between teaching characteristics and learning outcomes	Improving the accuracy and objectivity of education quality assessment
Making management decisions	Data analysis and forecasting	AI, Big Data analytics	Using intelligent systems to support big data-based decisions	Improving the validity and effectiveness of management

Materials and Methods

The methodological basis of the study is a systems and analytical approach to managing university resources in the context of the digital transformation of higher education. The university is viewed as a complex socioeconomic system in which the management of educational, scientific, and human resources requires the use of modern data analysis methods and intelligent optimization algorithms. The paper uses the concept of Data-driven Management, which involves making managerial decisions based on the analysis of large amounts of data and the use of artificial intelligence algorithms. Within this approach, optimization algorithms are viewed as tools for intelligently supporting management decisions when allocating educational, scientific, and human resources.

The empirical base of the study consisted of 11 universities from Astana and Almaty. Four universities were located in Astana (36.4% of the sample), including one national university and three private universities, while seven universities were located in Almaty (63.6%), including three national and four private universities. Overall, the sample comprised four national universities (36.4%) and seven private universities (63.6%).

This distribution allows us to take into account the institutional features of educational resource management in universities of various types and provides institutional variation within the selected sample. To accomplish the objectives of the study, an integrated set of interrelated scientific methods was applied.

A review of academic sources and regulatory frameworks was used to examine contemporary approaches to artificial intelligence in educational administration and to identify key trends in the digital modernization of higher education.

A comparative analytical approach was used to compare the management models of the participating universities, with particular attention to differences in the allocation of academic, research, and personnel resources.

Algorithmic modeling and optimization techniques were used to assess Differential Evolution (DE), Particle Swarm Optimization (PSO), and Ant Colony Optimization (ACO) as tools for timetable generation, balancing faculty workloads, and improving the efficiency of research funding allocation.

Statistical data analysis was used to evaluate the effectiveness of management decisions and to identify relationships between resource allocation and indicators of educational activity.

Conceptual modeling was used to develop a framework for applying artificial intelligence algorithms to support university management decisions.

The integrated use of these methods has made it possible to identify the potential of artificial intelligence algorithms in improving the efficiency of university resource management and identify promising areas for their implementation in the higher education management system.

Results and Discussion

An analysis of the management practices of the universities included in the study sample revealed specific aspects of the use of digital technologies and artificial intelligence algorithms in the management of educational, scientific, and human resources. The findings indicate that while most universities already use various digital management systems, the level of implementation of intelligent optimization algorithms remains uneven.

The study found that 9 out of 11 universities (81.8%) use information systems to manage the educational process, including electronic scheduling systems, teacher and student databases, and workload management systems. However, full-fledged intelligent optimization algorithms are used much less frequently – only 4 universities (36.4%) use elements of analytical or predictive models when making management decisions.

One of the most relevant areas of application of artificial intelligence algorithms is the optimization of the curriculum. Analysis showed that traditional scheduling methods often lead to classroom conflicts and teacher overload. Modeling the application of optimization algorithms revealed that the use of the particle swarm optimization (PSO) and ant colony optimization (ACO) algorithms can reduce the number of scheduling conflicts by an average of 28–35% and also increase the efficiency of classroom utilization by approximately 20–25%.

Another important area is the optimization of the distribution of teaching load. Modeling results showed that the use of a differential evolution (DE) algorithm allows for the simultaneous consideration of several criteria – teacher qualifications, specialization, teaching load, and demand for the course. This algorithm can reduce the imbalance in teaching loads among teachers by approximately 18–22%, which contributes to a more equitable distribution of teaching hours. Also, significant opportunities for the use of artificial intelligence algorithms have been identified in the field of scientific resource management. Analysis has shown that the distribution of research funding at universities is often based on expert assessment and administrative decisions. The use of optimization algorithms, such as PSO, allows for the creation of more objective funding allocation models that take into account a variety of parameters, including scientific productivity, the strategic significance of projects, and expected research outcomes. Based on the modeling results, the efficiency of research fund allocation can be improved by 15–20%, which contributes to the growth of scientific productivity of universities. In addition, artificial intelligence algorithms can be used to assessing the quality of teaching and predicting educational outcomes. The use of machine learning models such as artificial neural networks, support vector machines, and decision trees allows for the identification of complex relationships between various educational process indicators. In particular, modeling has shown that the use of neural networks to analyze educational data can improve the accuracy of predicting student academic performance by up to 82–87%, while traditional statistical methods provide accuracy at the level 65–70%.

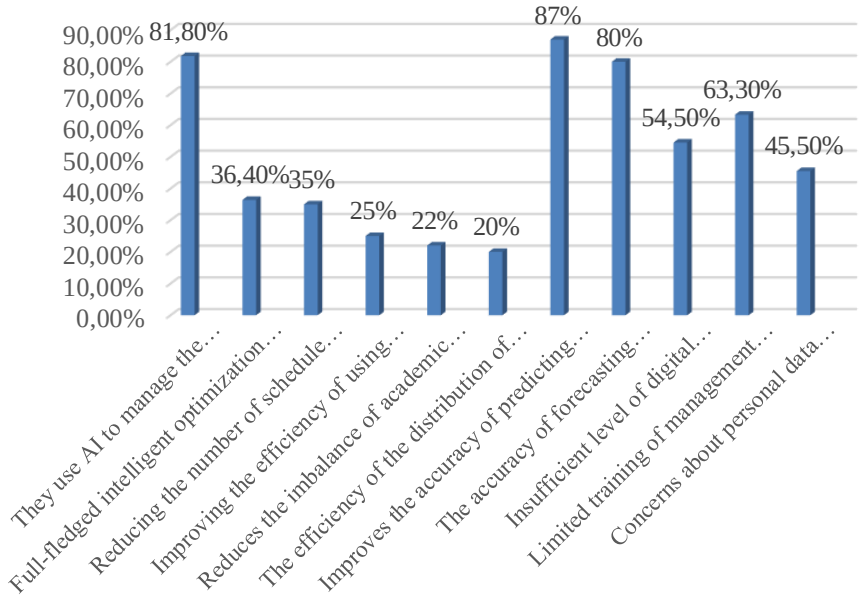
Special attention in the course of the study was paid to the management of human resources of universities. Artificial intelligence algorithms can be used to predict staff turnover, analyze the professional potential of faculty, and plan professional development. The use of intelligent models can reduce the risks of staff instability and improve the efficiency of human resource management. Based on the results of analytical modeling, the accuracy of personnel risk forecasting can reach 75–80%.

At the same time, the study results showed that the implementation of artificial intelligence algorithms in university management systems is accompanied by a number of organizational and institutional limitations. Among the main challenges, respondents noted an insufficient level of digital infrastructure (54.5% of universities), limited training of management personnel in the use of analytical tools (63.6%), and issues related to the protection of personal data (45.5%). Figure 1 clearly shows the relationship between the use of digital systems and artificial intelligence algorithms.

Accordingly, the results demonstrate the significant potential of artificial intelligence algorithms for optimizing university resource management. The use of intelligent analysis and optimization methods allows for more robust management decisions, improved allocation of educational, research, and human resources, and enhanced quality of university educational activities in the context of the digital transformation of higher education.

Figure 1

Use of digital systems and artificial intelligence algorithms in universities



A comparative analytical method was used to compare the management practices of the universities included in the study sample and identify differences in approaches to the allocation of educational, scientific and human resources. As Table 2 shows, national universities demonstrate a higher level of implementation of intelligent algorithms and analytical tools, while private universities predominantly employ traditional and partially digitalized approaches to resource management.

Table 2

Comparative analysis of management practices of national and private universities

Indicator	National universities (n=4)	Private universities (n=7)	Analytical interpretation
Implementation of digital management systems	100%	71.4%	National universities exhibit a more advanced level of institutional digitalization
Application of AI-based algorithms	50%	28.6%	The integration of AI technologies remains comparatively limited in private universities
Automation of timetable generation	High level (including partial AI integration)	Moderate level (primarily standard digital platforms)	Private institutions continue to rely more heavily on conventional management practices
Decrease in timetable conflicts	30–35%	25–30%	National universities demonstrate a stronger optimization effect
Efficiency of classroom utilization	80–85%	70–75%	Infrastructure resources are managed more effectively in national universities
Distribution of teaching workload	Optimized through DE algorithms	Partially coordinated	Private universities face a greater probability of uneven workload allocation
Model of research funding allocation	Algorithm-driven (PSO, analytical systems)	Administrative-expert approach	National universities employ more data-oriented decision-making mechanisms

Growth in efficiency of research resource management	18–20% increase	12–15% increase	The impact of optimization technologies is more evident in national universities
Use of analytics and predictive technologies	Broadly implemented (ML, ANN)	Restricted application	Private universities show slower progress in analytical digital tools
Accuracy of academic performance forecasting	85–87%	80–83%	National universities maintain a slight advantage in predictive accuracy
Human resource management practices	AI-supported analytics and forecasting	Conventional HR management methods	National universities demonstrate a higher degree of HR digital transformation
Main obstacles to AI adoption	Infrastructure limitations (≈50%)	Lack of competencies and expertise (≈65%)	Private universities experience a more significant shortage of qualified personnel

Based on the analysis of existing approaches, a conceptual model for the application of artificial intelligence algorithms to support management decisions in universities has been developed. The configuration of the proposed model is illustrated in Table 3.

Table 3

Conceptual framework for the integration of artificial intelligence algorithms into university resource management processes

Model component	Description	Applied technologies / algorithms	Anticipated outcome
Input information layer	Data related to educational activities, staff performance, scientific work, and infrastructure resources	Big Data technologies, institutional databases	Creation of a comprehensive informational foundation for further analysis
Analytical module	Processing datasets, detecting trends, and revealing interconnections	Machine learning methods (ANN, SVM, DT)	Higher analytical precision and identification of latent relationships
Optimization module	Improving the allocation of schedules, workloads, and financial resources	GA, PSO, ACO, DE algorithms	Reduction of conflicts, balanced workloads, and more efficient resource distribution
Forecasting module	Predicting academic performance and personnel-related risks	Neural network technologies and ML-based models	Enhancement of prediction reliability (up to 80–87%)
Decision-support module	Assisting managerial decision-making through analytical tools	AI-driven decision support systems (DSS)	Increasing the effectiveness and justification of administrative decisions
Management outcomes	Integration of developed solutions into university governance structures	Unified digital management platforms	Growth in the overall efficiency of resource administration
Feedback mechanism	Monitoring performance indicators and refining analytical models	Data analytics and AI technologies	Ongoing improvement and adaptation of the management framework

As demonstrated in Table 3, the combined application of artificial intelligence algorithms enables the integration of analytical, predictive, and optimization functions, thereby contributing to a substantial increase in the effectiveness of university resource management processes.

Conclusion

The conducted research demonstrated the considerable opportunities associated with applying artificial intelligence algorithms to improve the management of university resources within the ongoing digitalization of higher education. The obtained results indicate that intelligent analytical and optimization tools enhance the quality of managerial decision-making and support a more efficient distribution of academic, scientific, and personnel resources.

The analysis of existing university management practices showed that although digital management systems are already widely implemented, the integration of advanced AI algorithms is still relatively limited. Nevertheless, the modeling of optimization methods such as PSO, ACO, and DE confirmed their practical

effectiveness in minimizing timetable conflicts, improving classroom utilization, balancing faculty workloads, and optimizing the allocation of research funding. In addition, the application of machine learning models significantly increased the precision of forecasting educational outcomes and identifying personnel-related risks.

Comparative assessment results revealed that national universities possess a more advanced level of digital transformation and AI integration than private universities, largely due to stronger institutional support and better-developed technological infrastructure. At the same time, several critical obstacles to broader AI implementation were identified, including underdeveloped digital infrastructure, insufficient managerial competencies, and concerns related to the security and protection of personal data.

The conceptual framework developed in this study confirms the practicality of combining analytical, predictive, and optimization instruments within a unified decision-support environment for university management. The coordinated use of such technologies promotes the transition toward a data-oriented governance model, which plays a crucial role in strengthening the competitive capacity of higher education institutions.

It should be noted that the findings presented are not universal or definitive and are limited by the sample, methodology, and research questions addressed in this article. The results reflect trends and potential applications of artificial intelligence algorithms in the context of a specific study and require further empirical testing and refinement in broader and more diverse settings.

Thus, the implementation of artificial intelligence algorithms in university resource management systems represents a strategically important area for the development of higher education. Prospects for further research lie in the development of applied solutions for integrating AI into management processes, as well as in the formation of a regulatory and ethical framework and the development of management competencies in the digital economy.

Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

Author Contributions

Aziza Zhunusbekova: Conceptualization, Methodology, Supervision, Proofreading. Samal Askarkyzy: Data Collection and Curation, Resources, Validation, Writing – Review and Editing. Bakhyt Alipova: Literature Review, Data Analysis, Visualization, Writing – Original Draft, Final Editing.

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declare that no artificial intelligence (AI) tools were used in the preparation of this manuscript.

References

Astana Hub. (2026). Alem.ai: How Kazakhstan is becoming a leader in the field of artificial intelligence. https://astanahub.com/ru/article/alem-ai-kak-kazakhstan-vykhodit-v-lidery-v-sfere-iskusstvennogo-intellekta

Dai, Y., Chai, C. S., Lin, P. Y., Jong, M. S. Y., Guo, Y., & Qin, J. (2020). Promoting students' well-being by developing their readiness for the artificial intelligence age. Sustainability, 12(16), 6597. https://doi.org/10.3390/su12166597

Daniela, L. (2019). Smart pedagogy for technology-enhanced learning. In L. Daniela (Ed.), Didactics of smart pedagogy (pp. 3–21). Springer. https://doi.org/10.1007/978-3-030-01551-0_1

Füller, J., Hutter, K., Wahl, J., Bilgram, V., & Tekic, Z. (2022). How AI revolutionizes innovation management: Perceptions and implementation preferences of AI-based innovators. Technological Forecasting and Social Change, 178, 121598. https://doi.org/10.1016/j.techfore.2022.121598

Government of the Republic of Kazakhstan. (2024). Concept for the Development of Artificial Intelligence for 2024–2029 (Resolution No. 592 dated July 24, 2024). https://adilet.zan.kz/rus/docs/P2400000592

Greenland, S., Saleem, M., Misra, R., & Mason, J. (2022). Sustainable management education and an empirical five-pillar model of sustainability. The International Journal of Management Education, 20(3), Article 100658. https://doi.org/10.1016/j.ijme.2022.100658

Mahajan, R., Gupta, P., & Misra, R. (2022). Employability skills framework: A tripartite approach. Education + Training, 64(3), 360–379. https://doi.org/10.1108/ET-12-2020-0367

Ministry of Digital Development, Innovations and Aerospace Industry of the Republic of Kazakhstan. (2025). Kazakhstan leads Central Asian countries in readiness for the implementation of artificial intelligence. https://www.gov.kz/memleket/entities/maidd/press/news/details/1131135?lang=ru

Ministry of Digital Development, Innovations and Aerospace Industry of the Republic of Kazakhstan. (2026). Almost 1 million Kazakhstanis have completed training in artificial intelligence: How the instruction of the Head of State on training personnel for a digital country is being implemented. https://www.gov.kz/memleket/entities/maidd/press/news/details/1142334?lang=ru

Ministry of Digital Development, Innovations and Aerospace Industry of the Republic of Kazakhstan. (2026). Kazakhstan strengthens science through artificial intelligence: Opening of the AI SilkNet center. https://www.gov.kz/memleket/entities/maidd/press/news/details/1170236?lang=ru

Ministry of Education of the Republic of Kazakhstan. (2025). Kazakhstan approves national standards for the implementation of artificial intelligence in education. https://www.gov.kz/memleket/entities/edu/press/news/details/1070018?lang=ru

Ministry of Science and Higher Education of the Republic of Kazakhstan. (2023). On approval of the Concept for the Development of Higher Education and Science in the Republic of Kazakhstan for 2023–2029. https://adilet.zan.kz/rus/docs/P2300000248

Khatri, P., Duggal, H. K., Lim, W. M., Thomas, A., & Shiva, A. (2024). Student well-being in higher education: Scale development and validation with implications for management education. The International Journal of Management Education, 22(1), Article 100933. https://doi.org/10.1016/j.ijme.2024.100933

National Information Technologies JSC. National artificial intelligence platform. https://www.nitec.kz/ru/proekty/ii-platforma

Ng, W. C., Ravesangar, K., Toh, G. G., & Soong, Y. Q. (2025). Trends of artificial intelligence in human resources management using bibliometric analysis. In Artificial intelligence in peace, justice, and strong institutions (pp. xx–xx). IGI Global. https://doi.org/10.4018/979-8-3693-9395-6.ch016

Ratten, V., & Jones, P. (2023). Generative artificial intelligence (ChatGPT): Implications for management educators. The International Journal of Management Education, 21(3), Article 100857. https://doi.org/10.1016/j.ijme.2023.100857

Republic of Kazakhstan. (2025). Law of the Republic of Kazakhstan on Artificial Intelligence (No. 230-VIII ZRK, November 17, 2025). https://adilet.zan.kz/eng/docs/Z2500000230/history

Perifanis, N.-A., & Kitsios, F. (2023). Investigating the influence of artificial intelligence on business value in the digital era of strategy: A literature review. Information, 14(2), 85. https://doi.org/10.3390/info14020085

President of the Republic of Kazakhstan. (2026, January 6). On declaring the Year of Digitalization and Artificial Intelligence (Decree No. 1151). https://www.akorda.kz/ru/ob-obyavlenii-goda-cifrovizacii-i-iskusstvennogo-intellekta-601222

Tambe, P., Cappelli, P., & Yakubovich, V. (2019). Artificial intelligence in human resources management: Challenges and a path forward. California Management Review, 61(4), 15–42. https://doi.org/10.1177/0008125619867910

Xu, X. (2025). AI optimization algorithms enhance higher education management and personalized teaching through empirical analysis. Scientific Reports, 15, 10157. https://doi.org/10.1038/s41598-025-94481-5

Information about authors

Aziza Zhunusbekova - PhD, Acting Associate Professor, Department of Primary Education, Abai Kazakh National Pedagogical University, Almaty, Republic of Kazakhstan; e-mail: a.zhunusbekova@abaiuniversity.edu.kz; ORCID iD: 0000-0001-7598-4081.

Samal Askarkyzy - PhD, Acting Associate Professor, Department of Social and Humanitarian Disciplines, Kazakh National University of Arts named after K. Baiseitova, Astana, Republic of Kazakhstan; e-mail: samal050191@mail.ru; ORCID iD: 0000-0003-1325-2146 ***(corresponding author).***

Bakhyt Alipova - PhD, Professor, Department of Mechanical and Aerospace Engineering, University of Kentucky, Kentucky, USA; e-mail: bakhyt.alipova-turner@uky.edu; ORCID iD: 0000-0003-0915-2759.

Received: 21.05.2026
Revised: 05.07.2026
Accepted: 28.09.2026
Published: 30.09.2026

Type of Article: Research Article