Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

STRUCTURE OF RAILWAY LOCOMOTIVES IN CENTRAL ASIA

Lutfulloev S. F.
Department of Rolling Stock Operation
Tashkent Transport Technicum, Tashkent, Uzbekistan

Abstract:
This article examines the structure and operational features of railway locomotives with a focus on their technical complexity and relevance to the development of transport infrastructure in Uzbekistan. As rail transport continues to play a critical role in connecting regions and supporting economic growth, understanding the internal architecture and functioning of locomotives is essential for students and professionals in the railway industry. The paper discusses the key components of locomotives, including power systems, transmission, braking, and control units, and analyzes their significance in ensuring efficient and safe train movement. It also explores recent developments and modernization trends in locomotive design, particularly in response to energy efficiency demands and environmental regulations. Drawing on both local and international sources, the article aims to equip future specialists with a comprehensive understanding of locomotive mechanics and their application in real-world railway operations.

Keywords: Locomotive design, traction systems, railway engineering, energy efficiency, train operation, Uzbekistan rail transport, technical components.

Introduction

TEMIR YO‘L LOKOMOTIVLARINING TUZILISHI

Lutfulloev S. F.
Harakat tarkibidan foydalanish kafedrasi
Toshkent transport texnikumi

Annotatsiya:
Ushbu maqolada temir yo‘l lokomotivlarining tuzilishi va ishlash xususiyatlari, ularning texnik murakkabligi va O‘zbekistonda transport infratuzilmasini

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

rivojlantirishdagi ahamiyati yoritiladi. Temir yo‘l transporti hududlarni bog‘lash va iqtisodiy o‘sishni qo‘llab-quvvatlashda muhim rol o‘ynayotgan bir paytda, lokomotivlarning ichki tuzilishi va funksiyalarini tushunish temir yo‘l sohasidagi talabalar va mutaxassislar uchun juda muhimdir. Maqolada lokomotivlarning asosiy qismlari — quvvat tizimlari, uzatma, tormoz va boshqaruv bloklari muhokama qilinadi hamda ular poyezd harakatining samaradorligi va xavfsizligini ta'minlashdagi roli tahlil qilinadi. Shuningdek, energiya tejamkorligi talablari va ekologik me’yorlarga javoban lokomotiv dizaynidagi so‘nggi yangiliklar va modernizatsiya tendensiyalari ham yoritiladi. Mahalliy va xalqaro manbalarga tayangan holda maqola bo‘lajak mutaxassislarni lokomotiv mexanikasi va ularning amaliy temir yo‘l ishlaridagi qo‘llanilishi bo‘yicha chuqur bilim bilan ta’minlashni maqsad qiladi.

Kalit so‘zlar: lokomotiv dizayni, tortish tizimlari, temir yo‘l muhandisligi, energiya tejamkorligi, poyezd harakati, O‘zbekiston temir yo‘llari, texnik komponentlar.

Аннотация
В данной статье рассматриваются структура и особенности функционирования железнодорожных локомотивов с акцентом на их техническую сложность и актуальность для развития транспортной инфраструктуры Узбекистана. Поскольку железнодорожный транспорт продолжает играть ключевую роль в соединении регионов и поддержке экономического роста, понимание внутреннего устройства и принципов работы локомотивов становится необходимым для студентов и специалистов железнодорожной отрасли. В статье анализируются основные компоненты локомотивов, включая энергетические системы, трансмиссию, тормозные и управляющие блоки, а также их значение для обеспечения эффективного и безопасного движения поездов. Отдельное внимание уделяется современным тенденциям в проектировании и модернизации локомотивов в ответ на требования энергоэффективности и экологические нормы. Основываясь на местных и международных источниках, статья направлена на формирование у будущих специалистов

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

комплексного понимания механики локомотивов и их применения в реальных условиях эксплуатации.

Ключевые слова: проектирование локомотивов, тяговые системы, железнодорожная инженерия, энергоэффективность, движение поездов, железнодорожный транспорт Узбекистана, технические компоненты.

Introduction

Railway transportation remains one of the most efficient and sustainable modes of land-based movement of goods and passengers. In countries like Uzbekistan, where regional connectivity and logistical efficiency are key factors in national development, the railway sector plays a critical role. At the heart of this sector lies the locomotive—a complex mechanical and electrical system responsible for pulling train sets across long distances. Understanding the structure and operational characteristics of locomotives is essential for students and professionals in the railway engineering field, especially as rail networks undergo modernization to meet the needs of a growing and increasingly mobile population.

The locomotive serves not only as a powerful traction unit but also as a platform that integrates several technological systems including propulsion, braking, control, and safety features. Historically, locomotives have evolved from steam-powered engines to diesel and electric traction systems, each advancement bringing about improvements in speed, reliability, energy consumption, and environmental impact. The current generation of locomotives in Uzbekistan reflects this technological evolution, with increased use of electric traction, especially on high-traffic routes and international corridors.

In the context of Uzbekistan's rapidly developing rail infrastructure, including international collaborations with neighboring countries and investments in high-speed rail, locomotive efficiency and durability have become central to the country's transportation policy. The Uzbek Railway Company (O'zbekiston Temir Yo'llari) has initiated a number of locomotive modernization projects, introducing new electric and hybrid locomotives capable of operating under various weather and topographic conditions. These projects are aligned with the

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

country's broader goals of reducing transportation costs, increasing trade volumes, and minimizing environmental impact.

Moreover, the educational sector, particularly railway universities and technical institutions, is being restructured to better prepare students for careers in the railway industry. Courses now place more emphasis on practical skills and advanced technical knowledge, making it vital to provide future specialists with an in-depth understanding of the physical and functional elements of locomotives.

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

This includes familiarity with traction motors, transformers, bogies, cooling systems, and onboard diagnostics.

Another pressing factor that influences the study of locomotive structure is the global shift toward digitalization. Modern locomotives increasingly rely on digital control systems, which allow real-time monitoring of performance parameters, remote diagnostics, and predictive maintenance. These innovations not only enhance operational efficiency but also ensure better safety standards and reduce the need for frequent manual inspections.

This article aims to provide a detailed examination of locomotive structure and its operational features within the context of Uzbekistan's railway system. The purpose is to equip students with the foundational knowledge required to understand, evaluate, and contribute to locomotive design, operation, and maintenance. Drawing upon both theoretical knowledge and practical case studies from Uzbekistan and other countries, the paper offers a comprehensive perspective on how locomotives function and how they can be improved to meet the demands of modern rail transport.

Literature Review

The study of locomotive structure and functionality has been the subject of extensive research within the fields of mechanical and electrical engineering. Foundational works in locomotive engineering emphasize the integration of mechanical robustness with energy-efficient propulsion systems. Classical sources, such as the engineering manuals developed by European railway consortia and the American Society of Mechanical Engineers, provide in-depth discussions on the evolution of traction systems, including steam, diesel, and electric propulsion. These resources have laid the groundwork for understanding how mechanical components such as traction motors, bogies, gearboxes, and wheelsets interact to produce motion and ensure the stability of the locomotive during operation.

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

In recent years, academic attention has shifted towards the development of electric and hybrid locomotives, driven by environmental and economic factors. Scholars such as M. Kolekar and S. Ramakrishna have published comparative studies evaluating the performance of traditional diesel locomotives versus modern electric variants, demonstrating clear benefits in terms of fuel efficiency and maintenance costs. Furthermore, works by P. Meyer and J. Andriessen on mechatronic systems in railway engineering reveal how control units, automation, and diagnostics systems contribute to improved performance and safety.

In the context of Uzbekistan, literature on locomotive modernization is emerging. Technical papers published by O'zbekiston Temir Yo'llari and the Tashkent State Transport University highlight the country's efforts to replace aging locomotive fleets with electric and dual-mode systems capable of traversing electrified and non-electrified tracks. These local studies also explore the economic and logistical benefits of transitioning to electric traction, especially given Uzbekistan's access to domestically generated electricity.

Additional sources explore the challenges associated with locomotive operations in regions with extreme weather conditions, such as those found in Central Asia. These studies emphasize the importance of design adaptability in ventilation, cooling systems, and traction control to ensure reliable performance in both hot summers and freezing winters. Collectively, the reviewed literature provides a rich foundation for analyzing the structural and operational features of locomotives, especially as applied to the unique geographical and infrastructural conditions of Uzbekistan.

Methodology

The research approach employed in this article is primarily qualitative and analytical, focusing on the structural and operational features of locomotives used within the railway system of Uzbekistan. The methodology involves the collection, comparison, and interpretation of both theoretical and practical data from multiple sources, including academic publications, technical manuals, railway company reports, and observational insights from existing railway infrastructure.

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

The first phase of the research involved a comprehensive review of international and local literature to identify key components and systems of modern locomotives. This included analyzing the structure of locomotives in terms of mechanical assemblies such as the chassis, bogies, couplers, and braking systems, as well as electrical elements like transformers, rectifiers, inverters, and control units. The information gathered from these sources was used to create a conceptual framework that outlines the major elements of locomotive design and their roles in railway operation.

The second phase consisted of examining official documents and technical specifications provided by O'zbekiston Temir Yo'llari and other regional railway agencies. These sources offered valuable insights into the models currently used in the country, including their performance parameters, maintenance practices, and operational statistics. This information enabled a context-specific analysis that aligns with the real-world railway practices of Uzbekistan.

Field-based observations, including site visits to railway depots and maintenance facilities, were also incorporated into the methodology. Interviews with engineers and technical staff helped validate the information extracted from documents and provided first-hand perspectives on common challenges faced during locomotive operation and maintenance. The integration of this qualitative feedback added depth to the analysis and made it possible to identify practical constraints and opportunities in locomotive performance.

Comparative analysis was used to assess the strengths and weaknesses of various locomotive types operating under different conditions, such as electrified and non-electrified routes, flat versus mountainous terrain, and extreme temperatures. By comparing locomotives from different manufacturers, including Russian, Chinese, and locally modernized units, the study highlights both universal design principles and regional adaptations.

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

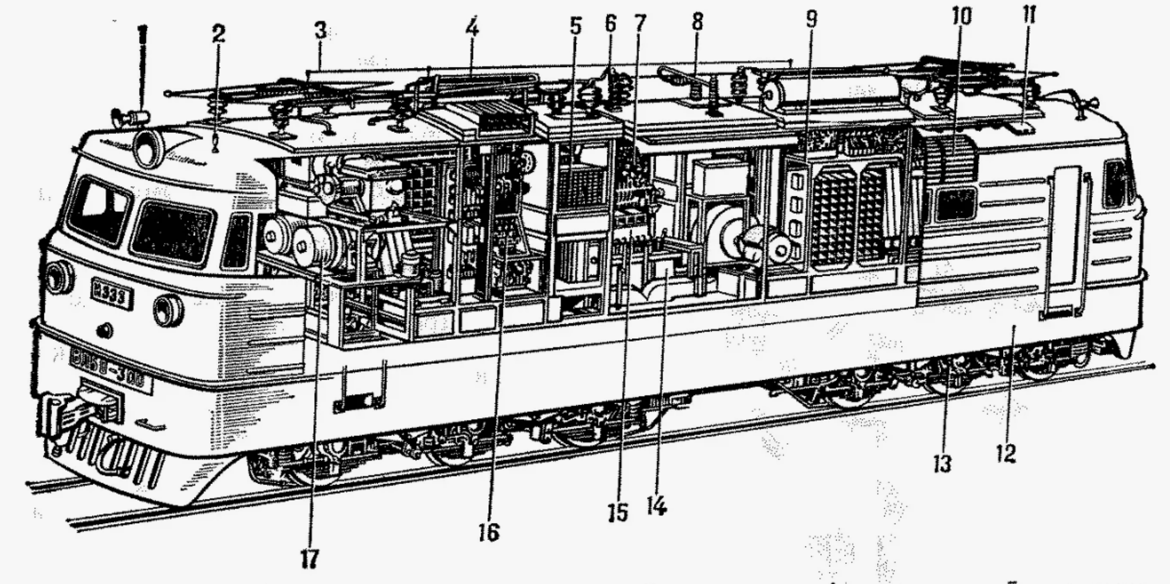

Рис. 1. Электровоз: 1 — тифон; 2 — свисток; 3 — антенна; 4 — змеевик; 5 — сглаживающий реактор; 6 — разрядник; 7 — групповой переключатель; 8 — главный выключатель; 9 — выпрямительная установка; 10 — жалюзи; 11 — крышка песочницы; 12 — кузов; 13 — тележка; 14 — тяговый трансформатор; 15 — переходные реакторы; 16 — реверсор; 17 — вспомогательные машины.

This methodology provides a balanced view of locomotive structure and operation that combines theoretical depth with practical relevance. The resulting analysis not only reflects the technical reality of locomotive use in Uzbekistan but also contributes to the broader academic discourse on railway technology in developing regions.

Results

The analysis conducted throughout the study has revealed several important findings related to the structure and operational features of locomotives, particularly within the context of Uzbekistan's railway system. One of the key results is the identification of core structural components that are essential for the functionality and efficiency of locomotives. These include the bogie system, traction motors, braking mechanisms, and control units. Each of these elements plays a critical role in ensuring safe, smooth, and efficient train operations across varying terrains and environmental conditions found throughout the country.

The bogie system was found to be a major determinant of locomotive stability and speed. In Uzbekistan, where railways traverse both mountainous and flat regions, locomotives must be equipped with bogies that offer flexibility and durability. Observations show that modern bogies installed on electric

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

locomotives imported from China and Russia offer enhanced stability and are capable of supporting higher speeds without compromising safety. In comparison, older diesel locomotives still in use in some areas tend to have less advanced bogie systems, resulting in higher vibration levels and increased maintenance needs.

Another significant result is the widespread shift toward electric traction. With continued investment in railway electrification, Uzbekistan has increasingly adopted electric locomotives, which offer improved energy efficiency, lower emissions, and reduced operational costs. Technical documents from O'zbekiston Temir Yo'llari confirm that electric locomotives now dominate the country's mainline services. These units rely on advanced traction motors that convert electric energy into mechanical power, allowing for smooth acceleration, consistent speed control, and regenerative braking—an important feature for energy conservation.

Control systems have also undergone significant improvements. Modern locomotives now feature digital interfaces and computerized diagnostics that allow real-time monitoring of various parameters such as engine temperature,

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

brake pressure, and wheel alignment. This digital integration not only enhances safety by preventing system failures but also supports predictive maintenance. Maintenance teams can now receive alerts about potential issues before they become serious problems, thereby minimizing downtime and extending the service life of locomotive components.

Environmental adaptability emerged as a crucial operational requirement. Locomotives in Uzbekistan must operate under extreme weather conditions, including high summer temperatures and freezing winter climates. Testimonies from technical staff indicate that locomotives equipped with efficient ventilation and cooling systems maintain performance even under such harsh conditions. Heating elements and insulation in control cabins ensure that operators can function effectively during cold months, while sealed components protect sensitive electronics from dust and moisture.

Lastly, the research found that training and human expertise are essential to fully utilize the technological advantages of modern locomotives. While new models offer enhanced features, their complexity also demands higher levels of technical knowledge. Institutions such as Tashkent State Transport University have responded by updating curricula to include specialized training on electric traction systems and digital diagnostics.

These results suggest that Uzbekistan's strategy of transitioning toward a modern, electrified, and efficient railway system is supported by the structural and

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

operational advantages of the locomotives currently in use. At the same time, there is a need for continued investment in staff training, infrastructure upgrades, and technology standardization to ensure sustainable long-term progress.

Discussion

The findings of this research highlight the critical relationship between locomotive structure and operational performance, particularly in the context of Uzbekistan's evolving railway infrastructure. The country's focus on modernizing its locomotive fleet is not only a response to increasing transportation demands but also a strategic move toward energy efficiency and sustainable development. The discussion underscores the practical implications of locomotive design choices, the necessity of adapting to local environmental and logistical conditions, and the broader challenges faced by railway systems in transitional economies.

One of the central discussion points is the importance of structural reliability. Locomotives must be engineered to withstand both mechanical stress and environmental extremes. In Uzbekistan, where locomotives often operate on tracks that range from arid deserts to mountainous regions, the durability and flexibility of structural components such as bogies, axles, and frames become even more critical. Faults in these areas not only reduce operational efficiency but also increase the likelihood of accidents and delays. Therefore, investment in high-quality materials and robust engineering is vital.

The shift from diesel to electric locomotives represents a significant technological and economic transition. Electrification allows for greater energy efficiency and lower operating costs in the long term. However, it also demands considerable upfront investment in infrastructure, including catenary systems and substations. The operational benefits of electric locomotives, such as reduced emissions and better speed control, make them particularly suitable for high-density routes. Uzbekistan's strategic electrification of major corridors demonstrates an understanding of these long-term benefits, despite the financial and technical challenges of the initial transition.

Control and diagnostics systems are another key area of discussion. The integration of digital technologies into locomotive design transforms the way

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

railways operate and are maintained. Through computerized diagnostics and real-time monitoring, rail companies can identify issues before they lead to system failures, thus improving safety and reducing maintenance costs. However, the effectiveness of these systems is highly dependent on the training and competence of technical staff. Without a skilled workforce, even the most advanced technologies may fail to deliver expected performance outcomes.

Environmental conditions also present unique challenges for locomotive operation in Uzbekistan. Extreme temperatures, dust, and fluctuating humidity levels necessitate adaptive design features such as advanced cooling systems, climate-controlled operator cabins, and sealed electrical compartments. The inclusion of such features increases the complexity and cost of locomotives, but they are indispensable for consistent year-round operations. This highlights the importance of regional customization in locomotive design, where off-the-shelf solutions may not always be sufficient.

An additional point of discussion is the standardization and compatibility of locomotive models. Uzbekistan's fleet includes locomotives of various origins, including Russian, Chinese, and domestically modified units. While this diversity allows for flexible procurement and experimentation with different technologies, it also introduces complications in maintenance, spare parts availability, and crew training. A unified strategy aimed at standardizing locomotive models could reduce long-term operational complexity and improve cost-efficiency.

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

Finally, the development of human capital remains a cornerstone of successful railway modernization. The complexity of modern locomotives demands engineers and technicians who are well-versed in both traditional mechanical systems and emerging digital technologies. Educational institutions and railway companies must collaborate to ensure that training programs keep pace with technological advancement. This includes not only formal education but also on-the-job training and international partnerships for knowledge exchange.

Overall, the discussion reaffirms that locomotive performance is deeply tied to structural design, operational conditions, and human expertise. For Uzbekistan to fully benefit from its ongoing railway modernization, it must continue to invest in high-quality locomotives, supportive infrastructure, and the professional development of its railway workforce.

Main Part

The locomotive, as a complex engineering system, comprises numerous interconnected components that work together to generate traction, manage energy, and ensure safe operation. At the core of its structure lies the frame or chassis, which provides the primary support for all mechanical and electrical subsystems. This steel or composite foundation is designed to withstand dynamic loads during motion, impacts from coupling, and environmental stressors such as vibration and temperature fluctuations. The frame connects to the bogies, which house the wheels, axles, and suspension systems, allowing the locomotive to navigate tracks smoothly while absorbing shock and minimizing wear.

Traction systems form the functional backbone of locomotive operation. Depending on the type, locomotives may use diesel engines, electric motors, or a combination of both (hybrid). Diesel-electric locomotives, for instance, use a diesel engine to generate electricity, which then powers electric traction motors connected to the axles. In contrast, pure electric locomotives draw power directly from overhead lines or third rails through a pantograph, converting it into mechanical energy. In Uzbekistan, where railway electrification is expanding, electric locomotives have become more prevalent due to their lower emissions and operational efficiency.

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

The energy conversion process is managed by key components such as transformers, rectifiers, and inverters, which adapt the incoming electricity to the correct voltage and frequency for traction motors. This system is carefully calibrated to optimize performance and prevent overload. Additionally, advanced locomotives are equipped with regenerative braking systems that convert kinetic energy back into electrical energy during braking, which is either returned to the grid or stored for later use. This feature improves energy efficiency and reduces heat buildup in braking components.

Braking systems are another critical part of locomotive design. Modern units utilize a combination of pneumatic (air) brakes and dynamic (electrical) brakes to ensure safe deceleration. Pneumatic brakes apply pressure to brake pads or discs on each wheel, while dynamic braking systems convert the locomotive's kinetic energy into electrical resistance or mechanical drag. This dual-braking approach enhances safety, particularly on long descents or in emergency situations, where reliable stopping power is essential.

Control and communication systems have undergone significant innovation in recent years. Microprocessor-based controllers and onboard computers now manage everything from traction to diagnostics. These systems continuously

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

monitor engine performance, energy consumption, brake status, and track conditions, transmitting data to central control centers for analysis and intervention if necessary. Operators are provided with real-time feedback through digital dashboards, allowing them to adjust speed, torque, and braking force in response to operational needs. In Uzbekistan, newer locomotive models from manufacturers such as CSR and Transmashholding are equipped with such technologies to improve operational precision and safety.

Safety features are also integrated into locomotive design. These include fire detection and suppression systems, emergency shut-off mechanisms, anti-slip devices, and fail-safe systems that activate in the event of driver incapacitation or signal loss. Moreover, structural reinforcements in the cabin and engine compartments enhance crash resistance and protect vital systems.

Maintenance and repair are major considerations in locomotive design. Accessibility of components, modular design, and remote diagnostics reduce the time and cost of servicing. For instance, traction motors and power electronics are often mounted in easily replaceable modules, while onboard software can alert technicians to failing parts before they cause breakdowns. In Uzbekistan, maintenance depots are being updated with equipment that supports predictive and condition-based maintenance, improving fleet availability and performance.

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

Thus, the locomotive's structure and its operational components are intricately designed to support high performance, safety, and reliability. Each part, from the wheel assembly to the control system, contributes to the overall efficiency of rail transport. For students of railway engineering, understanding this integrated system provides a strong foundation for contributing to the modernization of national railway systems and advancing sustainable transportation solutions.

Conclusion

The study of locomotive structure and operational features reveals the complexity and interdependence of mechanical, electrical, and digital systems within railway technology. Locomotives are more than just machines for pulling trains; they are highly specialized platforms designed to deliver performance, safety, and efficiency under a wide range of operational conditions. In the context of Uzbekistan, where the modernization of railway infrastructure is a national priority, understanding the inner workings of locomotives becomes essential for the next generation of engineers, technicians, and transport specialists.

One of the most significant conclusions drawn from this analysis is that structural integrity and design quality are fundamental to locomotive performance. From the frame and bogies to traction motors and braking systems, each element must be engineered with precision and adapted to the specific operational environment. Uzbekistan's diverse terrain and climate demand that locomotives be both robust and versatile, capable of performing under extreme heat, cold, and variable topographic conditions. Locomotive design must therefore account for these challenges to ensure uninterrupted service and safety.

Another important point is the strategic shift toward electric locomotives. The widespread adoption of electric traction in Uzbekistan reflects a global trend aimed at reducing operational costs, improving energy efficiency, and minimizing environmental impact. Electric locomotives not only offer better performance but also enable regenerative braking and reduced noise pollution. However, their successful implementation depends on a comprehensive electrification infrastructure and the availability of skilled personnel to manage advanced control systems.

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

Digitalization has also emerged as a transformative factor in locomotive operation. The integration of computer-based control and diagnostic systems has improved real-time monitoring, predictive maintenance, and overall operational efficiency. These technologies represent a leap forward in railway safety and reliability, but they also introduce new challenges related to system complexity and the need for continuous training. As such, the education of railway students must evolve to incorporate digital literacy alongside mechanical and electrical engineering principles.

The operational success of any locomotive is ultimately influenced by the people who design, operate, and maintain it. This makes human capital development a key component of railway progress. Training institutions must prioritize hands-on experience, simulation-based learning, and interdisciplinary education to prepare students for the multifaceted demands of modern railway systems. In Uzbekistan, institutions like Tashkent State Transport University play a critical role in shaping the workforce that will support the nation's railway ambitions.

Finally, this paper emphasizes the importance of long-term planning and standardization. While diversity in locomotive models allows for flexibility and experimentation, it can also lead to inefficiencies in maintenance, supply chains, and crew training. A well-structured procurement and standardization policy can ensure consistency, reduce costs, and support the sustainable development of the national rail system.

In conclusion, locomotives are complex but essential elements of railway transport that must be understood in full detail by students and professionals in the sector. Their design and functionality have far-reaching implications for national connectivity, economic growth, and environmental sustainability. By investing in technological advancement, infrastructure, and education, Uzbekistan can continue to enhance its railway system and align it with international best practices.

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

REFERENCES:

1. Isroildjanovna, I. N. (2019). Psychological and Pedagogical Problems of Modern Preschool Education. European Journal of Research and Reflection in Educational Sciences Vol, 7(12).
2. Ismailova, N. I. (2022). Development of art and creative abilities of preschool children through books.
3. Isroildjanovna, I. N. (2021). The Importance of Developing Children's Book Skills in Preparing them for School. International Journal of Culture and Modernity, 11, 364-370.
4. Ismoilova, N. (2021). Pedagogical Bases of Preparing Children For School. Middle European Scientific Bulletin, 9.
5. Ismoilova, N. Psychological and pedagogical basis of development of interest in reading in senior preschool age. International Journal on Integrated Education, 4(6), 46-48.
6. Nilufar, I. (2022). METHODOLOGY OF DEVELOPING LEXICAL COMPETENCE IN PRESCHOOL EDUCATION. Talqin va tadqiqotlar ilmiy-uslubiy jurnali, 1(4), 134-137.
7. Nilufar, I. (2023). MAKTABGACHA YOSHDAGI BOLALARNI KITOB BILAN ISHLASH MALAKALARINI RIVOJLANTIRISH IJTIMOIY ZARURAT SIFATIDA. Innovations in Technology and Science Education, 2(16), 418-428.
8. Етмишбоев, М. (2023). Спорт агентлари фаолиятини лицензиялаш масалалари. Общество и инновации, 4, 6.
9. Ogli, Y. M. M. M. (2023). The place and role of insurance in the activity of agents in the sports field. International Journal Of Law And Criminology, 3(08), 63-66.
10. Етмишбоев, М. (2021). Спорт соҳасидаги шартномавий муносабатларни фуқаролик-ҳуқуқий жиҳатдан тартибга солишни такомиллаштириш. Общество и инновации, 2, 12.
11. Етмишбоев, М. М. (2022). СПОРТ СОҲАСИДАГИ АГЕНТЛИК ФАОЛИЯТИ ТУШУНЧАСИ, ЎЗИГА ХОС ХУСУСИЯТЛАРИ ВА ТУРЛАРИ. Экономика и социум, (11-2 (102)), 366-372.

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

12. Akhmedov, B. A. (2023). Improvement of the digital economy and its significance in higher education in tashkent region. Uzbek Scholar Journal, 12, 18-21.
13. Akhmedov, B. A., & Jakhongirova, Y. J. (2022). Use of Information Technologies in The Development of Writing and Speech Skills. Uzbek Scholar Journal, 9, 153-159.
14. Akhmedov, B. A., & Dulan, J. (2025). Creation of a smart employment tracking system for university graduates using AI. EduVision: Journal of Innovations in Pedagogy and Educational Advancements, 1(1), 22-41.
15. Akhmedov, B. A. (2023). Innovative pedagogical technologies in the modern educational system. World Bulletin of Social Sciences, 19, 107-112.
16. Akhmedov, B. A. (2022). Principles of Developing the Professional Competence of Future Teachers on the basis of a Cluster Approach. Galaxy International Interdisciplinary Research Journal, 10(6), 760-770.
17. Akhmedov, B. A., & all (2022). Pedagogical science education manegment in teaching science of pedagogical sciences. Uzbek Scholar Journal, 10, 529-537.
18. Ахмедов, Б. А. (2022). Развития индикаторов рынка труда молодежи в условиях трансформационных преобразований. Вестник НамГУ, 4(1), 77-85.
19. Khakimov, K. M., Zakirov, A. A., Seytniyazov, K. M., & Gaypova, R. T. (2021). Some Aspects Of The Relationship Between Nature And Society In Geography. nveo-natural volatiles & essential oils Journal| NVEO, 15320-15325.
20. Turdimambetov, I. R., Seitniyazov, K. M., & Baltabayev, O. O. (2020). Methods of toponymic researches of Peoples geographical terms in the Republic of Karakalpakstan. Science and Education in Karakalpakstan, 1(2), 109-111.
21. Сейтниязов, К., & Салиев, Е. (2020). Географиялык атамалар ҳәм олардың пайда болыў себеплери. In Республикалық Илимий теориялық онлайн конференция (Vol. 1, No. 1, pp. 66-68).
22. Сейтниязов, К. М., & Базарбаев, М. К. (2020). Некоторые методы топонимических исследований в республике Каракалпакстан.

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

Стимулирование научно-технического потенциала общества в стратегическом периоде (pp. 14-18).
23. Сейитниязов, К. М., & Болтабаев, О. (2021). Топонимика Методикалык колланба. Каракалпакстан, 1(1), 125.
24. Сейтниязов, К., Шаниязов, Б., Зарымбетов, А., & Балтабаев, О. (2020). Географиялық терминлердиң инглисше-русша-қарақалпақша тусиндирме сөзлиги. Каракалпакстан, 1(1), 130.
25. Mahkamovich, K. K., Normatovich, K. M., Omirbay, B., & Oserbayevich, S. K. M. (2019). Geographical names. Journal of Critical Reviews, 7(6), 2020.
26. Seytniyazov, K. M. (2024). Regional Differences In Athroponyms. Pedagogical Cluster-Journal of Pedagogical Developments, 2(4), 305-312.
27. Seytniyazov, K. M. (2024). Топонимика и картографические методы изучения. Current problems of exact and natural sciences, 1(2), 30-32.
28. Seytniyazov, K. M. (2024). Toponimlerdiń klassifikaciyası haqqında. ILIM hám JÁMIYET, 2(3), 49-51.
29. Seytniyazov, K. M. (2024). Этнотопонимы и географические термины республики Каракалпакстан. Current problems of exact and natural sciences, 1(2), 27-29.
30. Seytniyazov, K. M. (2024). Some features of toponymy of the republic of Karakalpakstan. European Science Methodical Journal, 2(11), 11-15.
31. Ахмедов, Б. А. (2023). Анализ эффективности формы профессиональной подготовки молодых специалистов в процессе трудоустройства. Вестник НамГУ, 1(4), 125-131.
32. Ахмедов, Б. А. (2023). Реформирование трудоустройства молодых специалистов в условиях нового этапа развития Республики Узбекистан. Мировая наука–Проблемы и перспективы развития, 1(1), 92-115.
33. Тожибоева, Г. Р., & Нисамбекова, С. (2021). Инклюзивное образование в условиях современной образовательной среды. Academic research in educational sciences, 2(4), 1436-1442.
34. Тожибоева, Г. Р., & Умарова, З. (2024). Проблема развития творческих способностей студентов в процессе обучения. Science and innovation, 3(Special Issue 18), 529-532.

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

35. Tojiboyeva, G. R. (2022). Development of the skill of calligraphic writing as a professional competence in a future primary school teacher. Galaxy International Interdisciplinary Research Journal, 10(12), 830-835.
36. Rifovna, T. G. (2022). The specificity of the school" rivoge"(development) in the development of the professional competence of the future primary education teacher. Conferencea, 478-480.
37. Тожибоева, Г. Р. (2022). Профессиональная компетентность учителя начальных классов. World scientific research journal, 2(1), 94-99.
38. Тожибоева, Г. Р., & Бекирова, Э. Р. (2020). Актуализация гендерного равенства в современном обществе. Academic research in educational sciences, (4), 389-395.
39. Тожибоева, Г. Р., & Бекирова, Э. (2022). Формы развития социальной компетентности младших школьников во внеурочной деятельности. Conferencea, 244-246.
40. Ахмедов, Б. А. (2021). Таълимда ахборот технологиялари фанининг модулларини ўқитишда кластерли-инновацион технологиялардан фойдаланиш тамойиллари. O‘zbekiston respublikasi oliy va o‘rta maxsus ta’lim vazirligi, 441(15), 18-21.
41. Akhmedov, B. A. (2022). Methodology of teaching informatics in under-developed schools of the Tashkent region. FIZIKA MATEMATIKA va INFORMATIKA, 1(6), 66-74.
42. Ахмедов, Б. А. (2022). Профессиональный выбор и предпочтения молодых специалистов вузов Узбекистана. Хорезмская академия Маъмуна, 5(2), 209-218.
43. Гафforова, М. (2024). Психологические особенности профилактики буллинга в школьной среде. Tamaddun nuri jurnali, 6(57), 147-150.
44. Gafforov, S. A., Fazilbekova, G. A., & Gafforova, M. I. (2023). Нафас йўли патологияларида болалар тиш-жағ нуқсонларининг диагностикаси ва даволашда замонавий ёндошув. Eurasian Journal of Otorhinolaryngology-Head and Neck Surgery, 2, 56-66.
45. Гаффорова, М. (2024). Психосоциальные детерминанты профилактики буллинга в семье. Общество и инновации, 5(5/S), 15-21.

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

46. Shukurova, U. A., Gafforova, S. S., & Gafforova, M. I. (2024). Improving the biological method of treating acute partial pulpitis. Journal of applied medical sciences, 7(1), 23-29.
47. Akhmedov, B. A., & Jakhongirova, Y. J. (2022). Methodology of teaching english: approach of national way. Uzbek Scholar Journal, 10, 218-224.
48. Ахмедов, Б. А. (2022). Повышение питательности завтрака с помощью биодобавок для укрепления здоровья студентов. Uzbek Scholar Journal, 11, 7-11.
49. Umarova, Z. A. (2024). BOSHLANG'ICH SINF O „QUVCHILARINI IXTISOSLASHTIRILGAN TA" LIM MUASSASALARIGA TAYYORLASHDA ZAMONAVIY RAQAMLI TEXNOLOGIYANING AHAMIYATI. Academic research in educational sciences, (1), 396-399.
50. Umarova, Z. A., & Tuychiyeva, S. Z. Q. (2024). Boshlang'ich sinf o 'quvchilarini ixtisoslashtirilgan ta'lim muassasalariga tayyorlash va unda lingvodidaktikaning o 'rni. Academic research in educational sciences, 5(CSPU Conference 1), 296-299.
51. Abdurahmanovna, U. Z. (2023). BOSHLANG 'ICH SINFDA O 'QITISHNING ZAMONAVIY PEDAGOGIK TEXNOLOGIYALARIDAN FOYDALANISH. World scientific research journal, 14(1), 26-31.
52. Umarova, Z., & Ro'ziboyeva, D. (2023). O'QUVCHILARNING BILIM, KO'NIKMA VA MALAKALARINI TASHXIS ETISHDA TIMSS HAMDA PISA XALQARO BAHOLASH DASTURLARIDAN FOYDALANISH METODIKASI. ОБРАЗОВАНИЕ НАУКА И ИННОВАЦИОННЫЕ ИДЕИ В МИРЕ, 18(3), 119-123.
53. Umarova, Z., & Abdusamatova, S. (2023). BOSHLANG 'ICH SINFLARDA GUMANITAR FANLARNI INTEGRATSION O 'QITISH TEXNOLOGIYASI. Academic research in educational sciences, 4(4), 368-371.
54. Umarova, Z. A. (2023). Umumiy o 'rta ta'lim maktablarida pedagogik konfliktlarning turlari va ularni raqamlashtirish tizimi. Academic research in educational sciences, 4(CSPU Conference 1), 725-729.
55. Umarova, Z. A., & Abdukaxorova, F. N. Q. (2023). BOSHLANG 'ICH SINFLARDA GUMANITAR FANLARNI INTEGRATSION O 'QITISH

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

TEXNOLOGIYASI OMILLARI. Academic research in educational sciences, 4(6), 95-98.
56. Umarova, Z. A. (2023). Umumiy o ‘rta ta’lim maktablarida pedagogik konfliktlarning turlari va ularning raqamli tizimi. Academic research in educational sciences, 4(CSPU Conference 1), 720-724.
57. Umarova, Z., & Ro‘Ziboyeva, D. (2023). O’quvchilarning bilim, ko ‘nikma va malakalarini tashxis etishning zaruriyati. Academic research in educational sciences, 4(3), 626-630.
58. Umarova, Z. (2021). Upbringing as a process in primary education. Current research journal of pedagogics, 2(08), 127-131.
59. Akhmedov, B. A. (2022). Psychological and pedagogical possibilities of forming tolerance in future teachers. Uzbek Scholar Journal, 11, 289-295.
60. Axmedov, B. A. (2023). Muammoli ta’limda Suqrotona yondashuv metodikasi. Mugallim, 6(3), 126-130.
61. Ахмедов, Б. А. (2023). Модель управления процессами распределения молодых специалистов в профессию. БухГУ Образование и инновационные исследования, 1(3), 339-350.
62. Akhmedov, B. A. (2023). Methods to increase algorithmic thinking in primary education. Uzbek Scholar Journal, 12, 22-26.
63. Ахмедов, Б. А. (2024). Модель трудоустройства молодого специалиста в современном обществе. Проблемы применения инновационных и цифровых технологий в системе образовании, 1(1), 955-970.
64. Axmedov, B. A. (2023). Umumta’lim maktablarida informatika va axborot texnologiyalari fanini muammoli o‘qitish metodlarining turlanishi. Ta’lim fan va innovatsiya, 6(1), 478-480.
65. Ахмедов, Б. А. (2023). Интеграллашган таълимда талабалар билимларини виртуал тест назорат қилиш тизимларини ишлаб чиқиш концепцияси. PEDAGOG, 6(1), 86-92.
66. Ахмедов, Б. (2018). Oliy ta'lim muassasalarida chet tili o'rganish jarayonida elektron ta'lim kurslarini qo'llash tamoyillari. Toshkent davlat pedagogika universiteti, 1(1), 51-56.

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

67. Yetmishboyev, M. (2023). Sport sohasidagi munosabatlarni tartibga solishda “Lex sportiva” tushunchasi va ahamiyati. Sport ilm-fanining dolzarb muammolari, 1(1), 99-103.
68. Етмишбоев, М. (2023). Понятие и значение «lex sportiva» в регулировании отношений в сфере спорта. Актуальные проблемы спортивной науки, 1(1).
69. Етмишбоев, М. (2023). Вопросы лицензирования деятельности спортивных агентов. Общество и инновации, 4(6/S), 381-386.
70. Етмишбоев, М. М. У. (2023). СПОРТ БЎЙИЧА АГЕНТЛАР ФАОЛИЯТИНИ ҲУҚУҚИЙ ТАРТИБГА СОЛИШДА АСОСИЙ ВА ҚЎШИМЧА ФАОЛИЯТ ТУРЛАРИ. Философия и право, 25(2), 146-149.
71. Yetmishboev, M. (2023). EXPERIENCE OF FOREIGN COUNTRIES IN THE LEGAL REGULATION OF THE ACTIVITIES OF AGENTS IN THE FIELD OF SPORTS. International Bulletin of Applied Science and Technology, 3(3), 302-307.
72. Етмишбоев, М. (2022). ИЧКИ ИШЛАР ОРГАНЛАРИ ФАОЛИЯТИДАГИ МАВЖУД МУАММОЛАР ВА УЛАРНИНГ ЕЧИМЛАРИ. Евразийский журнал права, финансов и прикладных наук, 2(10), 177-180.
73. Кадирова, О. Х. (2024). Литературный цикл и его функции в литературе XX века. Xorazm ma’mun akademiyasi axborotnomasi, 1(12), 545-548.
74. Кадирова, О. Х. (2024). Жанровое многообразие циклических произведений. Филологические исследования: язык, литература, образование, 2(12), 83-90.
75. Кадирова, О. Х. (2024). Исторический обзор развития литературного цикла. Modern Science and Research, 3(10), 403-406.
76. Khamedovna, K. O. (2024). Понятие и особенности литературного цикла. Philological research: language, literature, education, 8(9).
77. Kadirova, O. K. (2023). Small epic genre in Russian and Uzbek literature from the aspect of cyclicality (using the example of literature of the 20th century). International Scientific Journal Theoretical & Applied Science, 3(12), 173-177.

Economic Horizons: Journal of Business, Economics, and Finance
ISSN: 2980-5295
Volume 01, Issue 03, March, 2025
Website: ecomindspress.com

78. Kadirova, O. H., Yusupaliyeva, F. Y. (2023). Methods of development of English-speaking skills of elementary school students. Ethiopian International Journal of Multidisciplinary Research, 10(11), 332-334.
79. Kadirova, O. K. (2023). Cyclization and cycle in Russian and Uzbek literature of the early 20 the century. TA'LIM FAN VA INNOVATSIYA, 2(6), 440-443.
80. Кадирова, О. Х. (2023). Проблема циклизации малых прозаических форм в русской литературе начала 20 века. Филологические исследования: язык, литература, образование, 8(9), 53-57.
81. Етмишбоев, М. (2021). Пути совершенствования гражданско-правового регулирования контрактных отношений в сфере спорта. Общество и инновации, 2(12/S), 343-347.