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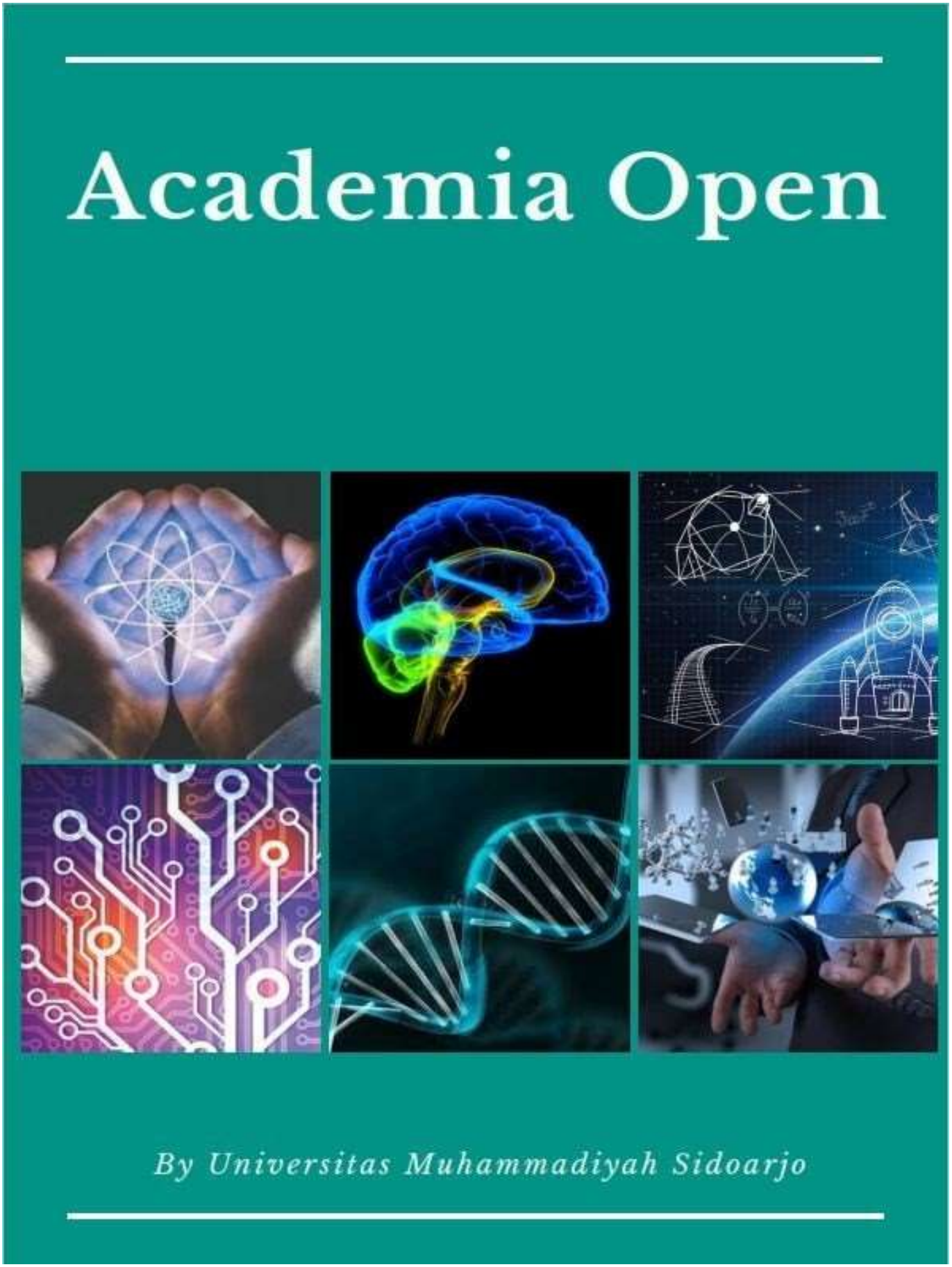

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Development Prospects and Recommendations for Improving Methods for Assessing Digital Investment Potential

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Abstract

General Background: Economic growth represents a fundamental indicator of national development, primarily influenced by macroeconomic variables including inflation rates and banking sector liquidity, which respectively determine price stability and financial intermediation capacity. **Specific Background:** While previous research has examined inflation and growth relationships independently, the Russian Federation's transition economy provides a unique context for analyzing these dynamics, particularly given its significant financial stability fluctuations between 2000 and 2024. **Knowledge Gap:** The joint interactive effects of inflation and banking sector liquidity on economic growth remain inadequately explored, especially for transition economies where structural and institutional characteristics differ substantially from developed markets. **Aims:** This study empirically investigates the relationship between inflation, banking sector liquidity, and GDP growth in the Russian Federation using ordinary least squares regression with robust standard errors and logarithmic transformations applied to annual data from 2000 to 2024. **Results:** The analysis reveals that inflation exhibits a positive and statistically significant effect on GDP growth (coefficient = 0.507, p = 0.0001 in the log-log-log model with $R^2 = 0.650$), while banking sector liquidity demonstrates a weaker, secondary impact requiring cautious interpretation. **Novelty:** This research uniquely examines inflation and banking liquidity as joint interactive economic phenomena rather than isolated variables, employing comprehensive model comparisons including multiple logarithmic transformation approaches. **Implications:** These findings suggest that controlled inflation management can stimulate economic activity and sustainable growth, while banking liquidity plays a supportive role, offering valuable guidance for central banks and policymakers in transition economies regarding monetary policy formulation and financial stability management.

Keywords : Economic Growth, Inflation, Banking Sector Liquidity, OLS Regression, Russian Economy

Highlight :

- Inflation demonstrates positive statistical significance on Russian GDP growth (2000-2024 analysis).
- Banking sector liquidity shows weaker influence requiring cautious interpretation in growth models.
- Log-Log-Log transformation achieves highest explanatory power with R^2 of 0.650.

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Introduction

Effectively assessing the effectiveness of digital investment potential requires the integration of modern technologies, qualified personnel, and a well-thought-out development strategy. In the context of accelerating digital transformation, investment decisions in railway transport must be supported by reliable analytical tools that allow not only for the evaluation of expected economic outcomes, but also for the assessment of long-term strategic effects. The success of the digital transformation of Uzbekistan's railway transport largely depends on the industry's ability to adapt to emerging technological challenges and to fully utilize the opportunities created by digital technologies(Uzbekiston Temir Yollari JSC, 2022).

Railway transport plays a key role in the national economy, ensuring connectivity between regions, supporting industrial development, and facilitating international trade. As a result, digital investments in this sector have a multiplier effect, influencing operational efficiency, service quality, and overall investment attractiveness. The increasing complexity of digital solutions, including integrated information systems and data-driven management tools, requires a comprehensive and systematic approach to evaluating investment potential. Fragmented or isolated assessments are no longer sufficient to support informed managerial and policy decisions(Karakulov, 2016).

A comprehensive approach to assessing digital investment potential creates the foundation for evidence-based decision-making and allows for the alignment of investment priorities with strategic development goals. Such an approach ensures the rational allocation of financial resources, reduces investment risks, and enhances transparency in the implementation of digital projects. Moreover, it supports the transition from short-term efficiency considerations to long-term sustainable development of the railway sector(Tricker, 2019).

In this context, improving methods for assessing digital investment potential becomes an essential task for ensuring the competitiveness and resilience of Uzbekistan's railway transport. The development of integrated assessment frameworks contributes to strengthening investment attractiveness and provides the necessary conditions for sustainable growth and modernization of the industry(World Bank, 2020).

Methodology

The methodological framework of this study is based on a comprehensive and integrated approach to assessing the digital investment potential of railway transport in the Republic of Uzbekistan, reflecting the objectives of digital transformation outlined in the study. The research relies on analytical, comparative, and system-based methods to examine existing practices and identify areas for improving investment assessment mechanisms(Greiner, 1998). The analysis incorporates the evaluation of digital technologies currently applied or planned within the railway sector, including artificial intelligence, predictive analytics, digital twins, blockchain technologies, and 5G networks, as elements influencing investment effectiveness and strategic development. Particular attention is paid to the synthesis of qualitative and quantitative indicators that characterize operational efficiency, investment attractiveness, and long-term sustainability. Comparative analysis is employed to assess changes in key performance indicators before and after digitalization, allowing for an evidence-based evaluation of digital investment outcomes. The study also applies a benchmarking approach to harmonize national assessment methods with international standards and recommendations, such as ISO/IEC 27001, EU rail interoperability standards (TSI), and the guidelines of the International Union of Railways, ensuring methodological consistency and comparability. Scenario analysis is used to substantiate the proposed strategic roadmap for digital development, enabling the identification of phased priorities and expected results over the medium and long term(Batirbekova, 2023a). Data for the analysis are drawn from sectoral reports, strategic planning documents, and aggregated performance indicators of railway transport, ensuring reliability and relevance. The methodological approach supports the transition from fragmented assessments to a unified evaluation framework, providing a systematic basis for informed decision-making and the development of recommendations aimed at enhancing the efficiency, transparency, and sustainability of digital investments in the railway sector

Result And Discussion

The digital transformation of Uzbekistan's railway industry is not simply the introduction of new technologies, but a strategic shift to a new paradigm of management, operation, and interaction. Synthesizing key findings, we can highlight the central role of integrated information systems, which, using artificial intelligence and predictive models, not only optimize current operations but also formulate long-term investment plans. The implementation of digital twins for modeling infrastructure assets, blockchain for increasing transaction transparency, and artificial intelligence systems for optimizing schedules and predictive rolling stock maintenance are interconnected and form the foundations for creating a unified digital platform(Grigoryan & Karakulov, 2018).

Harmonizing national standards with international ones, such as ISO/IEC 27001 and UIC recommendations on digitalization, not only increases the trust of international partners and investors but also ensures the interoperability necessary for integration into global transport corridors. This is critical for expanding interagency collaboration, both domestically and with international technology leaders, facilitating funding through public-private partnerships and international financial institutions.

The introduction of 5G technology on railway infrastructure serves as a catalyst for the implementation of all these initiatives, providing the ultra-fast data transfer necessary for autonomous systems and IoT devices, which in turn enhances operational efficiency and safety. This synergy of various digital initiatives creates the foundation for sustainable development and regional leadership for Uzbekistan in railway transport(North, 1990).

Expanding monitoring and analytics functionality with the introduction of artificial intelligence and predictive models will enable forecasting investment needs and optimizing their allocation. As part of this effort, it is planned to create a unified digital platform integrating data from all railway operational systems – from train control and logistics to infrastructure maintenance and customer services. The use of advanced technologies, such as digital twins for modeling key assets, blockchain for enhancing transaction transparency and security, and artificial intelligence systems for schedule optimization and predictive rolling stock maintenance, will significantly improve asset utilization and reduce operating costs. This will enable a shift from reactive to proactive investment management, based on in-depth data analysis and forecasting future needs(Batirbekova, 2020).

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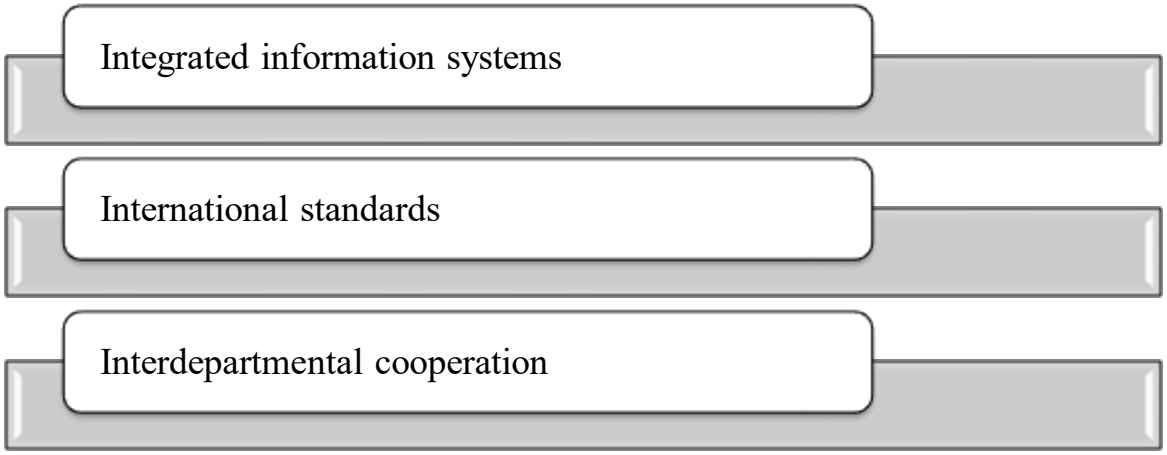
Figure 1. Improving methods for assessing digital investment potential



Adapting global methodologies for assessing investment effectiveness in the digital sector will increase the comparability of results and the trust of international partners and investors. National standards will be harmonized with international practices such as ISO/IEC 27001 for information security, EU standards for rail interoperability (TSI), and the recommendations of the International Union of Railways (UIC) on digitalization. This includes the implementation of data quality management systems (DQMS), the use of unified ROI metrics for digital projects, and ensuring compliance with the regulatory frameworks of partner countries. Adapting these standards to the local conditions of Uzbekistan will create a reliable and transparent framework for project evaluation, attracting strategic investors and opening up new opportunities for international cooperation in rail transport(OECD, 2015).

The creation of a unified data exchange platform between government agencies and railway companies will enhance the transparency of digital projects and accelerate decision-making. This entails developing cooperation not only within the country but also with international technology giants (e.g., Siemens, Huawei, Alstom) and leading consulting companies specializing in the digital transformation of transport. To secure financing and attract investment, government support programs and public-private partnership (PPP) mechanisms will be developed, and international financial institutions such as the World Bank, EBRD, and the Asian Development Bank will be actively engaged. The implementation of 5G technology on railway infrastructure will create the foundation for ultra-fast data transmission required for autonomous systems and IoT devices. These measures will help Uzbekistan position its railway sector as a regional leader in digital innovation and sustainable transport development(Batirbekova, 2023b).

Table 1. Strategic Roadmap for Digital Development (2024-2030+)

Stage	**Key initiatives**	**Required investments**	**Expected results**
Phase 1: Foundation of Digitalization Timeframe (2026-2027)	Implementation of core AI systems for schedule optimization and predictive maintenance; development of pilot projects for digital twins; initiation of standards harmonization with ISO/IEC 27001; creation of a unified data platform.	Significant	Increase operational efficiency by 10-15%; improve data security; launch the first "smart" systems.
Phase 2: Expansion and Integration Timeframe (2027-2028)	Scaling the application of digital twins to key nodes; implementing blockchain for supply chain management; adapting TSI standards; expanding partnerships with international tech giants; deploying 5G in critical areas.	High	Reducing operating costs by 15-20%; increasing investment attractiveness; achieving regional leadership in certain digital indicators.
Phase 3: Autonomization and Regional Leadership Timeframe 2029-2030+	Implementation of fully autonomous traffic management systems; use of AI to predict passenger flow and fares; full deployment of 5G and IoT infrastructure; integration with international transport corridors; creation of a regional competence center for digital railway technologies.	Constant	Positioning Uzbekistan as a key regional hub for digital railway technologies; maximizing resource optimization; creating high-tech jobs; and sustained investment growth.

The study presents a preliminary strategic roadmap for the development of Uzbekistan's digital railway (**Table 1**).

Implementing these recommendations will create a solid foundation for the sustainable development of digital infrastructure and enhance the investment attractiveness of Uzbekistan's railway transport at the regional and international levels(Vickers & Yarrow, 2014).

Table 2. Comparative analysis of indicators before and after digitalization

Aspect	Before digitalization	After digitalization	Improvement (%)

Operational efficiency	Manual control, fragmented data, long downtimes	Automation, predictive maintenance, schedule optimization	20-25%
Investment attractiveness	Traditional approaches, high risk, low transparency	International standards, blockchain, public-private partnerships, high transparency	30-40%
Customer satisfaction	Limited services, slow feedback	Mobile apps, personalized services, fast support	35-45%
Cost structure	High operating costs, suboptimal use of resources	Cost reduction, efficient asset management, energy optimization	15-20%
Data-driven decision making	Intuitive decisions, lack of analytics	AI analytics, digital twins, predictive models	High quality
International competitiveness	Local solutions, limited integration	Harmonization of standards, integration with global corridors, and regional leadership	Essential
Environmental sustainability	Significant consumption of resources, emissions	Optimizing energy consumption, reducing carbon footprint	10-15%

Digital transformation is becoming a key factor in enhancing the competitiveness and investment attractiveness of Uzbekistan's railway industry internationally(Estache & Saussier, 2018). The need for a comprehensive methodology for assessing and managing digital investments ensures balanced development and maximum return on investment(World Bank, 2017). Numerous challenges remain to be overcome on the path to full digitalization of railway transport, but the opportunities that emerge justify the effort and investment(Grigoryan и др., 2020).

Conclusion

The conducted study confirms that the assessment of digital investment potential is a strategically important element in ensuring the effective and sustainable digital transformation of Uzbekistan's railway transport. The results demonstrate that fragmented or isolated approaches to evaluating digital investments are insufficient under conditions of increasing technological complexity and growing integration of digital solutions into operational and management processes. The proposed integrated assessment framework, grounded in the use of artificial intelligence, predictive analytics, digital twins, blockchain technologies, and 5G networks, enables a transition toward a more systematic, transparent, and forward-looking investment management model. Harmonization of national assessment methodologies with international standards and recommendations contributes to improving comparability, strengthening investor confidence, and expanding opportunities for international cooperation and financing. The strategic roadmap developed in the study illustrates the phased implementation of digital initiatives and highlights their expected effects on operational efficiency, investment attractiveness, and long-term sustainability. Comparative analysis of key indicators before and after digitalization confirms that digital transformation enhances data-driven decision-making, reduces operating costs, improves service quality, and supports environmental sustainability. At the same time, the study emphasizes that achieving these outcomes requires coordinated institutional efforts, the development of unified data platforms, and the consistent application of standardized evaluation criteria. Overall, the findings indicate that improving methods for assessing digital investment potential provides a reliable basis for substantiating investment decisions, minimizing risks, and ensuring the maximum return on digital investments. This approach supports the long-term modernization of the railway sector and strengthens its integration into regional and international transport systems, contributing to sustainable economic development

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