

STRATEGY OF INNOVATIVE AND INVESTMENT DEVELOPMENT OF RAILWAY TRANSPORT ENTERPRISES

СТРАТЕГІЯ ІННОВАЦІЙНО-ІНВЕСТИЦІЙНОГО РОЗВИТКУ ПІДПРИЄМСТВ ЗАЛІЗНИЧНОГО ТРАНСПОРТУ

Global trends in the development of rail transport have been studied and the dominance of trends in its digitalization and greening, electrification of the network, multimodality and interoperability, innovative and technological cooperation of railway transport enterprises, increasing infrastructure investment in the development of this industry has been established. The processes of revision of global and national strategic initiatives of innovative and investment development of railway transport have been revealed. The expediency of forming the strategy of innovation and investment development of domestic enterprises of railway transport, aimed at ensuring the socio-economic efficiency of their functioning and competitiveness through the activation of innovative abilities and rational use of investment opportunities, has been substantiated. The key aspects of the strategy of innovation and investment development of railway transport enterprises are disclosed. It is noted that the implementation of the latter will stabilize the current state of railway transport enterprises and ensure their innovation and investment development in the strategic perspective.

Key words: railway transport enterprises, innovation and investment development, strategy, global trends, digital changes.

Досліджено глобальні тенденції розвитку залізничного транспорту і встановлено домінування трендів його цифровізації та екологізації, електрифікації мережі, мультимодальності та інтероперабельності, інноваційно-технологічної співпраці підприємств залізничного транспорту, нарощення інфраструктурних інвестицій у розвиток даної галузі. Виявлено активізацію процесів перегляду глобальних і національних стратегічних ініціатив щодо інноваційно-інвестиційного розвитку залізничного транспорту. Доведено доцільність формування стратегії інноваційно-інвестиційного розви-

тку вітчизняних підприємств залізничного транспорту, спрямованої на забезпечення соціально-економічної ефективності їх функціонування і конкурентоспроможності за рахунок активізації інноваційних здатностей і раціонального використання інвестиційних можливостей. Розкрито ключові аспекти стратегії інноваційно-інвестиційного розвитку підприємств залізничного транспорту, які розкривають стратегічне бачення, цілі, завдання та напрями забезпечення інноваційно-інвестиційного зростання підприємств галузі. Зокрема як стратегічні напрями інноваційного розвитку підприємств залізничного транспорту визначено реалізацію масштабних проєктів розбудови залізничної мережі, модернізацію та оновлення рухомого складу, реалізацію проєктів цифровізації, впровадження інноваційних рішень у сфері сервісного обслуговування споживачів послуг, застосування цифрових рішень у сфері підготовки кадрів тощо. Серед напрямів інвестиційного розвитку підприємств залізничного транспорту виділено: диверсифікацію джерел інвестиційного забезпечення реалізації проєктів, використання сучасних інструментів їх фінансування та управління проєктними ризиками, розроблення конкурентної тарифної політики, впровадження прозорої системи планування, залучення та використання інвестицій тощо. Відзначено, що впровадження розробленої стратегії інноваційно-інвестиційного розвитку підприємств залізничного транспорту сприятиме стабілізації сучасного стану підприємств галузі і забезпеченню їх інноваційно-інвестиційного зростання в стратегічній перспективі.

Ключові слова: підприємства залізничного транспорту, інноваційно-інвестиційний розвиток, стратегія, глобальні тренди, цифрові зміни.

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Исследованы глобальные тенденции развития железнодорожного транспорта и установлено доминирование трендов его цифровизации и экологизации, электрификации сети, мультимодальности и интероперабельности, инновационно-технологического сотрудничества предприятий железнодорожного транспорта, наращивания инфраструктурных инвестиций в развитие данной отрасли. Вывявлена активизация процессов пересмотра глобальных и национальных стратегических инициатив по инновационно-инвестиционному развитию предприятий железнодорожного транспорта, направленной на обеспечение социально-экономической эффективности их функционирования и конкурентоспособности за счет активизации инновационных способностей и рационального использования инвестиционных возможностей. Раскрыты ключевые аспекты стратегии инновационно-инвестиционного развития предприятий железнодорожного транспорта. Отмечено, что внедрение последней будет способствовать стабилизации современного состояния предприятий железнодорожного транспорта и обеспечению их инновационно-инвестиционного развития в стратегической перспективе.

Ключевые слова: предприятия железнодорожного транспорта, инновационно-инвестиционное развитие, стратегия, глобальные тренды, цифровые изменения.

Formulation of the problem. Global experience of economic growth of countries shows that today infrastructure is a key factor of sustainable development and economic recovery during the crisis. The growth of the global market for transportation services in the coming years will be driven by a steady demand for passenger and freight transportation, particularly by

rail transport, as the most environmentally friendly and safe type of transport. Against the backdrop of growing demand for rail transport services, there will be an increase in investment in the railroad industry. Already today we can see that significant funds are being allocated to infrastructure projects aimed at developing the railway network, in particular high-

speed traffic, introducing digital changes in the railway industry, developing research infrastructure, and developing and implementing innovative types of rolling stock.

Given the digitalization of rail transport, its greening, multimodality and interoperability, innovative and technological cooperation of railway companies, increasing infrastructure investments in the development of rail transport, global and national strategic and program initiatives of innovation and investment development of rail transport are reviewed, this determines the feasibility of reviewing the strategy of innovation and investment development of domestic enterprises of railway transport.

Analysis of recent research and publications.

Features of ensuring innovation and investment development of railway transport enterprises, including strategic aspects of the implementation of this problem are considered in the scientific works of such scientists as V. Dykan, N. Kalicheva, M. Korin, V. Ovchinnikova, I. Tokmakova, V. Yanovskaya and others [1–6]. Scientists have studied the content of the concept of innovation and investment development and highlighted the positions on the formation of a strategy for sustainable innovation and investment growth of railway transport enterprises. While paying tribute to the significant contribution of scientists, it should be noted that at present a more thorough study of global innovation and investment changes in the railroad industry is required in order to form a strategy for innovation and investment growth of railway transport enterprises in accordance with the global transformations in this area.

Problem statement. Given the above, a more thorough study of innovation and investment processes characteristic of the global railway industry and the development of a strategy for innovation and investment growth of railway transport enterprises, taking into account such transformations, is now of great theoretical and practical importance.

Presentation of the main research material. In 2020, the world faces an economic crisis triggered by the COVID-19 pandemic. In the context of the coronavirus pandemic, rail transport faces a number of challenges that require rail companies to form new models for organizing their operations. At the same time, the new model of work organization in the railway industry should, on the one hand, preserve such important elements of the system as private ownership and competition between carriers, and on the other hand, be protected from the risks of declining traffic volumes through various contract type mechanisms between railway carriers, the owner of the railway infrastructure and the state.

The liberalization of the rail transport market in the EU has now led to the emergence of more than a thousand independent companies - private operators who own rolling stock (trailing stock and locomotives)

and organize train traffic on the EU infrastructure. The share of independent carriers varies from one European country to another, but in general there is a growing trend in the private rail transport sector. The share of independent private carriers (with their own wagons and locomotives) was 42% in the EU as a whole. It is interesting that the share of independent carriers differs in the segment of freight and passenger transportation. If in the freight transportation market the share of independent operators (carriers) exceeds 40%, in the commercial passenger transportation market it is only 10%, and in the socially important transportation market it is about 16%. As for employment in the railway industry, 42% work in companies managing the railway infrastructure, while 36% work in the private segment.

Organizational changes and transformation of the model of railway transport development are also typical for the domestic railway transport. Thus, it is generally planned to form an effective model of company management, eliminate cross-subsidization of passenger traffic at the expense of freight traffic, increase freight turnover and reduce administrative and managerial staff by reducing the number of management levels. It is planned to divide the company into four verticals: freight, passenger, infrastructure and production, which provides repair and production of rolling stock. The basis of UZ Cargo will be the eponymous cargo carrier UZ Cargo. Additional functions will be performed by such branches as the Leski Transport Services, the refrigerated car company and the Transportation Logistics Center. At the beginning of 2021, the creation of a UZ Cargo branch was announced. However, the supervisory board later decided to cancel the initiative to create this branch [7].

In addition to organizational transformations, other qualitative changes in the operating environment of railway transport enterprises, related to the influence of global innovative and investment trends in the development of companies, were also recorded. The analysis of global changes in the industry shows the following.

First, it is the development of the high-speed network and the creation of high-speed rolling stock. Today the length of such a network is about 40 thousand km. According to studies, the length of the high-speed rail network may reach 45.0 thousand km in the next few years due to the development of high-speed railroads in China, Turkey, Spain, India and France. At the end of July 2021, the length of China's high-speed railways alone reached 36 thousand km [8]. With this in mind, research is being conducted into the creation of new types of high-speed rolling stock. Among recent examples of innovative projects, it is worth mentioning the initiative to create China's first high-speed train on magnetic suspension, which reaches a speed of 600 km/h. Alstom recently received

an award for the Avelia Horizon double-decker train, which combines the aesthetic image and outstanding characteristics of a high-speed express train. The innovative technical solutions used to create this train have reduced energy consumption by 20% and operating costs by 30%.

Second, various types of innovative rolling stock are being created, and the existing fleet of cars and locomotives is being equipped with digital solutions, in particular sensor technology, sensors are being introduced to track train movements, the location of cargo and its condition, and so on. Locomotives are also now equipped with automatic driving systems. In particular, German Railways, together with Siemens, demonstrated the first automated train that runs on the Hamburg railroad in automatic mode with a driver on board controlling traffic. Maneuvering operations, such as turning the train to the end station of the route, are performed in fully unmanned mode. The train traffic is automated using autotracking on top of the European Train Control System (ETCS). Such a system is expected to increase line capacity by about 30%, as well as reduce energy consumption by 30%, ensuring precise compliance with the timetable. In addition, Germany published a strategy in July 2021 to switch to electric trains with traction batteries, which should replace diesel trains on routes that partially run on non-electrified lines. Such electric trains have more power and a high level of environmental safety. At the same time, it should be noted that a large number of railway engineering companies are currently engaged in the development of environmentally friendly rolling stock. For example, Alstom and Siemens are testing trains running on hydrogen fuel.

Third, there has been an increase in cooperation between the two countries in the transport and logistics sector, including the implementation of innovative projects. The most striking example is the deepening of cooperation between China and the EU in implementing infrastructure projects and increasing the volume of commodity flows between the regions. Cooperation between companies of individual countries is also intensifying, particularly in the production of rolling stock and components for the needs of rail transport. For example, Alstom and the Ministry of Trade and Integration of the Republic of Kazakhstan signed a memorandum on mutual assistance and cooperation, which concerns increasing the level of localization of production of high-tech spare parts and components. Currently, the level of localization of production is 38%; in the future, it is planned to increase it to 50% by 2025. Alstom has launched a plant to produce components for the needs of railway transport in India. The plant will assemble and test traction converters, other power equipment, equipment cabinets, driver consoles, and other rolling stock components. The opening of the plant, in which

25 million euros were invested, created 10,000 jobs. In addition, it should be noted that the plant complies with the Sustainable Development Goals. Therefore, 80% of the energy consumed by the plant is derived from renewable sources, only natural lighting is used during the day, sediment collection, water purification and reuse are provided for.

Fourth, there is the active introduction of digital technologies and the development of digital platforms for the development of rail transport. For example, decentralized data ecosystems are being developed today that provide simultaneous access to information for a large number of participants, who can read it, analyze it, and incorporate it into their services. Germany's Knorr-Bremse, for example, is actively promoting the concept of secure, decentralized data spaces, creating new opportunities for operators to integrate digital technology into maintenance and operational management systems. Overall, digitalization and sustainability initiatives offer rolling stock manufacturers prospects for development and innovation, including collaboration with transport operators and startups. Many companies are increasingly focusing on the use of digital technologies in maintenance, application development on the MaaS (Mobility as a Service) platform, and localization of production in cooperation with local businesses.

German operator Deutsche Bahn AG (DB AG) is introducing new solutions to improve service and increase operational efficiency. A large part of the technical solutions used by the company is based on IoT technologies. For example, long-distance trains are equipped with equipment that sends signals every 10 seconds about the location, possible deviations from the schedule, and the train's condition in real time. This system works on all long-distance trains in DB's fleet and is now being actively implemented on the company's new freight locomotives to perform intelligent analytics, predict schedule deviations and inform customers.

Fifth, an intensification of cooperation between railroad companies and research institutes. Thus, the Austrian company Frauscher Sensonic and the Institute for Machine Learning, Johannes Kepler University Linz will cooperate in adapting the latest machine learning technology to diagnose the technical condition of railway infrastructure. The developed solution involves the creation of a digital twin of all vibrations along the railroad track, parallel to which a fiber optic cable is laid. This digital twin contains an array of information of great value to the industry. The results of fundamental scientific research in the field of machine learning will improve the quality of the company's software. Over the next three years, the Austrian company will fund the work of two doctors of engineering sciences and participate in the development of a cluster of high-performance distributed computing.

International experience shows that investments in infrastructure projects should not decline during a crisis. They become a driving force of economic recovery. Infrastructure development is the basis of a country's social and economic growth, ensuring the mobility of the population, promoting new trade relations and increasing additional jobs. According to long-term macroeconomic projections, the global population will increase to 9.7 billion people in 2050. At the same time, the volume of consumption will also increase significantly. This will lead to an increase in the mobility of the population and goods, and could be a prerequisite for the creation of a unified intercontinental logistics system. In this context, one of the most valuable assets of the country could be the transport infrastructure.

In connection with the above, it should be noted that the world market for transport services will grow by an average of 7.8% annually and will reach 8.0 trillion USD in 2025, the growth of the world market for transport services will be due to a steady demand for passenger and freight transport. The introduction of new technologies and increased financing of the transport industry will ensure that the demand for passenger and freight transportation is met. Despite the fact that sea transport currently dominates in international freight transportation (more than 60% of freight is transported by sea), recently there has been a tendency to increase the share of international freight transportation by railroads. The emergence of this trend is largely due to the emergence and implementation of such an initiative as the "New Silk Road," which provides for the creation of a unified transport system between Europe and Asia. As envisaged by this project initiative, three trans-European transport corridors with corresponding transport and logistics infrastructure should be created within the framework of the Silk Road Economic Belt with the investment support of the PRC, and the The Silk Road Economic Belt should expand port infrastructure in order to increase the capacity of ports to serve Chinese goods flows. The OECD forecasts that passenger and freight demand will triple between 2021 and 2050.

Against the background of the growth of the global market of transport services, in particular due to the growing demand for railway transport services, there will be an increase in investment in the railway industry. It is already possible to observe that significant funds are allocated for the implementation of both large-scale and local infrastructure projects. At the same time, funds are allocated for the development of the railway network, in particular for high-speed traffic, the construction of new industrial and research facilities, the creation and introduction of innovative types of rolling stock, in particular with an emphasis on high power and environmental friendliness, and so on.

Given the digitalization of rail transport, its greening, electrification of the railway network, multimodality and interoperability of transportation, innovative and technological cooperation of railway companies, increased infrastructure investment in the development of rail transport, a review of global and national strategic and programmatic initiatives for innovation and investment development of rail transport, which determines the feasibility of forming a strategy of innovation and investment development of domestic enterprises of railway transport, the purpose of which is to ensure the socio-economic efficiency of their functioning and competitiveness by activating the innovative abilities and rational use of investment opportunities (Fig. 1).

In particular, the strategic directions of innovative development of rail transport are defined as:

- large-scale projects for the development of the railway network, including high-speed rail, and its electrification;
- modernization and renewal of rolling stock, including the purchase of environmentally friendly rolling stock;
- development of modern infrastructure facilities for charging and refueling locomotives using alternative energy sources;
- implementation of projects to digitally equip railway infrastructure and rolling stock;
- application of digital technologies to modernize operational business processes at railway transport enterprises;
- implementation of innovative solutions in the development of services and customer service of railway transport enterprises;
- application of digital solutions in the field of preparation and retraining of personnel, development of their digital and other professional competencies;
- formation of a modern cybersecurity system at railway transport enterprises, etc.

As for the areas of investment support for the development of railway transport enterprises, the main ones are:

- diversification of sources of investment support for the implementation of projects of railway transport enterprises;
- the use of modern tools for investment cooperation of railway transport enterprises;
- formation of the risk management mechanism in the implementation of railway transport development projects;
- development of a competitive tariff and pricing policy in the railway industry;
- development and implementation of a transparent system for planning, attracting and using investments;
- development of a roadmap for investment projects and ensuring their rating;

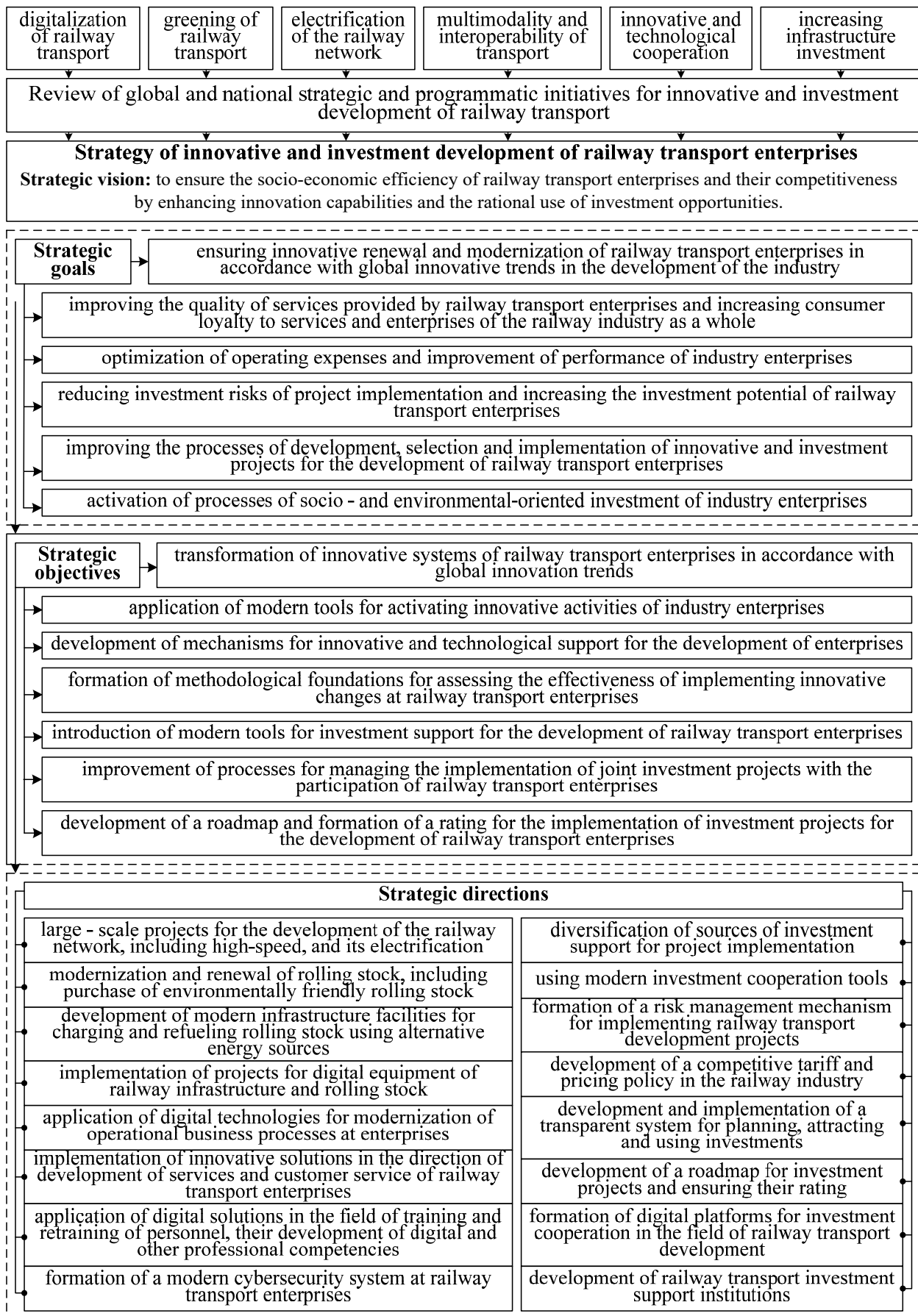


Fig. 1. Strategy of innovative and investment development of railway transport enterprises

Source: author's development

- formation of digital platforms for investment cooperation in the field of railway transport development;
- development of investment support institutions for railway transport etc.

Conclusions. So, on the basis of the study of world experience in the development of railway transport global innovative trends in their growth have been identified, which is the basis for the developed strategy of innovation and investment development of enterprises of railway transport. The introduction of the latter will stabilize the current state of domestic enterprises of railway transport and ensure their outstripping innovation and investment development in the strategic perspective. As further directions of research it is necessary to determine the formation of a portfolio of business strategies for the development of railway transport enterprises in the context of digitalization of the industry.

REFERENCES:

1. Dykan V.L. and Solomnikov I. V. (2017) Inzhynirno-marketynhovi tsestr innovatsiinykh tekhnolohii yak osnova aktyvizatsii innovatsiino-investytsiinoho potentsialu pidpriemstv zaliznychnoho transportu [Engineering and Marketing Center for innovative technologies as a basis for activating the innovation and investment potential of railway transport enterprises]. *Visnyk ekonomiky transportu i promyslovosti*, vol. 57, pp. 9–20.
2. Kalycheva N.Ye. (2019) Teoretyko-metodologichni zasady zabezpechennja konkurentospromozhnosti pidpriemstv zaliznychnoho transportu v umovakh transformacii biznes-seredovyshha [Theoretical and methodological bases of ensuring the competitiveness of railway transport enterprises in the conditions of transformation the business environment] (Doctor's Thesis), Kharkiv, Ukrainian State University of Railway Transport.
3. Korin M.V. (2019) Teoretyko-metodologichni aspekty rozvytku infrastruktury zaliznychnoho transportu v umovakh transkordonnogo spivrobitnyctva [Theoretical and methodological aspects of railway transport infrastructure development in the context of cross-border cooperation] (Doctor's Thesis), Kharkiv, Ukrainian State University of Railway Transport.
4. Ovchynnikova V.O. (2018) Teoretyko-metodologichni aspekty strategichnogo upravlinnja rozvytkom zaliznychnoho transportu Ukrainy [Theoretical and methodological aspects of strategic management of railway transport development in Ukraine] (Doctor's Thesis), Kharkiv, Ukrainian State University of Railway Transport.
5. Tokmakova I.V. (2015) Zabezpechennia harmonijnoho rozvytku zaliznychnoho transportu Ukrainy [Ensuring the harmonious development of railway trans-

port in Ukraine], Kharkiv, Ukrainian State University of Railway Transport.

6. Yanovska V. P. and Harmatiuk N. V. (2018) Suchasni strateghiji rozvytku zaliznychnogho transportu Ukrainy [Modern strategies for the development of railway transport in Ukraine]. *Zbirnyk naukovykh prats DUIT. Ser.: Ekonomika i upravlinnia*, vol. 42 (2), pp. 55–65.

7. Official web-site of JSC "Ukrzaliznytsya" (2021) Integrated Report of JSC "Ukrzaliznytsya" (Management Report) for 2020, available at: <https://www.uz.gov.ua/> (accessed 10 December 2021).

8. Railways of the world (2021) China invests more than 150 billion US dollars in rail transport, available at: <https://zdmira.com/news/kitaj-investiruet-v-zheleznodoro-zhnyj-transport-bolee-150-mlrd-dollarov-ssha> (accessed 12 December 2021).

БІБЛІОГРАФІЧНИЙ СПИСОК:

1. Дикань В. Л., Соломніков І. В. Інжиніринго-маркетинговий центр інноваційних технологій як основа активізації інноваційно-інвестиційного потенціалу підприємств залізничного транспорту. *Вісник економіки транспорту і промисловості*. 2017. № 57. С. 9–20.
2. Каличева Н.Є. Теоретико-методологічні засади забезпечення конкурентоспроможності підприємств залізничного транспорту в умовах трансформації бізнес-середовища: автореф. дис. ... д-р екон. наук: 08.00.04; Український державний університет залізничного транспорту. Харків, 2019. 43 с.
3. Корінь М.В. Теоретико-методологічні аспекти розвитку інфраструктури залізничного транспорту в умовах транскордонного співробітництва: автореф. дис. ... д-р екон. наук: 08.00.03; Український державний університет залізничного транспорту. Харків, 2019. 43 с.
4. Овчиннікова В.О. Теоретико-методологічні аспекти стратегічного управління розвитком залізничного транспорту України: дис. ... д-р екон. наук: 08.00.03; Український державний університет залізничного транспорту. Харків, 2018. 517 с.
5. Токмакова І. В. Забезпечення гармонійного розвитку залізничного транспорту України : монографія. Харків: УкрДУЗТ, 2015. 403 с.
6. Яновська В. П., Гарматюк Н. В. Сучасні стратегії розвитку залізничного транспорту України. *Збірник наукових праць Державного університету інфраструктури та технологій. Сер.: Економіка і управління*. 2018. № 42(2). С. 55–65.
7. Інтегрований звіт АТ «Укрзалізниця» (Звіт про управління) за 2020 р. АТ «Укрзалізниця»: веб-сайт. URL: <https://www.uz.gov.ua/> (дата звернення: 10.12.2021).
8. Китай инвестирует в железнодорожный транспорт более 150 млрд долларов США. Железные дороги мира: веб-сайт. URL: <https://zdmira.com/news/kitaj-investiruet-v-zheleznodorozhnyj-transport-bolee-150-mlrd-dollarov-ssha> (дата обращения: 12.12.2021).