Improving the supply chain management of China’s rail logistics system

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Abstract. The main purpose of the study is to propose possible ways of improving the supply chain management of China’s railway logistics system as part of the ongoing “One Belt One Road” initiative. Based on a multi-aspect analysis of scientific sources, the impact of the “One Belt One Road” initiative on the railway logistics system of China is justified. The author’s forecast results of rail freight transportation for the period 2022-2030 are given. It was revealed that the digital transformation of supply chain management is the main tool for improving the efficiency of China’s railway logistics system. Within the framework of scientific novelty, a range of basic elements of digital transformation and digital solutions are indicated that can be included in each of the areas of railway transport management. The prospects for the development of supply chain management of China’s railway logistics system in the view of “One Belt, One Road” initiative are identified and the corresponding innovative digital tools in the field of logistics are justified. It is concluded that the use of the latest digital technologies by rail carriers contributes to high performance and maintaining a competitive position in the logistics market, which is an integral part of the transition to sustainable rail freight transport.

1 Introduction

The modern railway logistics system of China is a unique example of the development of routes, directions and infrastructure in the global transport system [1]. In terms of scale, China’s rail logistics supply chain is not only one of the largest in the world today, but also one of the most efficient one. A record was set for the volume of rail traffic in China, which in the first half of 2022 increased by 6.6% compared to the same period in 2021. A total of 340 million tons of cargo passed through China’s rail logistics network in 2021, which is 21.1 million tons more than in 2020 [2].

Currently the One Belt One Road Initiative (OBOR) or the Belt and Road Initiative (BRI) is considered the critical project of China. The relevance of studying the initiative is due to the progressive increase in China’s influence in modern international politics. In the beginning of 2022 the initiative reached global proportions: about two hundred cooperation documents were signed with 149 countries and 32 international organizations with 63% of the world’s population as members of the project, and global GDP reached 40%. According to official statistics, from 2013 to 2021, annual trade between China and countries along the
route increased from $1.04 trillion to $1.8 trillion (11.6 trillion yuan) [3]. Within the BRI, a particularly important role is assigned to China’s international logistics system, the main goal of which is the creation or modernization of transport routes from China and the formation of economic growth points along them. As one of the most important strategies in China’s development process, the BRI is now gradually becoming a reality, which has a significant impact on China’s economic and social development. In turn, the development of the international logistics industry in China has acquired innovative elements, both in terms of the internal and external environment, and in terms of international trade services. According to experts, the OBOR is “…the most ambitious economic project” [4], which is based on the promotion of peaceful cooperation, where all countries have the full right to participate, regardless of their size of territory or level of well-being.

However, the multi-format nature of the BRI initiative still calls for further study in economic science. For the successful implementation of the goals set, it is necessary not only to declare their interests and mutual benefits for all countries falling into the orbit of this initiative, but also to improve the supply chain management of China’s railway logistics system in the new economic reality. So far, the basic concept of China’s logistics supply chain development is not perfect, the BRI initiative is suffering from supply chain interruptions and international travel restrictions caused by both the coronavirus pandemic and global economic challenges (the pandemic has negatively affected 60% of BRI projects, China’s GDP has decreased by 6.8% in the first quarter of 2020 [3]. Scientific theoretical views regarding the definition of supply chain management of China’s railway logistics system remain inconsistent. Given the innovative model of interaction and the formation of a new order of interregional cooperation within the BRI, an inevitable requirement for a sustainable economy is becoming a digital acceleration of the development of China’s modern rail logistics system, innovating the organization and management of rail supply chains, and improving the service efficiency and competitiveness of rail logistics transport.

Due to these objective reasons, the issues of improving the supply chain management of China’s railway logistics system in a fast-paced digital environment are becoming increasingly important. It is necessary to formulate new drivers for sustainable economic growth in China and cross-border trade, a comprehensive strategy for the development of the international logistics industry, in order to ensure the effective supply chain management of China’s railway logistics system.

Based on the relevance of the issue, this article provides an overview of scientific concepts and approaches in the field of supply chain management, presents the main logistics projects of China implemented as part of the BRI initiative, provides forecast data for China’s railway transport development strategy as part of the BRI initiative, and suggests possible ways to improve supply chain management rail logistics system of China in the context of the BRI.

2 Materials and methods

The purpose of this study is to identify and justify possible ways to improve the supply chain management of China’s railway logistics system.

The objectives of the study include:
1) Analyzing the development status of China’s railway logistics system.
2) Identifying possible ways to improve the supply chain management of China’s rail logistics system in the context of the Belt and Road Initiative.

The study used Russian-language, English-language and translated from Chinese scientific articles and analytical materials. To date, a multidimensional analysis of the transport and logistics system of China in the framework of the One Belt One Road
initiative is reflected in the works of Chinese scientists [4, 6-9] et al. and Russian researchers [10-15] et al., who assessed the potential of the transregional BRI project not only globally, but also at the national level. Works [16-24] et al. are devoted to the main aspects of the digital transformation of supply chains, which identify the key types of effects that accompany this process. However, since the BRI initiative is constantly evolving and changing, no study on identifying and justifying possible ways to improve the supply chain management of China’s railway logistics system has been completed, which leads to further study of the above issues.

The research methodology is based on scientific methods (analysis, synthesis, classification) that allow to form a general picture regarding the supply chain management of China’s railway logistics system. The main provisions of structural and situational analysis with the involvement of statistical methods of data processing are applied.

3 Results and discussion

Currently China’s rail logistics holds the key position in the supply chain. The goal of China’s railway transport development strategy is to provide transport for accelerated economic growth in China based on effective development [5, 14, 25]. In this regard, there is a need to consider issues related to supply chain management within China’s railway logistics system.

Railway logistics, as an important part of China’s modern logistics system, has a wide network coverage area, strong trunk transport capacity, good potential for intermodal transportation, a large logistics load, and many cooperating enterprises and users [1]. Data from China’s National Bureau of Statistics show that rail freight volume grew by 10.7% in 2021 [3].

The most important role in the transport provision of Eurasia in the context of the covid-19 pandemic has been acquired by the already built global infrastructure initiatives, one of which is the Chinese project “One Belt, One Road” (OBOR) [6, 26, 27]. The main components of this initiative are the Silk Road Economic Belt (Belt) and the new Maritime Silk Road (Road), each of which involves significant investments in logistics infrastructure. From 2013 to 2021, China’s project investment in the implementation of the BRI program amounted to $890 billion. Of this amount, 40.2% was invested in energy projects, such as the construction of power plants and oil pipelines, and 22.8% in the development of transport infrastructure [2].

As part of the initiative, transport and logistics channels with high throughput characteristics have been gradually formed, spanning east-west, north-south, and at the same time logistics facilities have been improved, gradually realizing direct, fast and heavy cargo transportation. The OBOR route stretches across Southeast Asia, South Asia, Central Asia, West Asia, North Africa, Central and Eastern Europe and other regions. The total area of the route is more than 1/3 of the entire globe [28].

The most priority areas of cooperation between countries within the BRI are logistics infrastructure projects of international importance located along the Silk Road (FEZ “Khorgos-Eastern Gates”, Dry Port “KTZE-Khorgos Gateway”, China-Kazakhstan-Uzbekistan-Turkmenistan-Iran Railway, Freight railway route Wuyishan (Fujian)-Almaty, Yiwu-Madrid railway line, section of the road passing through Almaty and Nur-Sultan, which is part of the Yiwu-London railway line, Arkalyk-Shubarkol railway line), which will strengthen economic cooperation both within the Asian region, and beyond, in particular, an important task is to strengthen ties and speed up delivery times to European countries [14].

According to China’s National Transport Complex Strategic Development Plan for the years 2021-2035, the railway sector are prioritized in terms of improving technological
innovation capacity, building a new type of industry ecosystem, promoting industrial integration and development, improving the infrastructure system, and deepening openness and cooperation. If the rate of growth in the development of railway transport in subsequent years coincides with the growth rate from 2014 to 2021, the indicators of rail traffic for the period 2022-2030 will be as follows (see Table 1):

**Table 1.** Forecast indexes of rail freight transportation for the period 2022-2030.

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<tr>
<th>Index</th>
<th>2022</th>
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<tr>
<td>Cargo transportation, million tons</td>
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<td>4346</td>
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<td>Total number of trains</td>
<td>21780</td>
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<td>Railway lane length, th km</td>
<td>150.4</td>
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*Source: [2, 3]*

However, despite the fact that economic development opens up new opportunities, it also creates certain problems [11-13]. There is a certain digital gap. The traditional supply chain is based on periodic forecasts and plans, which become more and more outdated and therefore inaccurate with each stage of SCM development. In this background, it is important to accelerate the development of modern logistics, supply chain management, introduce innovative technologies in the organization and management of railway transport, as well as improve the railway transport service system, which determines digital transformation as one of the main tools for increasing the efficiency of supply chain formation [15, 19]. Fig. 1 shows the transition from a traditional supply chain to a single digital supply chain.

The implementation of the digital tools of Industry 4.0 (Fourth Industrial Revolution) needed to modernize China’s BRI rail supply chains entails the creation of a web of competitive digital platforms (DPCs) (ecosystems, twins) [6]. For example, with the help of blockchain technology, China has created a digital financial service platform aimed at facilitating the development of rail freight operations between China and Europe. An example of a digital platform created on a territorial basis is the European Logistics Platform (ELP), within which organizations such as DHL, P&G, Volvo, Michelin, European Rail Freight Association and many others operate. The digital platform based on the principle of information unification includes the LOGINK (National Public Information Platform for Transport & Logistics) National Open Information Platform for Transport and Logistics, which integrates not only China’s national logistics flows, but also flows with Japan and South Korea.
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Fig. 1. Digital transformation of supply chain management in railway logistics. Source: compiled by the authors.

It should be noted that LOGINK unites about 50 leading Chinese companies, 91 logistics parks, about 26 seaports and more than 500 thousand enterprises of various profiles. The information system allows processing up to 30 million messages every day and accompanying the transportation of more than 1 trillion goods per year. The main technical means necessary for the functioning of the digital logistics platform include: IoT, RFID, DDSN and GSM.

Thus, digital transformation is a key factor in improving the efficiency of supply chain management in railway logistics and involves the inclusion of digital technologies in each of the areas of railway transport management.

4 Conclusion

A multi-aspect analysis of literature sources has revealed a digital gap between the implementation of BRI and the requirements of a sustainable economy for the development of a modern railway logistics system. In this background, the digital transformation of supply chain management is the main tool for increasing the efficiency of China’s railway logistics system. Strangely enough, but the chaos caused by the COVID-19 pandemic has created ideal conditions for digital transformation in logistics supply chains. On the one hand, demand fluctuations, unpredictable consumer behavior and trade disruptions have exposed companies’ weaknesses. On the other hand they have opened up a unique
opportunity for top management to make smarter and more daring decisions about their companies’ supply chains. The Digital Supply Chain (DSC) is a smart, value-driven, efficient process that generates new forms of revenue and business value for companies and uses new approaches through new technological and analytical methods. When introducing digital technologies, it is important to consider the specifics of transport activities, and above all, the changing role of transport in the logistics services market. Moreover, transport should be considered as a specific link in the value chain, in the complexity of the digital technologies used, taking into account reforming government measures and recommendations. Ignoring these measures will negatively affect the digitalization of supply chain management, and in the future will lead to the inefficiency of China’s transport and logistics system as a whole.

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