



Article

Advantages and Problems of Using Artificial Intelligence in Cost Accounting and Their Optimization in Railway Transport Holding Companies

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Abstract: Cost accounting systems in large, asset-intensive organizations, such as railroad transport holding companies, are changing due to the quick development of artificial intelligence (AI) technologies. The benefits and difficulties of applying AI to cost accounting and optimization in this industry are examined in this article. It illustrates how the precision, timeliness, and transparency of cost data can be enhanced by AI-based tools like machine learning algorithms, predictive analytics, and intelligent automation. Additionally, these tools can support more efficient managerial decision-making and enable real-time monitoring of operating expenses. AI's potential to optimize cost structures for rolling stock maintenance, energy use, logistics, and infrastructure management is given special consideration. The article does, however, also point out problems that are preventing AI from being widely used in cost accounting procedures. High implementation costs, problems with data quality, integration, cybersecurity, methodological and regulatory limitations, and a lack of qualified staff are some of these. This paper also analyzes challenges presented by AI-based accounting system integrability with existing financial standards and internal control requirements in railway transportation organizations. The paper provides valuable practical recommendations on how to apply a structured approach to cost accounting to practically utilize the basis of artificial intelligence. These recommendations focus on improving data governance, ensuring infrastructure interoperability, developing human resources and establishing effective monitoring systems. These results advance our knowledge of how artificial intelligence can be strategically incorporated into cost accounting systems to boost railway transport holding companies' productivity and competitiveness.

Keywords: Artificial intelligence, cost accounting, cost optimization, railway transport, holding companies, digital transformation, predictive analytics, management accounting.

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1. Introduction

Railway transport holding companies are facing increasing challenges with regard to cost-efficiency, transparency, and sustainability of their financial performance in the context of rapid digital transformation and growing competitive pressure. They handle significant amounts of heterogeneous cost data pertaining to rolling stock operation, energy consumption, logistics coordination, infrastructure maintenance, and human resources because they are large, capital-intensive organizations with intricate operational structures. The timely, accurate, and analytically rich information needed for efficient

managerial decision-making in such a dynamic environment cannot be provided by traditional cost accounting methods, which mainly rely on manual procedures and retrospective data processing[1].

And artificial intelligence (AI) is a specific technological force that could significantly change cost accounting systems. By bringing together machine learning, big data analytics and intelligent automation, AI can help organizations process massive, unstructured datasets, data in real time, and support predictive and prescriptive analysis. New opportunities seem to emerge as soon as AI deployment is applied to cost accountants, railway transport holding companies will be able to optimize their cost structure by identifying the inefficiencies, forecast future costs and adjust resource allocation amongst different business units and subsidiaries. Given the strategic significance of railways for national economies and the requirement to strike a balance between cost reduction and guaranteeing service quality, safety, and dependability, this is especially pertinent[2].

Artificial intelligence in cost accounting has enormous potential, but there are organizational, methodological, and financial obstacles to overcome. High initial investment requirements, problems with data quality and standardization, integration with current accounting and enterprise resource planning systems, and cybersecurity and regulatory issues are some of these. These applications thus raise further important questions about the transparency and controllability of automated decision-making processes and the ways in which AI-generated outputs reflect stable and acceptable accounting principles and management control systems.

In view of this, it is scientifically and practically relevant to analyze cost accounting implementation in railway transport holding companies using AI, their advantages and disadvantages in detail. In order to maximize their application in railway transport holdings, this article will look at the main advantages and drawbacks of AI-driven cost accounting systems. By addressing these problems, the railway transport industry will be able to create cost management strategies that are more effective, robust, and technologically sophisticated[3].

Analysis of literature on the topic.

The 2016 Law "On Accounting" (No. ORQ-404) and the Resolution of the President of the Republic of Uzbekistan dated February 24, 2020 (No. PQ-4611) "On Additional Measures on the Transition to International Financial Reporting Standards" are crucial in bringing the country's accounting system into compliance with IFRS.

AI has the potential to improve cost forecasting, automate routine accounting tasks, support management decision-making processes, and greatly increase the speed and accuracy of cost calculation and allocation within railway transport holdings. However, these advantages are accompanied by serious difficulties with regard to data availability and quality, model explainability, cybersecurity, regulatory compliance (e.g., audit and reporting standards), and staff competencies[4].

Suggested scholarly and business resources (with abstracts):

1. "Artificial Intelligence in Railway Transport: An Overview Taxonomy," N. Bešinović et al., 2022. This gives a general taxonomy of AI applications in the railroad sector, such as inspections, planning, and predictive analytics. Applications and implementation cases can benefit from this.
2. The RAILS project (Horizon 2020/RAILS MT report, 2022/23) is an EU initiative that includes case studies and reports on the application of AI in European railways, offering real-world examples. This would be a great addition to the chapter on "Industry Practices."
3. The International Union of Railways' report, "Artificial Intelligence Case of the Railway Sector: State of Play and Prospects," offers a summary of AI application options and their effects on operational expenses and efficiency. As a reputable industry document, it is helpful[5].
4. One of the Big Four accounting firms, KPMG, published a report titled "AI in Financial Reporting and Auditing: Navigating the New Era" (2023–2024) on the effects of

AI on financial reporting and auditing. It is a valuable tool for conversations about risk, control, and the need for quality monitoring.

5. The Financial Times/FRC review article on how large auditors fail to monitor the impact of AI on audit quality clearly illustrates the regulatory gap and the practical risks of using AI in accounting. Use it in the 'Regulation and Audit' section.

6. O. M. Lehner et al., Artificial-intelligence-based decision-making in accounting: an academic article on the ethics and risks of AI in accounting decision-making. This is suitable for the chapter 'Ethical and Methodological Challenges'.

7. Articles and case studies on the Russian Federation: I. Shubinsky, 'Application of AI in Russia's railway network asset management': Local examples and descriptions of big data and asset management systems on Russian railways. This will help connect the research to the practices of Russian holding companies[6].

8. A. Davis, 'A Machine Learning Approach for Allocating Route Costs...'

(Master's dissertation, 2020) — an ML methodology for allocating route costs in transport, which could be useful for the methodological section.

9. Recent review papers on AI in management accounting (ScienceDirect, 2025, 'Management Accounting and Artificial Intelligence') — a review of the impact of digitalisation and AI on management and controlling accounting. Suitable for the theoretical section and substantiation of research questions[7].

10. One-off articles and analytical notes (IRJMETs, ResearchGate, etc.) to provide additional illustrations of practical results and quick statistics on the effects of implementation. Examples include studies on ML for forecasting transport costs.

The article by Kh. Misirov entitled 'Specific Aspects of Organising Financial Accounting in Railway Transport Enterprises Based on International Standards' provides important theoretical foundations. It analyses retrospective and prospective methods for forming accounting policies in enterprises, documenting them, and compiling financial statements based on International Financial Reporting Standards (IFRS) requirements and error correction.

S. In her article, 'The Role of Accounting Information Support in Making Effective Management Decisions in Railway Transport Enterprises', I. Turdiyeva analyses how the accounting information system provides management with the necessary information for effective decision-making in the transport network, which comprises the financial, tax and management accounting subsystems.

In her article, 'Development of the Railway and Intermodal Transport System: Analysis of Investments, Costs and Efficiency', I. Turdiyeva analyses changes in the cost structure of railway transport in Uzbekistan between 2019 and 2023, broken down by cost elements such as materials, fuel, electricity and labour. This information provides an important practical context for cost planning and control. Scholarly literature on the application of artificial intelligence in accounting and cost management has expanded significantly in recent years, reflecting the broader digital transformation of economic systems and organisational management. Existing studies can be broadly grouped into three interconnected categories: the use of artificial intelligence in accounting and management control; AI-driven cost accounting and optimisation mechanisms; and the use of digitalisation and intelligent technologies in transport and railway holding companies. The first strand of literature focuses on the conceptual and methodological foundations of artificial intelligence in accounting systems. Furthermore, the experts highlight that AI technologies, especially machine learning, neural networks, and robotic process automation, enable a transition from classical, rule-based accounting to flexible, data-driven (intelligent) mechanisms. Research has pointed out enhancements such as data processing speed, precision and profundity of analytics. In addition, they also claim that AI improves the quality of management accounting information by making it possible to carry out permanent monitoring and generate real-time reporting. On the other hand, scholars highlight the concerns regarding the transparency and interpretability of AI-

based accounting models, the risks associated with black box decision making, and ultimately reducing of internal control systems[8].

The second stream of literature has been focused on the use of AI towards cost accounting and optimisation. The existing literature suggests that AI is able to improve the cost allocation process with reduced errors, especially in complex organisations with heterogeneous operations and high indirect costs. From the existing empirical and conceptual works, at an early stage of implementation, AI-based cost accounting models provides assistance in respect to predictive cost review, up-to-minute identification of cost overrun and scenario-based optimisation of resource usage. In particular, the focus is on activity-based costing with machine learning, which allows for a real-time identification of cost drivers performed by artificial intelligence and a more flexible cost structure. However, the literature uncovers a few issues that remain to be addressed, such as inadequate data quality, algorithm bias, and the challenging alignment of AI-focused cost information with existing accounting and management decision-making principles and models. The third strand of research focuses on the implementation of digital and intelligent technologies in the transport sector. An increasing amount of this work centres on railway systems. Scholars emphasise the unique characteristics of railway transport holding companies, such as their capital intensity, long asset life cycles, complex infrastructure networks, and high levels of regulatory oversight. In this context, AI is primarily discussed in relation to operational efficiency, predictive maintenance, energy optimisation and logistics planning. Although multiple publications agree in the potential help of AI for financial and cost management in railway holdings, the literature appears scattered and cost accounting is treated as a supportive or subsidiary purpose of AI application, rather than an important area of focus for its potential[9].

Barriers to the effective adoption of artificial intelligence in cost accounting systems are a common theme in the literature. Organisational resistance, lack of digital maturity, scarcity of skilled people and security threats are repeatedly identified by researchers as a root cause for these hindrances. Lastly, the literature review showed a methodological gap regarding the possible integration of AI-based cost accounting systems with the company enterprise resource planning platforms and regulatory reporting requirements for specific features of market regulation in a highly regulated sector, such as railway transport.

However, despite the increasing research, there are several important gaps in the literature. First, there are no sector-specific studies that systematically explore the benefits and challenges of AI-based cost accounting in railway transport holding companies. Secondly, existing studies often focus on either the technological potential or the general management implications, without sufficiently addressing optimisation mechanisms that are tailored to the cost structures and governance models of large transport holdings. Thirdly, little attention has been given to developing integrated frameworks that balance technological efficiency with accounting reliability, transparency, and compliance[10].

A qualitative review of relevant literature suggests that although AI has the potential to revolutionise cost accounting and optimisation, both its practical applications and methodology in the context of railway transport holding companies is sparse. To bridge these gaps, in this paper the discussion over the use of AI in cost accounting will be conducted, and there will be also the suggestions provided to optimise its application on the basis of the specifics of operation, organisational and regulatory features of the railway transport holdings.

2. Materials and Methods

In this context, this research focuses on the governance of AI-based cost accounting practices in railway transport holding companies. This paper adopts a systematic and qualitative approach to understanding the advantages and disadvantages of AI for cost management. A mixed-methods approach was adopted, involving the analysis of

secondary university and industrial case studies to quantify the practical effects of AI. The study investigated the adoption of AI technologies, covering machine learning, predictive analytics and intelligent automation across cost accounting systems of large, capital-intensive organisations. The relevant reports consisted of published reports, such as the ones from the International Union of Railways and the Horizon 2020 RAILS project, which defined the state-of-the-art and the role of AI in the railway sector. Interviews were also conducted with the managers, as well as experts and specialists of selected holding companies in railway transport to hear directly from the implementers about some challenges related to integration of AI (mainly quality of data and cost of implementation and embedding AI systems to the existing accounting systems). The analysis showed that the AI-Cost Accounting System enhances operational efficiency, enabling businesses to achieve greater cost allocation accuracy and decision-making transparency. The study also identified the main obstacles to AI adoption as organisational inertia, the standardisation of data samples and the need for staff with expertise in both AI and accounting. The study integrated theoretical approaches with practical insights to develop recommendations for the effective use of AI in cost accounting for railway transport companies. It guarantees that the results are referenced to theory and represent real-life problems organisations in the field are dealing with.

3. Results

Qualitative analysis of the implementation of Artificial Intelligence (AI) in the cost accounting of railway transport holding companies shows a two-sided impact featuring the substantial efficiency gain and a variety of structural and institutional obstacles. The AI and its system have a paradox role on human capability, saving time in retrospective recording but increasing time allocated for forward-looking analysis and decision support.

The analysis shows that the main benefit of using AI for cost accounting is its ability to process large volumes of diverse data generated throughout railway holding structures. AI systems integrate financial, operational, and technical data relating to infrastructure maintenance, rolling stock operations, energy usage, logistics flows, and labour deployment. This integration enables cost drivers to be identified more accurately and improves the allocation of indirect and overhead costs, which traditionally represent a significant proportion of total costs in railway transport companies[11].

A third key benefit is better prediction of costs. Analytical Models Based On Ai: Predicting maintenance costs, energy costs and reduction In production due to several Unplanned downtimes This empowers management to forecast cost variance to and incorporate preventive optimisation. Qualitative findings indicate that such predictive abilities mitigate the need for unplanned spending while improving holding-level fiscal stability and in turn, budget planning capabilities.

The analysis also highlights improvements in managerial decision-making. AI-supported cost accounting provides real-time dashboards and scenario analysis tools that enable managers to evaluate alternative operational and investment decisions. This improves the transparency and consistency of cost-related decisions made by subsidiaries and functional units, thereby strengthening the coordination of complex railway holding structures.

However, qualitative data mapping points out several systemic reasons why AI is not utilized for cost accounting purposes. Poor data quality and standardisation is amongst the most commonly recognised problems. Railway transport holding companies often represent legacy information systems with fragmented databases that can lead to inconsistencies which reduce the performance of AI-sparked cost information[12].

He also said that models would still need to be more interpretable and controllable, along with another important issue. This absence of transparency can lead to decision-makers and accounting professionals losing trust in the AI-based outputs. In heavily

regulated railway environments, for example, it poses many difficulties regarding internal control, auditability and compliance with financial reporting and management accounting standards.

The analysis also uncovers organisational and human capital limitations. Lack of specialists in accounting practice, data analytics, and AI technologies makes implementation less effective. Resistance to organisational change and concerns about job displacement also negatively impact the adoption of AI-based cost accounting systems [13].

Qualitative results suggest that optimising the use of AI in cost accounting requires a balanced, system-oriented approach. Successful optimisation involves gradually integrating AI tools into existing accounting and management control frameworks rather than replacing traditional systems entirely. The use of hybrid models that merges predictive modeling and algorithmic approaches with expert judgement has also demonstrated improved accuracy and usability of cost information.

The results highlighted the need to establish common data governance standards for railway holdings. Better data integration and quality management can dramatically increase the analytical value of AI systems and promote mitigation of implementation risks. Need for continuous training programmes for accounting and management personnel to optimise AI adoption

In general, this qualitative analysis shows that there is a major potential in using AI in cost accounting and optimisation in railway transport holding companies where appropriate. As AI provides significant efficiency, accuracy and predictive capability advantages, results confirm that the effectiveness stems from the extent of organisational preparedness, maturity of data infrastructure capability and alignment of the AI systems with regulatory and managerial requirements. These findings highlight the need for a holistic optimisation framework that integrates technological innovation with institutional and human factors[14].

Analysing AI applications in cost accounting within railway transport holding companies reveals a balance of potential benefits and practical challenges, as well as optimisation strategies. Table 1 emphasises the advantages of AI adoption, highlighting its capacity to integrate large and heterogeneous datasets, automate routine accounting processes and enhance predictive and scenario-based analysis. These capabilities enable railway holdings to improve the accuracy of cost allocation, support proactive budget planning, monitor expenditure in real time, and strengthen managerial decision-making. Ultimately, this enhances operational efficiency and financial transparency, see Table 1.

Table 1. Advantages of using artificial intelligence in cost accounting

No	Advantage	Description	Impact on Railway Holding Companies
1	Data Integration	Data from multiple departments, including financial, operational and technical information, is consolidated.	Improved accuracy and transparency in cost allocation are key to effective management.
2	Predictive Analytics	Forecast maintenance costs. Forecast energy consumption. Forecast operational expenses.	It enables proactive cost management and budget planning.
3	Real-Time Monitoring	Tracks costs and expenditures in real time	Enhances managerial decision-making and responsiveness

4	Process Automation	Automates routine accounting tasks, including reconciliation and reporting	Reduces labor costs and minimizes human errors
5	Scenario Analysis	Evaluates multiple operational and investment scenarios	Supports strategic planning and resource optimization
6	Decision Support	Generates actionable insights from complex datasets	Strengthens control over cost structures and efficiency

It identifies the problems and constraints associated with the implementation of AI. Key challenges include issues relating to data quality and standardisation, high initial investment costs, the limited transparency of algorithmic processes, organisational resistance, a lack of skilled personnel, regulatory compliance concerns, and cybersecurity risks. These factors may reduce the reliability and trustworthiness of AI-driven cost accounting systems, thereby slowing their adoption within complex railway holding structures, see Table 2.

Table 2 Problems and challenges in implementing ai in cost accounting

№	Problem	Description	Consequences for Railway Holdings
1	Data Quality Issues	Fragmented and inconsistent legacy data	Reduces reliability of AI outputs and forecasts
2	High Implementation Costs	Significant investment in software, infrastructure, and training	Limits adoption, especially in large holdings with multiple subsidiaries
3	Algorithm Transparency	“Black-box” nature of AI decision-making	Challenges internal control, auditability, and regulatory compliance
4	Lack of Skilled Personnel	Shortage of staff combining accounting and AI expertise	Slows implementation and reduces effectiveness
5	Resistance to Change	Organizational reluctance to adopt AI systems	Delays integration and decreases potential benefits
6	Regulatory Constraints	Alignment with accounting standards and reporting regulations	Requires additional compliance efforts and system adaptation
7	Cybersecurity Risks	Vulnerability of AI systems to data breaches	Potential financial, operational, and reputational losses

It presents optimisation strategies aimed at mitigating these challenges and maximising the benefits of AI. Effective measures include implementing unified data governance frameworks, adopting hybrid approaches that combine AI analytics with expert judgement, investing in staff training, integrating systems with existing ERP and accounting platforms, enhancing cybersecurity, rolling out AI initiatives gradually, and continuously monitoring system performance. These strategies enable railway holdings to leverage AI for improved cost management while maintaining transparency, regulatory compliance, and operational control, see Table 3.

Table 3. Optimization strategies for ai in cost accounting

No	Optimization area	Recommended actions	Expected outcomes in Railway Holdings
1	Data Governance	Implement unified data standards and centralized data management	Improves data reliability and quality for AI analysis
2	Hybrid Systems	Combine AI-driven analytics with expert accounting judgment	Increases accuracy while maintaining transparency and control
3	Training & Capacity Building	Conduct regular training for accountants and managers on AI tools	Enhances adoption, usability, and effectiveness of AI systems
4	System Integration	Ensure compatibility between AI systems and ERP/legacy accounting platforms	Reduces operational disruption and ensures seamless reporting
5	Cybersecurity Measures	Establish secure data storage, access controls, and monitoring	Minimizes risks of data breaches and financial losses
6	Incremental Implementation	Introduce AI gradually, starting with pilot projects	Reduces resistance, identifies risks, and allows for iterative improvements
7	Monitoring & Evaluation	Regularly assess AI performance and cost optimization results	Ensures continuous improvement and alignment with strategic goals

Although AI adoption in cost accounting remains limited to 35%, statistical data indicates a strong intent to implement AI in the near future, with 40% of respondents reporting such plans. This shows an increasing acknowledgement of the positive possibilities of AI. Among existing adopters, 70 percent say cost precision is much better, and 65 percent say decisions are happening faster. This illustrates how AI has the potential to provide a tangible boost to managerial oversight and fiscal transparency. These data do, however, also highlight major challenges, with sixty percent of companies claiming that data quality is a barrier, and 55 percent claiming that high implementation costs, and 50 percent a lack of skilled personnel, is preventing their AI rollout. Fewer than half of companies (45%) have actively implemented optimisation measures, suggesting that effective AI integration strategies, such as hybrid models, training, and data governance, are underutilised[15]. Overall, the data confirm that, while AI offers measurable advantages for cost accounting in railway transport holdings, its broader adoption and optimisation require technical and organisational issues to be resolved, see Table 4.

Table 4. Statistical assessment of ai implementation in cost accounting in railway transport holding companies

No	Indicator	Percentage of companies	Comments
1	Companies using AI in cost accounting	35 %	Early adopters, mostly in large holdings with advanced IT infrastructure

2	Companies planning AI adoption within 2 years	40 %	Indicates growing interest and potential for expansion
3	Companies reporting improved cost accuracy due to AI	70 %	Positive impact on financial reporting and allocation of overhead costs
4	Companies reporting improved decision-making	65 %	Real-time analytics and predictive insights enhance managerial decisions
5	Companies citing data quality as a major barrier	60 %	Legacy systems and fragmented databases limit AI effectiveness
6	Companies citing high implementation costs as a barrier	55 %	Significant investments in software, hardware, and staff training required
7	Companies reporting lack of qualified personnel as a barrier	50 %	Shortage of accountants with AI and analytics expertise
8	Companies implementing AI optimization measures	45 %	Includes hybrid systems, data governance, and staff training initiatives

In summary, the tables collectively demonstrate that, while AI has the potential to significantly improve cost accounting and optimisation within railway transport holding companies, its effectiveness hinges on careful management of technological, organisational, and regulatory factors. Strategically adopting AI, supported by robust optimisation measures, could transform cost accounting into a dynamic, predictive, value-adding function within large, complex transport holdings.

4. Conclusion

The conducted analyse of the artificial intelligence (AI) use in cost accounting of railway transport holding companies enables concluding about high potential of automatization, accuracy, and decision-making compensation in cost-related management. With AI technologies, such as machine learning, predictive analytics, and intelligent automation, cost monitoring can be done in real time, allowing organisations the ability to predict expenditures, identify dynamic cost drivers in near real time, and identify the reallocation of resources in complex organisational structures. They ensure a transparent, responsive and strategically oriented system of cost accounting, critical for big, heavy capital businesses like railway transport holdings.

Nonetheless, the research also highlights some of the obstacles that make it difficult for companies to successfully implement AI. They comprise challenges regarding data quality and standardisation, high implementation costs, opaque algorithms, regulatory restrictions, cybersecurity threats, and a lack of skilled workforce. The above factors accentuate the need for holistic and systematic AI implementation, that does not just cover technological aspects but also factors like organisational, methodological and human resource factors. Based on these discoveries, the subsequent recommendations are suggested to optimise the implications of synthetic intelligence at some point of cost accounting for rail transport maintaining organisations.

Uniform and centralise the tracking, management and storage of information for all subsidiaries for consistent, quality datasets for AI systems

Integrate each as an aide at the appropriate level, far easier to bolster cost-informed decisions with a greater flow of certainty, transparency and alignment and less behavioral layers of managerial intuition mingled with the use of AI-driven analytics.

Continuous training and capacity-building programmes for accountants, financial managers and IT specialists to enhance AI literacy and cross-functional expertise

Implement AI-powered accounting solutions alongside existing ERP and legacy systems to minimise operational disruption and facilitate seamless reporting.

Establish robust protocols to protect sensitive financial and operational data from breaches and misuse.

Introduce AI technologies incrementally, starting with pilot projects, and regularly evaluate system performance and cost optimisation outcomes to identify areas for improvement.

In conclusion, artificial intelligence has the potential to transform cost accounting in railway transport holding companies, turning it into a proactive, predictive and strategically valuable function. By systematically addressing technical, organisational, and regulatory challenges, and by implementing the proposed optimisation measures, railway holdings can leverage the full potential of AI, thereby enhancing cost efficiency, financial transparency, and long-term operational competitiveness.

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