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Prospects for the application of artificial intelligence to address workforce shortages in Kazakhstan's transport and logistics sector

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Abstract. Kazakhstan's transport and logistics sector are rapidly growing, but workforce shortages are hindering its efficiency and competitiveness. Implementing artificial intelligence can optimize logistics processes and help address the labor deficit. This article explores the prospects of using artificial intelligence to address the workforce shortage in Kazakhstan's transport and logistics sector. AI-driven solutions in personnel selection, automation of logistics processes, and employee training can significantly enhance industry efficiency. Implementing these technologies will help mitigate workforce shortages and improve the quality of logistics services.

Keywords: *artificial intelligence, transport logistics, workforce shortage, automation, digital technologies, personnel selection, logistics efficiency, intelligent systems.*

1. Introduction

The transport and logistics complex of Kazakhstan has considerable potential, which is driven by several key factors. First and foremost is the country's advantageous geographic location, enabling it to serve as a vital transit hub between Europe and Asia. In addition, Kazakhstan, as a country with a well-developed resource-based economy, has a constant need for reliable and efficient transport corridors to export its products. It is also worth noting that the country possesses one of the longest railway networks in the CIS — approximately 16.6 thousand kilometers — while the total length of its roads exceeds 96.2 thousand kilometers [1]. The most important logistics hubs supporting international transport and trade connections are the dry port "Khorgos – Eastern Gate" and the seaport of Aktau, which plays a key role in cargo transportation across the Caspian Sea.

In 2022, the Concept for the Development of the Transport and Logistics Potential of the Republic of Kazakhstan until 2030 was adopted [2]. The strategic goal of the Concept is to stimulate the country's economic growth and improve the quality of life of its citizens through the development of accessible, efficient, and safe transport and logistics services. Over the past three decades, about 2.5 thousand kilometers of railways have been built, and now the government plans to construct over 1.3 thousand kilometers of new railway lines within three to four years. The development of logistics infrastructure is viewed as one of the key factors capable of driving the country's economic growth. One example is the construction of the Bakhty–Ayagoz railway line, which began in 2023. This project, aimed at strengthening ties with China, is expected to significantly increase the throughput capacity of routes between the two countries — from 28 to 48 million tons of cargo per year, effectively doubling the current transportation volume. Kazakhstan has set a strategic goal to become one of the most important international transport and transit hubs, playing a significant role in global logistics [3].

As the transport and logistics complex continues to develop, the demand for qualified specialists is becoming increasingly acute. Industry representatives are increasingly pointing to a workforce shortage that is already affecting the stability of the sector's operations. According to data from the Ministry of Transport of the Republic of Kazakhstan for 2024, the shortage of specialists in the transport sector amounts to approximately 13,800 people [4]. At the same time, by the end of 2023, the number of students enrolled in logistics and transportation-related programs did not exceed 2,500. This indicates that training new personnel alone will not solve the problem, as the current educational capacity cannot meet the short-term needs of a rapidly growing industry. Therefore, it is necessary to explore alternative ways to address the labor shortage by employing comprehensive measures and modernizing workforce management approaches.

The prospects of applying artificial intelligence (AI) in logistics have been examined by Khoroshilova T.N. and Sharan K.N., while its use in workforce management has been discussed by Nonka A.Yu. and Borisova A.A. The goal of this study is to identify solutions to the workforce shortage in Kazakhstan's transport and logistics complex.

The growth of Kazakhstan's transport and logistics sector makes the problem of staffing shortages even more pressing. Each year, the volume of cargo transportation increases, requiring a larger number of qualified specialists to manage logistics processes, coordinate multimodal transport, and work with digital solutions in transport infrastructure. For example, since 2010, the freight turnover on railway transport has been growing annually, and a similar trend is observed across all types of transport. This inevitably leads

to increased pressure on the transport infrastructure (Figure 1). In this context, it is especially important to develop tools that can reduce the burden on infrastructure, enhance operational efficiency, and ensure the rational use of resources [5].

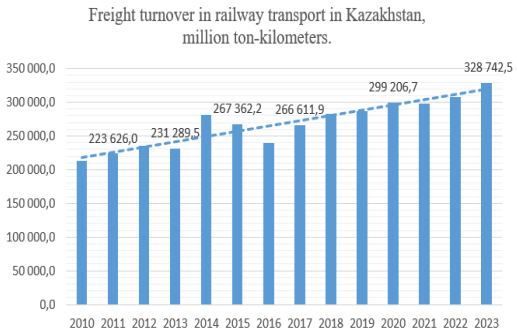

Figure 1. Graph of increase in load on transport infrastructure

2. Materials and methods

Since the mid-20th century, scientists have been actively engaged in the development of artificial intelligence (AI) aimed at easing human labor by optimizing work processes, automating routine tasks, increasing forecasting accuracy, and reducing costs. The rapid advancement of this scientific field in recent years has made it possible not only to discuss AI's potential capabilities but also to successfully implement it to improve efficiency and automate various areas of activity. Today, the integration of artificial intelligence into Kazakhstan's transport and logistics complex is viewed as one of the most promising solutions to the problem of workforce shortages. Compared to traditional tools, AI offers advantages such as autonomy, high precision, the ability to minimize errors, and significantly faster execution of work processes. Moreover, AI not only reduces the industry's dependence on the human factor but also adapts to real-time changes, ensuring flexibility and resilience in logistics operations — making it an indispensable tool in the transport and logistics complex (TLC).

Considering all these advantages, it becomes evident that the use of artificial intelligence can not only compensate for personnel shortages but also significantly enhance the performance of Kazakhstan's transport and logistics complex. However, in order to fully unlock AI's potential, its implementation must be directed at addressing the key challenges in workforce management. In this context, three main areas can be identified where artificial intelligence will have the greatest impact: optimization of recruitment and personnel management processes, automation of logistics operations, and improvement of workforce qualifications.

3. Results and discussion

The automation of logistics processes through artificial intelligence (AI) has long been a subject of discussion among industry experts, as it could help address the workforce shortage in logistics by automating operations and making more efficient use of available personnel. In 2023, in an interview with Forbes.kz, Anuar Akhmetzhanov, Deputy Chairman of the Board for Strategy and Digitalization at JSC «NC Kazakhstan Temir Zholy», noted that the automation of the documentation process for domestic freight transport reduced the time required for shipment approval by a factor of 15 — from 11 hours to just 5 minutes — and cut the time for redirection requests from two days to one hour [6]. These improvements were made possible through the implementation of digital technologies, and further use of AI is expected to enhance system efficiency even more, setting a new standard for the entire logistics industry. Artificial intelligence plays a crucial role in modernizing logistics by increasing efficiency, reducing costs, and improving customer service quality.

A notable example of successful AI implementation in logistics is the collaboration between McKinsey and ECU Worldwide. As part of a digital transformation initiative, the ECU360 platform was developed, allowing for the automation of complex logistics operations, real-time decision-making, and instant pricing. The use of AI in this system significantly boosted operational efficiency, reduced data processing time, and improved the company's flexibility in adapting to market changes. According to McKinsey, integrating AI into supply chain management improves demand forecast accuracy by 10–20%, which leads to a 5% reduction in storage costs and a 2–3% increase in revenue [7].

One of the most advanced AI-based solutions is Mobe3 — a warehouse management system (WMS) that combines a user-friendly iOS interface with neural network capabilities to enhance the efficiency of warehouse document management. This system can simulate various warehouse operation scenarios, compare their performance indicators, and determine the most productive strategies. With such functionality, companies can design new warehouse complexes, optimize existing logistics processes, adapt order-picking methods, and boost workforce efficiency during peak loads. Mobe3 is highly flexible and can adapt to the specific needs of any warehouse, easily integrating with leading ERP systems such as Microsoft Dynamics GP, Sage 500, and Infor CloudSuite [8]. In real time, the system analyzes key warehouse performance indicators and provides recommendations on optimizing labor use, storage space, and time resources, thereby improving the overall efficiency of logistics operations.

Thus, the integration of artificial intelligence into logistics processes not only increases overall operational efficiency but also reduces the burden on personnel by reallocating labor resources and automating routine tasks. This allows companies to make optimal use of their existing workforce, providing employees with more comfortable working conditions and enhancing productivity without the need for significant staff expansion.

However, in addition to the automation of logistics, the issue of recruitment and personnel management remains equally important, since even with the adoption of AI, qualified specialists continue to be a key link in the successful operation of the transport and logistics system. In this aspect, AI also plays a vital role by helping companies efficiently recruit talent, forecast staffing needs, and reduce employee turnover. One of the main challenges in addressing the labor shortage lies in the workload placed on HR departments. HR specialists deal with a large volume of routine tasks on a daily basis, which slows down the recruitment process. For example, a significant portion of an HR specialist's working day — up to 1.5 hours — may be spent simply responding to internal employee inquiries, with an equal amount of time used for communicating with potential candidates. Furthermore, the search for suitable

applicants itself demands a great deal of time and effort. As of today, the job portal hh.kz lists around 125,000 résumés under the category «Transportation, Logistics, Warehousing, Foreign Economic Activity», and HR professionals are physically unable to process such a volume of information promptly [9]. As a result, suitable candidates may be missed, further exacerbating the staffing issue.

Currently, AI technologies are widely used in neighboring Russia. Programs such as Skillaz, Potok, Sever, Friendwork, HR-bot HRom, Huntflow, and Robot Vera are utilized to optimize HR department processes, freeing up time for more strategic tasks and helping to address the workforce shortage (Table 1). For example, Skillaz assists in gathering suitable résumés based on the employer's request from all major Russian job websites, and then applies automated surveys or tests according to specified criteria. The Sever program incorporates video interview analysis processed by AI, which evaluates not only the candidate's knowledge on various topics but also their facial expressions. The Huntflow system does not assess the candidate directly, but helps collect résumés from targeted groups, presenting candidate data alongside each résumé, thus simplifying the search for suitable applicants. These tools, widely used in Russia, offer a broad range of capabilities that enhance the precision of recruitment and ensure higher-quality candidate selection. For instance, the HR-bot HRom evaluates job seekers even before a vacancy is presented to them [10]. It gathers data based on job search behavior and general online activity — even when the candidate is not actively seeking employment. These and other AI-driven programs make the recruitment process more efficient and faster, contributing to solving the staffing shortage problem.

While Russia is actively implementing AI-based solutions to optimize HR processes, Kazakhstan is also beginning to take initial steps in this direction. Local companies are starting to introduce technologies for automated recruitment and data analytics, adapting international experience to fit the specifics of the local market. The platform HireBee.kz offers HR specialists AI-powered tools that help save up to 38% of their time. The system operates using Big Data and AI, collecting information about applicants based on their activity within the platform and from their résumés. A distinctive feature of the platform is its integration with social media, which enables it to track user activity and thus match them with the most relevant job openings. The use of such platforms in HR departments will significantly reduce the workforce shortage in Kazakhstan's transport and logistics complex, as recruitment will become more cost-effective thanks to the efficiency of AI-powered search tools.

As previously noted, the job portal hh.kz hosts approximately 125,000 résumés, making the recruitment process more complex. At the same time, the number of job openings for the same period stands at 45,000, meaning there are on average three applicants for each position. Yet despite this, even with thorough résumé screening, not all vacancies are being filled. This raises the question: why, with such a large number of candidates, does the labor market continue to face a workforce shortage?

Employers increasingly cite the shortage of qualified specialists as one of the most pressing issues in the transport and logistics sector. Even with a large number of applicants, finding truly suitable candidates for vacant positions remains challenging. As mentioned earlier, the education system is not always capable of promptly supplying the labor market with a sufficient number of trained professionals. In such circumstances, the most effective solution is to upskill existing employees and attract new personnel to fill their roles, which allows the workforce shortage to be addressed without compromising productivity.

The integration of artificial intelligence into educational programs makes this process more accessible and efficient, as AI helps eliminate several shortcomings of traditional learning. Classical training courses often lack adaptability to the individual needs of learners, follow rigid schedules, and offer limited opportunities for personalization. AI resolves these issues by tailoring learning materials to each employee's knowledge level, ensuring flexible training and providing personalized learning paths. For instance, the Fast.ai platform already uses AI to customize educational programs according to the specific needs of learners, making the training process more targeted and effective. By integrating AI-driven educational platforms into their training systems, Kazakhstani companies can significantly improve employee qualifications and quickly fill vacancies that require high levels of expertise.

Table 1. Programs for optimizing HR processes

Service Name	Functions	Additional features	Application area
Skillaz	Automated candidate selection, résumé analysis, video interviews	In-depth soft skills analysis, CRM integration	Large enterprises, retail, banking
Potok	Recruitment automation, candidate selection via AI algorithms	AI adaptation to company-specific needs	Tech companies, startups
Sever	Facial expression and speech analysis during interviews	Identification of candidates' emotions and honesty	Manufacturing enterprises, logistics
Friendwork	Cloud-based HR management system, recruitment automation	Multichannel hiring support, AI analytics	Medium and large businesses
HR-robot HRom	Candidate diagnostics, analysis of their online behavior	Identification of candidates' hidden traits	HR agencies, recruiting companies
Huntflow	Recruitment optimization, candidate analytics	Interactive personnel selection, AI-driven analytics	Corporate HR departments
Robot Vera	Robotized interviewing, automated candidate screening	Voice synthesis, dialog-based interviewing	Government agencies, banks, IT companies
HireBee.kz	Recruitment automation and labor market analytics in Kazakhstan	Support for the Kazakhstani market, integration with local services	Kazakhstan's labor market, HR agencies
Fast.ai	Training AI algorithms for HR and analytics	Flexible AI training configuration, AI development in the HR field	International online education, AI courses

4. Conclusions

An effective way to address the workforce shortage in Kazakhstan's transport and logistics complex is through the use of artificial intelligence technologies. The key areas of

their application in the transport and logistics sector include the optimization of recruitment and personnel management processes, automation of logistics operations, and enhancement of workforce qualifications.

It is recommended, first, to implement digital human resource management systems that automate hiring and personnel evaluation processes. Second, it is important to develop intelligent logistics solutions that optimize routing and reduce costs. Third, a system of continuous learning should be established using AI platforms to improve employee qualifications.

The experience of other countries shows that the adoption of AI not only accelerates recruitment and minimizes costs but also improves the quality of specialist training. Kazakhstan is already taking its first steps in this direction by introducing AI technologies to tackle staffing challenges. The development of AI-based solutions in the HR field and the active integration of advanced technologies in education can form the foundation for overcoming the industry's workforce crisis. Following these approaches will not only allow for effective vacancy fulfillment but also increase the overall competitiveness of the country's logistics system.

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Қазақстанның көлік-логистикалық кешенінде кадр тапшылығын шешуде жасанды интеллектті қолдану перспективалары

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Аңдатпа. Қазақстанның көлік-логистикалық саласы қарқынды дамып келеді, алайда кадр тапшылығы оның тиімділігі мен бәсекеге қабілеттілігін төмендетуде. Жасанды интеллектті енгізу логистикалық процестерді оңтайландыруға және жұмыс күшінің тапшылығын азайтуға мүмкіндік береді. Бұл мақалада Қазақстанның көлік-логистикалық кешенінде кадр тапшылығын шешуде жасанды интеллектті қолданудың болашағы қарастырылады. Жасанды интеллект қызметкерлерді іріктеу, логистикалық процестерді автоматтандыру және мамандардың біліктілігін арттыру сияқты негізгі бағыттарда тиімділікті арттыруға мүмкіндік береді. Тиісті технологияларды енгізу саладағы кадрлық мәселелерді азайтып, логистикалық қызметтердің сапасын жақсартуға ықпал етеді.

Негізгі сөздер: *жасанды интеллект, көлік логистикасы, кадр тапшылығы, автоматтандыру, цифрлық технологиялар, қызметкерлерді іріктеу, логистикалық тиімділік, интеллектуалды жүйелер*.

Перспективы применения искусственного интеллекта для решения кадрового дефицита в транспортно-логистическом комплексе Казахстана

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Аннотация. Транспортно-логистическая отрасль Казахстана активно развивается, однако нехватка кадров снижает ее эффективность и конкурентоспособность. Внедрение искусственного интеллекта позволит оптимизировать логистические процессы и сократить дефицит рабочей силы. В статье рассматриваются перспективы использования искусственного интеллекта для решения кадрового дефицита в транспортно-логистическом комплексе Казахстана. Применение ИИ в подборе персонала, автоматизации логистических процессов и повышении квалификации сотрудников позволяет повысить эффективность отрасли. Внедрение данных технологий способствует снижению кадрового дефицита и повышению качества логистических услуг.

Ключевые слова: *искусственный интеллект, транспортная логистика, кадровый дефицит, автоматизация, цифровые технологии, подбор персонала, логистическая эффективность, интеллектуальные системы*.

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