10.63550/ICEIP.2026.33.56.027

Adaptation of Artificial Intelligence Methods for Human Resource Management in Ground Transportation Organizations

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Keywords: Artificial Intelligence, Human Resource Management, Ground Transportation, Digitalization, Forecasting, Neural Networks, Machine Learning, HR Analytics.

Abstract: This paper examines the adaptation of artificial intelligence (AI) methods for human resource management in ground transportation organizations. Digitalization in the transport sector has increased the complexity of HR tasks, including recruitment, training, motivation, and retention of employees. Traditional HR approaches are often insufficient to address challenges such as high staff turnover, rising training costs, and strict safety regulations. The paper clarifies the classification of AI methods applied to HR systems, including machine learning, neural networks, expert systems, frame-based technologies, and fuzzy logic. An author's model of HR management using AI is proposed, integrating recruitment, training, motivation, and monitoring processes. Furthermore, an economic forecasting model based on ROI evaluation is developed to assess the feasibility of AI implementation under baseline, optimistic, and pessimistic scenarios. The findings demonstrate that AI contributes to cost reduction, productivity growth, and improved safety, while also enhancing the resilience of transport systems. The results confirm the practical significance of AI-driven HR digitalization for the strategic development of ground transportation organizations.

1 INTRODUCTION

Digitalization of the transport industry is accompanied by increasing complexity in human resource management tasks. With the growth of passenger traffic, the expansion of ground transportation networks, and the need to ensure uninterrupted operations, the issues of recruitment, training, and employee retention become particularly significant. Traditional HR management methods, based on statistics and expert assessments, are often insufficient to address contemporary challenges such as high staff turnover, rising costs of specialist training, and the need for flexible adaptation of work schedules. Digitalization of the transport sector is aligned with the national AI development strategy in Russia (Galikeeva and Farkhiyeva, 2021).

One of the promising tools for addressing these challenges is artificial intelligence (AI). In recent years, AI has been actively integrated into human resource management, enabling automation of routine processes, prediction of employee turnover, development of personalized learning pathways, and analysis of staff engagement. In transportation organizations, this trend acquires a specific character: the key factors include strict safety requirements, rigid regulation of work and rest schedules, as well as high social responsibility. Today, in the railway sector, AI is already applied for labor standardization and production process analysis, which has reduced employees' time expenditures by nearly 40%.

Foreign research also confirms the effectiveness of AI implementation in transport and logistics. For example, McKinsey analysts show that the use of intelligent algorithms in workforce planning improves the accuracy of personnel demand

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forecasting and reduces operational costs by 15–20%. This opens opportunities for developing new HR management models, in which AI does not replace humans but serves as a tool for enhancing the quality of decision-making (Amar et al., 2024).

The purpose of this article is to identify the features of adapting artificial intelligence methods for human resource management in ground transportation organizations and to develop an original model of their application that accounts for industry-specific risks and social factors.

2 THEORETICAL FOUNDATIONS AND MODELS

2.1 Theoretical foundations of AI application in HR-management

Artificial intelligence (AI) is regarded as a key technology of the 21st century, which has found broad application in human resource management. Its use enables not only the automation of routine tasks but also the improvement of managerial decision-making accuracy through the analysis of large-scale data, forecasting of personnel-related risks, and the creation of personalized career development pathways. AI is considered a key technology in HR systems, enabling automation and predictive analytics (Kretov et al., 2024; Nareyko, 2023; Budhwar et al., 2023). Digital HR analytics and AI-based workforce management have been increasingly adopted in transport companies (Nareyko, 2023).

Researchers identify several key areas of AI application in HR systems:

- automation of routine processes – processing resumes, matching candidate profiles with job requirements, and creating shift schedules. This frees HR professionals to focus on strategic tasks.
- analytics and forecasting – identifying patterns in employee behavior, predicting staff turnover, and determining workforce demand.
- onboarding and training – personalized digital platforms utilizing machine learning algorithms to adapt new employees and accelerate the acquisition of professional competencies.
- monitoring performance and engagement – evaluation of KPIs, identification of employee strengths and weaknesses, and determination of factors contributing to motivation or burnout.
- succession planning – AI algorithms support the formation of talent pools and the identification of employees with high potential for managerial positions.

In the transportation sector, these directions acquire specific features. For example, in railway transport, AI is applied to labor standardization, workload analysis, and enhancement of transportation safety. The experience of Russian Railways (RZD) demonstrates that the use of computer vision systems and data processing technologies reduces employees' time spent on routine operations by nearly 40%, while simultaneously improving the accuracy of quality control.

International experience also highlights the importance of AI integration into HR processes within transportation and logistics companies. A McKinsey study indicates that the implementation of generative AI in workforce planning ensures more accurate forecasting of personnel demand, cost reduction, and a 15–20% increase in productivity through optimized allocation of human resources (Amar et al., 2024).

Thus, the theoretical foundations of AI application in HR emphasize its dual role: on the one hand, as a tool of automation that reduces the workload of specialists, and on the other, as an analytical system that enhances the strategic resilience of transportation organizations.

2.2 Classification and adaptation of AI methods for HR-systems in ground transportation

The application of artificial intelligence in human resource management within the ground transportation sector requires careful consideration of industry-specific factors: high social responsibility, strict labor and rest regulations, and the critical importance of transportation safety. To address these challenges, it is advisable to apply various AI methods adapted to HR processes.

Machine learning methods – enable the identification of patterns in large datasets on employees and allow the prediction of indicators such as staff turnover, work efficiency, and the probability of disciplinary violations. In the transport sector, such algorithms are applied to shift scheduling and employee allocation across routes, which helps reduce overwork risks and related safety issues.

Neural networks – are employed for analyzing employee competencies, assessing psychological states, and modeling behavioral scenarios in non-standard situations. In the railway industry, neural network algorithms are already used for video stream

processing and detecting violations in personnel activities.

Expert systems – represent knowledge bases that support HR specialists in decision-making concerning staff recruitment, talent pool formation, and career trajectory planning. Their application in transportation organizations makes it possible to consider not only formal criteria (experience, qualifications) but also industry-specific requirements, such as locomotive driver licensing.

Frame-based technologies – are applied to structure information on employee career trajectories and to model long-term workforce development scenarios. In the HR dimension of ground transportation, such models can be utilized to forecast managerial staff demand in line with infrastructure modernization plans.

Fuzzy logic methods – support decision-making under conditions of uncertainty and incomplete data, which is particularly important for shift planning under seasonal fluctuations in passenger traffic and force majeure circumstances. International transport companies demonstrate that the use of such algorithms in scheduling improves the accuracy of personnel allocation and reduces costs by 10–15%.

The results of the analysis make it possible to systematize the main AI methods according to the HR tasks relevant for transportation organizations (see Table 1).

Table 1: AI Methods and HR Tasks in Ground Transportation.

AI Method	HR Tasks	Application in Transport	Expected Effect
Machine Learning	Turnover prediction, performance analysis	Shift planning, workforce allocation	–10–15% staff turnover
Neural Networks	Competency analysis, psychological assessment	Monitoring of train drivers, video/audio analysis	+20% accuracy of evaluation
Expert Systems	Support for HR decision-making	Licensing, formation of talent pool	15% reduction in errors
Frame-Based Models	Career planning	Forecasting career trajectories	+10% employee retention
Fuzzy Logic	Planning under uncertainty	Scheduling under disruptions	–12% overwork

The systematization of these methods in relation to HR practices in ground transportation allows us to conclude that AI is not merely a tool for automation but also a foundation for shaping an intelligent human resource policy. Thus, the adaptation of AI methods should take into account both the technical capabilities of algorithms and the socio-economic characteristics of the transportation industry with strict requirements for work and rest regimes and the digitalization of station complexes (Nikonova and Proskuryakova, 2022).

2.3 Author's Model of Human Resource Management Using AI

For ground transportation organizations, the key task is to ensure the continuity of transport operations while simultaneously maintaining high standards of safety and passenger service quality. These requirements necessitate the establishment of an effective human resource management system that takes into account the specific features of the industry. Based on the analysis of domestic and international research, as well as on the materials of the author's dissertation study, a model of human resource management using artificial intelligence methods is proposed (see Figure 1).

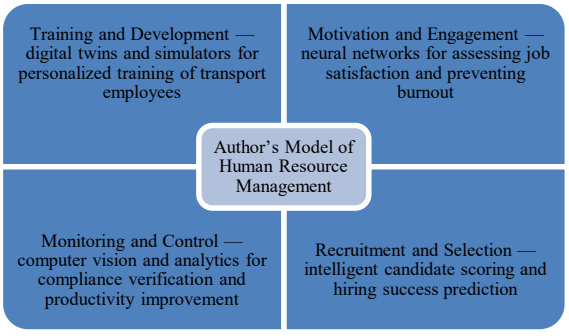

Figure 1: Author's Model of Human Resource Management Using AI.

The proposed model integrates both technical and social aspects of HR management. It does not replace the work of HR specialists but enhances their analytical capabilities, enabling more informed and timely decision-making. The novelty of the model lies in its adaptation to the conditions of ground transportation, where human resource management is associated not only with economic efficiency but also with ensuring the safety and resilience of the transportation process.

2.4 Model for Forecasting the Economic Efficiency of AI Implementation

The introduction of artificial intelligence technologies into human resource management in ground transportation must be accompanied by an assessment of their economic feasibility. For this purpose, the author's research proposes a forecasting model of efficiency based on the calculation of the Return on Investment (ROI) indicator and the analysis of AI's impact on key HR processes (see Figure 2).

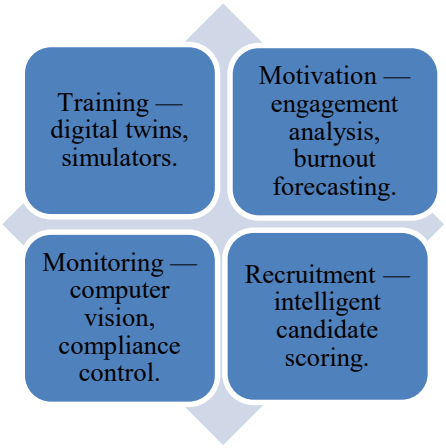

Figure 2: Model for Forecasting the Economic Efficiency of AI Implementation.

The reduction of recruitment costs is achieved through the automation of key stages of the hiring process — from initial resume parsing and entity extraction (experience, skills, certifications) to intelligent candidate scoring based on job profiles and historical hiring success data. Machine learning algorithms allow ranking applicant flows by the probability of successfully passing probation and predicting "time-to-productivity," which reduces "time-to-fill" and direct costs of vacancy closure. In the transportation sector, where prolonged understaffing leads to shift redistribution and penalties for schedule disruptions, the effect of accelerated recruitment translates into measurable savings. International reviews confirm that the application of AI tools in workforce planning and recruitment results in double-digit reductions of operating costs; in typical cases, savings of 15–20% are reported, alongside improved accuracy of workforce demand forecasting through the integration of discrete data sources (applications, schedules, seasonality, regulatory constraints) (Amar et al., 2024).

Implementation should be accompanied by bias controls and periodic recalibration of scoring models to prevent discrimination based on non-essential factors and to ensure compliance with labor legislation.

The reduction of staff turnover is achieved by shifting from reactive to predictive management: attrition models are built on data regarding work schedules, excess continuous work, insufficient recovery periods, productivity indicators, engagement signals, and results of internal surveys. Such early-warning models enable the precise identification of risk groups (e.g., new employees on intensive routes, crews with chronic overtime) and the timely application of retention measures: schedule adjustments, personalized training and career pathways, revised allowances, and mentorship. The economic effect is derived from reduced direct costs of repeated hiring and training, the mitigation of hidden costs from shift coverage "gaps," and the stabilization of service quality. In transportation and logistics practice, predictive analytics is combined with "day-of" management protocols — quick briefings and operational plan adjustments for the shift — which sustain operational resilience during demand spikes or unplanned absences (Amar et al., 2024).

The optimization of schedules and working time relies on an ensemble of methods: stochastic and robust planning, fuzzy logic for decision-making under incomplete data, and ML models for short- and medium-term workload forecasting. In ground transportation, beyond the usual constraints (qualification, skills, location), there are strict regulatory requirements for work/rest regimes, licensing, access to specific routes/lines, and reserve staff obligations. Intelligent schedulers account for absenteeism, passenger traffic seasonality, infrastructure maintenance windows, and weather factors, offering dynamic reallocations that minimize overtime and manage fatigue. This directly reduces

risks of errors and incidents, lowers compensation payments and penalties for non-compliance, and improves KPIs by reducing the "overtime rate," lowering the "fatigue risk index," and increasing the accuracy of demand coverage. Importantly, explainability mechanisms must be embedded: any automatic reassignments should be accompanied by transparent rationales for shift managers and trade unions.

The improvement of training efficiency is achieved through the use of digital twins and high-fidelity simulators of work situations. Personalized learning trajectories are built on competency profiles, error histories, and target roles (train driver, station duty officer, metro dispatcher). Simulators allow large-scale practice of rare but critical scenarios (emergency stops, communication failures, extreme weather conditions) without risks for passengers and infrastructure, while digital twins track progress and adapt content to employees' "weak spots." International practice in aviation and call centers shows reductions in onboarding time and face-to-face training costs of 10–15%, alongside increased skill retention thanks to spaced repetition and microlearning (Amar et al., 2024). For ground transportation, it is critical to legally define which skills can be validated through simulation and which require in-person certification, as well as to ensure compatibility of training systems with licensing and accreditation registries.

The reduction of time spent on routine operations is achieved through computer vision and intelligent data stream processing, which relieve the burden on technical and frontline staff. In the railway sector, automatic analysis of video and audio streams is already applied for labor standardization, compliance monitoring with technological protocols, and verification of key operations; this allows significant portions of working time previously spent on manual review and labeling to be reallocated. Industry publications report reductions in such time expenditures by up to 40%, while simultaneously improving the completeness and objectivity of monitoring (Stepanenko, 2024). When deploying such systems, it is important to standardize sensors and data formats, delineate zones of automatic vs. selective human control, and establish an appeals process for disputed incidents to sustain staff trust in AI systems. Further studies highlight AI as a factor of efficiency in railway operations (Bochegov and Mednikova, 2024).

Together, these elements form a closed loop of improvements: forecasts of workforce demand and attrition influence recruitment and training priorities; actual productivity and compliance data feed back into schedule planning; and the impact of changes (cost savings, reduced overtime, improved service quality) is quantitatively captured and drives the next iteration of the model. Such integration of analytics, operational protocols, and change management is particularly effective in large-scale ground transportation networks, where thousands of employees work across distributed locations and daily local decisions must align with safety and service objectives (Amar et al., 2024).

To assess the economic feasibility of AI implementation in HR, three implementation scenarios were modeled: baseline, optimistic, and pessimistic (see Table 2).

Table 2: Economic Effect of AI Implementation.

Scenario	ROI, %	Turnover Reduction, %	Time-to-Hire Reduction, %	Cost Reduction, %
Baseline	10–15	10	15	8
Optimistic	25–30	20	25	18
Pessimistic	<10	5	7	3

- Baseline scenario assumes partial automation of recruitment and monitoring; ROI between10–15%.
- Optimistic scenario implies comprehensive implementation of AI in recruitment, training, and monitoring; ROI up to 25–30%.
- Pessimistic scenario involves implementation without proper integration and staff training; ROI less than 10%.

The modeling results demonstrated that the introduction of AI has a positive impact on key HR metrics (see Table 3). This proves the practical significance of digitalizing HR processes.

Table 3: Impact of AI Implementation on HR Metrics.

HR Metric	Before Implementation	After AI Implementation	Change, %
Average Time-to-Hire (days)	45	34	–24
Employee Turnover (%)	22	17	–23
Employee Engagement (%)	62	70	+13
Productivity (index points)	100	114	+14

The implementation of AI clearly contributes to improving HR efficiency. The most notable effects are the reduction in time-to-hire (–24%) and the decrease in staff turnover (–23%). This confirms the practical significance of adapting AI for transportation companies. Big data and AI are seen as drivers of railway digitalization (Akimov, 2023).
Thus, the model for forecasting economic efficiency shows that the integration of AI into human resource management in ground transportation ensures not only higher productivity and cost reduction but also long-term advantages in strengthening the resilience and safety of transport operations. In rail, AI use cases increasingly target safety, on-time performance, and workforce optimization (UIC, 2024).

2.5 Scientific Novelty of the Study

The classification of artificial intelligence methods applied to human resource management in ground transportation organizations has been refined, taking into account industry-specific features (machine learning, neural networks, expert systems, frame-based technologies, fuzzy logic).

An author's model of HR management using AI has been developed, including blocks of recruitment, training, motivation, and employee monitoring, aimed at improving efficiency and reducing personnel-related risks.

A model for forecasting the economic efficiency of AI implementation in HR systems of transport enterprises has been proposed, enabling the assessment of return on investment (ROI) depending on the digitalization scenario.

The practical significance of AI application in ground transportation has been demonstrated, proving its role as a tool not only for improving labor productivity and reducing costs but also for enhancing the safety and resilience of the transportation process.

3 CONCLUSION

The application of artificial intelligence in human resource management in ground transportation opens broad opportunities for improving organizational efficiency, optimizing HR processes, and ensuring transport safety. The analysis of domestic and international research has shown that AI makes it possible to automate routine operations, forecast employee turnover, design individualized learning trajectories, and monitor compliance with labor regulations.

The author's proposed HR management model using AI integrates key HR processes and can be implemented in the practice of large transportation enterprises. In addition, the developed model for forecasting economic efficiency confirms that the digitalization of HR functions generates long-term economic benefits while reducing social risks.

Thus, the integration of AI into HR management in ground transportation should be regarded as a strategic direction for industry development, ensuring not only higher productivity and cost reduction but also improved resilience and safety of transport systems.

Future research may focus on testing the proposed model in specific ground transportation enterprises, such as metro systems, tram and trolleybus associations, and bus depots.

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REFERENCES

Kretov, M.V., Degtyareva, A.V., Shlyapina, M.V., 2024. Artificial intelligence in human resource management. In *Proceedings of the Samara Regional Student Scientific Conference*, pp. 64–65. Samara National Research University, Samara.

Stepanenko, D.Yu., 2024. Application of artificial intelligence in the railway industry. *Scientific Review*, 5, pp. 19–23.

Amar, J., Parikh, N., Arora, S., McConnell, S., Cornwall, T., Faucher, J., 2024. AI can transform workforce planning for travel and logistics companies. McKinsey & Company.

Bochegov, M.A., Mednikova, O.V., 2024. Artificial intelligence in the railway industry. *Problems of Science*, 4(85), pp. 7–12.

Akimov, A.E., 2023. Big data, artificial intelligence and cloud technologies: digitalization of railways. *Innovations and Investments*, 3, pp. 314–318.

Nikonova, Y.I., Proskuryakova, E.A., 2022. Digitalization of railway station complexes. *Innovative Transport Systems and Technologies*, 3, pp. 55–67.

Nareyko, V.G., 2023. Artificial intelligence in human resource management. *Dialogue*, 1, pp. 50–53.

Galikeeva, N.N., Farkhiyeva, S.A., 2021. On the national strategy for the development of artificial intelligence until 2030 in the Russian Federation and the federal project "Artificial Intelligence". *Modern School of Russia. Issues of Modernization*, 3-1, pp. 186–188.

Budhwar, P., Chowdhury, S., Nguyen, Q., 2023. Human resource management in the age of generative artificial intelligence. *Human Resource Management Journal*, 33(3), pp. 606–659.

International Union of Railways (UIC), 2024. The journey toward AI-enabled railway companies. URL: https://uic.org/com/IMG/pdf/uic_layout_web_05032024.pdf (accessed October 2025).