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Optimizing Chongqing's Logistics System Oriented to the New Western Land–Sea Corridor

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Abstract: Chongqing is the logistics and operation organization center of the New Western Land–Sea Corridor. Accelerating the optimization of the logistics system is of great significance for Chongqing to integrate and support the construction of the Corridor. The logistics system of Chongqing oriented to the Corridor is characterized by various transportation modes, multiple channel patterns, and wide coverage. Specific problems exist at the same time, such as those related to obstructed external transportation channels, underdeveloped hub platforms, and weak connections of multimodal transport. This paper presents optimization strategies for the logistics system, such as improving domestic transportation channels and promoting the construction of overseas transportation channels, optimizing the layout of logistics hubs and improving the function of hub ports, strengthening the infrastructure of multimodal transportation and innovating organization modes of multimodal transportation. To leverage the geographical advantage in development, Chongqing needs to actively participate in and support the construction of the Corridor, form a new pattern of opening up with land–sea linkage and east–west two-way cooperation, and provide strong support for high-quality economic development of the western region. DOI: 10.13813/j.cn11-5141/u.2022.0608-en

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0 Introduction

The New Western Land–Sea Corridor runs through provinces, cities and municipalities in western China, including Chongqing, Guangxi, Guizhou, Gansu, Qinghai, Xinjiang, Yunnan, Ningxia, and Shanxi, connecting the Silk Road Economic Belt in the north, the 21st Century Maritime Silk Road in the south, and the Yangtze River Economic Belt in the east. The Corridor is an important axis in the pattern of China's regional coordinated development, as well as a vital transportation, logistics, industry, and commerce corridor connecting the eastward and westward over the land and sea, and connecting the international and domestic markets. The Corridor takes up a significant strategic position in the national regional coordinated development pattern.

In August 2019, the State Council approved the *Overall Plan for the New Western Land–Sea Corridor*, which elevated the New Western Land–Sea Corridor to a national strategy and entered a new stage of construction. The construction of the Corridor not only needs to rely on top-level design and high-level coordination at the national level but also needs to rely on the provinces and cities to deepen research and detailed implementation in accordance with the local realities. At present, there are not many related studies. Some studies explore the current situation, problems, and development strategies of the New Western Land–Sea

Corridor in terms of transportation and rail-sea intermodal transport from the overall perspective [1–3]. There are also some studies exploring the development strategies of the transportation system, logistics organization, and regional coordination in the context of the construction of the New Western Land–Sea Corridor based on the local perspectives of Guangxi [4–5], Guizhou [6], Chengdu [7], etc.

As the logistics and operational organization center of the New Western Land–Sea Corridor, it is of great significance for Chongqing to think about how to optimize the logistics hub system and improve the efficiency of logistics and transportation of the Corridor based on the actual situation, thus helping to implement the *Overall Plan for the New Western Land–Sea Corridor*. On account of the actual situation in Chongqing, this paper explores the existing problems and optimizing strategies of Chongqing's logistics system oriented to the New Western Land–Sea Corridor based on field research and interviews with relevant departments.

1 Characteristic of Chongqing's logistics system oriented to the New Western Land–Sea Corridor

The New Western Land–Sea Corridor is an important component of the *China-Singapore (Chongqing) Strategic Connectivity Demonstration Project*, which was first

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launched in April 2017. At present, the New Western Land–Sea Corridor has basically formed a pattern of two starting points in Chongqing and Chengdu, three railway lines in the east, middle, and west, and several cross-border highway transportation lines. Chongqing is the starting point of two railway lines and many cross-border highway transportation lines in the east and middle of the Corridor, southward through Guizhou, Guangxi, Yunnan, and other outbound access to the world. Container trains basically achieve daily operation and connection with the China–Europe train. In general, Chongqing’s logistics system oriented to the New Western Land–Sea Corridor has the characteristics of diversified modes of transportation, multiple corridor patterns, and a wide range of radiation.

1.1 Diverse transportation methods

The transportation method of Chongqing oriented to the New Western Land–Sea Corridor has formed three regular transportation methods, mainly rail–sea intermodal transport, supplemented by cross-border highway and cross-border railway. 1) Rail–sea intermodal transport trains depart from Tuanjie Village via the port in the north, radiating 189 ports in 80 countries and regions on five continents. 2) Cross-border highway shuttles depart from Nanpeng, setting up more than 30 distribution points in China and Southeast Asia. The international artery transportation network covers Vietnam, Laos, Myanmar, Thailand, Cambodia, Singapore and other countries. 3) Cross-border railway trains depart from Tuanjie Village and reach Hanoi, Vietnam, Vientiane, Laos directly, etc. From January to November 2020, the volume of Chongqing’s rail–sea intermodal transport oriented to the New Western Land–Sea Corridor reached 136 800 TEU, the volume of cross-border highway reached 10 500 TEU, and the volume of cross-border railway reached 3 700 TEU (Tab. 1).

Tab. 1 Cargo transport of Chongqing oriented to the New Western Land–Sea Corridor from January to November 2020

Transportation method	Freight volume/TEU	Proportion of the freight volume/%	Cargo value/a hundred million	Proportion of cargo value/%
Rail–sea intermodal transport	136 736	91	171.20	61
Cross-border highway	10 503	7	27.44	10
Cross-border railway	3 662	2	79.80	29
Total	150 901	100	278.44	100

Data source: Reference [8]

1.2 Multiple channels pattern

The transportation corridor of Chongqing oriented to the New Western Land–Sea Corridor has formed a pattern of multi-channel connections. Among them, there are two rail–sea intermodal transport lines, which are Chongqing–Guizhou–Guangxi new marine channel from Chongqing through Guiyang, Nanning to Qinzhou and Chongqing–Henan–Guangxi new navigational channel from

Chongqing through Huaihua, Liuzhou to Beihai port. Compared with the river–sea intermodal transport channel from Chongqing through Shanghai to ASEAN, the distance of this rail–sea intermodal transport channel is reduced by about 2 100 km, and the transportation time is shortened by more than 10 days. There are five cross-border highway shuttle lines, namely the East Line, the West Line, the Asia–Europe Line, the Central Line, and the East Complex Line. There are two cross-border railway lines, which China–Vietnam railway shuttles depart from Chongqing through Nanning, Pingxiang port to Hanoi, Vietnam, and China–Laos railway shuttles depart from Chongqing through Kunming, Mohan port to Vientiane, Laos (Tab. 2).

Tab. 2 Transportation lines of Chongqing oriented to New Western Land–Sea Corridor

	Channel and line	Connected cities	Distance/km	Time-consuming/h
Rail–sea intermodal transport	Chongqing–Guizhou–Guangxi new channel	Qinzhou port	1 213	40
	Chongqing–Henan–Guangxi new channel	Beihai port	1 340	23
Cross-border highway	the East Line	Vietnam, Cambodia	1 400	45
	the West Line	Myanmar	2 700	79
	Asia–Europe Line	Southeast, Europe	12 400	480
	Central Line	Thailand	2 800	98
	East Complex Line	Vietnam, Singapore	2 700	240
Cross-border railway	China–Vietnam railway shuttles	Hanoi, Vietnam	1 560	48
	China–Laos railway shuttles	Vientiane, Laos	1 980	72

1.3 Wide range of radiation

Chongqing’s New Western Land–Sea Corridor has a wide range of radiation, including domestic trade transportation covering the western and coastal provinces of Guangxi, Guangdong and Hainan, with cargo accounting for about 2/3 of the total volume of transport. Foreign trade transportation involves ASEAN, Europe, Africa, the United States, and 80 countries and regions from five continents worldwide, with cargo accounting for about 1/3 of the total volume of transportation, of which ASEAN is the leading foreign trade import and export object (Tab. 3).

Tab. 3 Chongqing’s transportation in major internal and external trade areas oriented to the New Western Land–Sea Corridor in 2018

Regions	Freight volume/TEU	Proportion/%	Regions	Freight volume/TEU	Proportion/%
ASEAN	6 639	23.6	Guangxi	4 870	17.3
EU	669	2.4	Guangdong	2 813	10.0
Africa	580	2.1	Hainan	1 758	6.3
The United States	30	0.1	Others	10 741	38.2

Data source: Port and Logistics Office of Chongqing People’s Government.

2 Current problems of Chongqing's logistics system oriented to the New Western Land–Sea Corridor

2.1 Unsmooth external transportation channel, and limited transportation capacity

1) The operation standard of the marine railway channel is different.

As an important component of the new Chongqing–Guizhou–Guangxi marine channel, the Chongqing–Guiyang railway was opened in 1965. Chongqing–Guiyang railway is a single-track railway with a design speed of $80 \text{ km}\cdot\text{h}^{-1}$ and a transportation capacity of 2 200 t. The efficiency and safety of transportation are poor with old facilities and equipment, and the interruption of traffic is often caused by landslides due to rainfall [9]. At the same time, the transportation capacity of the Chongqing–Guiyang railway is much lower than that of its connection Guizhou–Guangxi railway (with design speed of $120 \text{ km}\cdot\text{h}^{-1}$ and a trailing load of 4 000 t), which has become the transportation bottleneck of the new Chongqing–Guizhou–Guangxi marine channel (Fig. 1). In addition, as the important components of the new Chongqing–Hunan–Guangxi navigational channel there is also a gap of transportation capacity between Chongqing–Huaihua railway and Huaihua–Liuzhou railway, resulting in the full capacity of the whole line cannot be fully utilized. In 2019, the utilization rate of the Chongqing–Guiyang railway reached 98%, and the utilization rate of the Fuling section reached 100%, which is a section of the Chongqing–Huaihua railway, both have been saturated. With the rapid development of the regional economy, inter-regional logistics transportation will be in great demand in the future. At the same time, the existing railway is difficult to undertake the growing logistics transportation demand from the rail-sea intermodal transportation channel [2].

2) The construction of cross-border highway and cross-border railway transportation lines is lagging behind

In recent years, ASEAN countries have made great achievements in the construction of the highway network. Countries with relatively better economic development have built an interconnected highway network, such as Thailand, Malaysia, Singapore, etc. While countries bordering China still have relatively lower levels of highway networks, such as Vietnam, Laos and Myanmar, resulting in the problems of low-level and poor highway conditions of the sections outside the border of five regular cross-border highway routes from Chongqing to ASEAN. For example, about 160 km of the east line of the cross-border highway (accounting for 55% of freight volume of the cross-border highway) from Longbang port in Guangxi province to Hanoi in Vietnam is a spiral road, making it difficult for large vehicles to pass, especially for container vehicles. The highway section of the west line

of the cross-border highway from Ruili port in Yunnan province to Mandalay in Myanmar (accounting for 23% freight volume of the cross-border highway) is still a highway under the second class with low transportation efficiency.

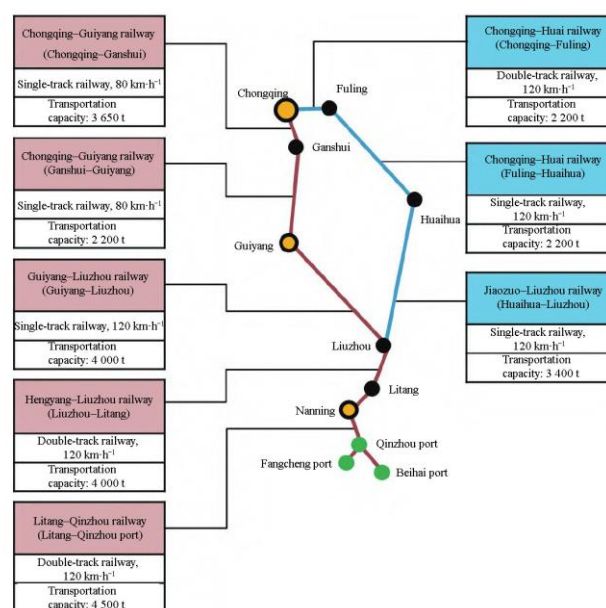


Fig. 1 Routes of railway–sea transportation channel in Chongqing

In terms of cross-border railway, Chongqing's cross-border railway oriented to the New Western Land–Sea Corridor only opened the middle line of the Trans-Asian Railway (China–Lao train) and the middle and east line of the Trans-Asian Railway (China–Vietnam train). Influenced by the geopolitical and geo-economic of Southeast Asia, overseas sections of the west and east line of the Trans-Asian Railway advanced relatively slowly.

2.2 Insufficient development of hub platform, weak functions

1) Uneven utilization of the development of the hub system

Chongqing's New Western Land–Sea Corridor has formed a hub system of “one main hub, two ancillary hubs and multiple nodes” with the central city area and Jiangjin as the main hub, Wanzhou and Fuling as ancillary hubs, and Qianjiang, Changshou, Hechuan, Qijiang, Yongchuan, Xiushan as important nodes. The railway freight function of the hub system is overly concentrated in the main hub of the central city area (Fig. 2), and the development of other ancillary hubs and nodes is relatively lagging behind. For example, in 2018, the capacity of Tuanjie Village Station, which is the core function of the main hub, has been saturated. There are insufficient flat-bed trailers, reach stackers and container yards due to the increase in the volume of China–Europe trains, resulting in a significant increase in the time of container picking.

2) The function of the port remains uncompleted

There are three types of ports in Chongqing: airport, port and railway (see Tab. 4). But the functions of each open port remain uncompleted and lack functional integration with each other, which only covers part of the goods categories. For example, the railway port only has the function of car loading, but not the functions such as importing grain and meat, designated supervision sites etc. As a result, the corresponding products transported to Tuanjie Village Station through the rail-sea intermodal transport can not be directly out of customs. They have to be transferred to the Cuntan port by highway transportation for customs clearance and then transported to Chongqing commercial market, which not only increases the operating costs of enterprises with a 46 km detour distance but also decreases the efficiency of logistics transportation.

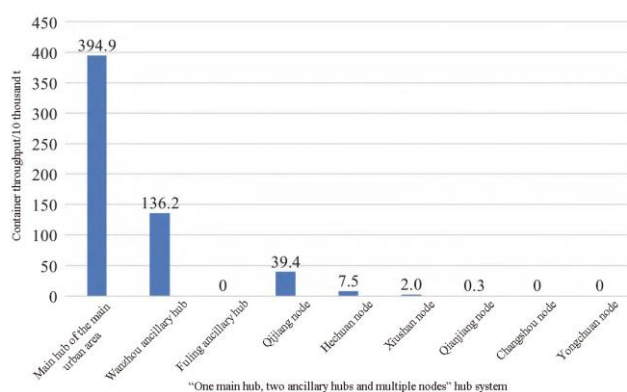


Fig. 2 Railway containers throughput of Chongqing hub system featuring “one main hub, two ancillary hubs, and multiple nodes” in 2017

Data source: China Railway Chengdu Group Co., LTD.

Tab. 4 Imports of Chongqing Port in 2018

Type of port	Categories of imported products	Quantity	Value/10 thousand dollars
Airport	Fresh-frozen fishery products	400 t	1 085
	Edible aquatic animal	849 t	638
	Fruit	9 t	11
	Rough diamond	0 t	0
Port	Meat	214 t	783
	Grain	23 t	663
	Fruit	0 t	0
Railway	Automobile (entire vehicles): 2 145 vehicles	2 145	4 109

2.3 Unsmooth and insufficient connection of multimodal transport

1) The connection network between logistics hubs is uncompleted

Port operation areas, railway yards, highway distribution centers and other logistics hubs are the basis of the organization of multimodal transport. But at present, the “last kilometer” railway access problem of port operation areas and highway distribution centers has not yet been completely

solved, making it difficult to achieve a seamless connection between ports, highways, railways, and other modes of transportation. Most of the industrial parks in Chongqing are still under construction, which means that the cargo transportation to the entrepôts must be first delivered through highway transportation, increasing the transportation cost of enterprises. At the same time, the container transportation chain within the city is uncompleted, and tedious processes such as cross-docking and handling result in high logistics costs [10].

2) The standard of the transportation system is not unified

On the one hand, logistics enterprises in Chongqing mainly provide less-than-truckload transportation and full-truckload transportation, and most logistics enterprises lack the ability to use the container transportation mode connecting with railway and marine transportation, which reduces the probability of enterprises in logistics park to use multimodal transportation. On the other hand, the technical standards of railway and marine transportation for classifying container types, cargo safety levels, and transportation loading requirements are also not unified. At the same time, railway, customs, marine transportation, freight agents, ports, and other relevant entities all use independent information management systems, lacking a unified and integrated rail-sea intermodal information platform, which leads to some export cargo having to be unpacked and repacked before it can be transported by rail after arriving at the port. Due to the lack of seamless intermodal transportation of goods, transportation costs of enterprises increase and delivery time is delayed.

3 Optimizing strategies of Chongqing’s Logistics System

3.1 Unblocking external transportation channels

1) Actively promote the filling of the weakness of domestic transportation channels

Although the main transportation framework of Chongqing oriented the New Western Land-Sea Corridor has been basically formed, some arteries have revealed capacity bottlenecks and the construction of some trunk lines still needs to be accelerated. Under the situation of rapid growth in demand for rail-sea intermodal transport, it is urgently necessary to carry out technical transformation of the Chongqing-Guiyang section of the Sichuan-Guizhou railway and the Chongqing-Huaihua section of the Chongqing-Huaihua railway in accordance with the double-track standard of design speed of $160 \text{ km} \cdot \text{h}^{-1}$, transportation capacity of 4 000t to remove the bottlenecks of the rail-sea intermodal transportation channels, so as to form a high-standard channel throughout the entire line. At the same time, making sure that the construction of the Chongqing-Liuzhou railway is on time, so as to form the shortest and highest standard rail-sea

intermodal transportation channel from Chongqing to the northern bay ports (Qinzhou Port, Fangcheng Port, Beihai Port) through Liuzhou.

2) Actively seeking national support to promote the construction of overseas transportation channels

In view of the issue of transportation bottlenecks caused by the poor conditions of cross-border highway and railway transportation in countries such as Vietnam, Laos, and Myanmar, we should actively seek support from the National Development and Reform Commission under the premise of regional and international stability, so as to guide the Asian Infrastructure Investment Bank, the Silk Road Fund and other financial institutions to provide financing services for the construction of cross-border transportation infrastructures, accelerate the construction of Indo-China Peninsula highway and the east and west lines of Trans-Asian railway and break through the bottlenecks of channel between the corresponding ports in the countries along the channel and China. At the same time, formulating plans for the construction of a cross-border highway and logistics information platform of railway transportation to achieve real-time tracking and optimize cross-border transportation.

3.2 Completing the construction of hub platforms

1) Optimizing the layout of Logistics hubs

Based on the development patterns and experiences of logistics hubs in megacities such as Beijing, Guangzhou, and Tokyo ^[11], the regional logistics hub functions will move from the central city areas to the outskirts of the city as the central city area upgrades their functions, which improves the organizational efficiency of transportation while reducing overall operational costs. Therefore, as the innovative service functions in the central area of Chongqing are strengthened, the logistics functions will inevitably weaken. In the future, the portal logistics hub facing the New Western Land-Sea Corridor will migrate outward along the channel from the central city area. Accordingly, combined with the locational conditions of Qijiang in the main channel of the New Western Land-Sea Corridor, it is recommended to move the south-facing logistics functions of Tuanjie Village Station to Qijiang Station, enhance Qijiang Station's function as an international logistics hub and optimize the layout of the logistics hub.

2) Accelerating the improvement of ports functions of the hub platform

Ports serve as gateways for Chongqing's opening up. Promoting high-level opening up and high-quality development of ports is of great significance for Chongqing to build a new open-economy system at a higher level and implement opening up in more comprehensive ranges, more fields, and deeper levels. Therefore, it is necessary to seek support from relevant national departments and further improve the port functions of important logistics hubs, promote the expansion and extension of port functions for imported fruits, grains, and meats at Chongqing Port to railway ports and accelerate

the declaration and construction of various designated supervisory sites for all kinds of ports. It is necessary to accelerate the improvement of foreign trade services and management mechanisms at the ports, raise the level of professional services at the ports and the level of customs clearance facilitation, and create international logistics corridors and regional trade and logistics hubs with the smooth flow of goods, convenience and efficiency, so as to make Chongqing an important distribution center of imported products covering the Southwest region and radiating to the whole country.

3.3 Optimizing the organization of multimodal transport

1) Accelerating the improvement of infrastructure of multimodal transport

The development of multimodal transport plays an important role in reducing transportation costs and enhancing the competitiveness of enterprises. With the construction and improvement of the integrated transportation system, multimodal transport has a promising future in its development ^[12]. Therefore, it is necessary to strengthen the overall planning and guidance, improve the integrated layout and construction level of transportation infrastructure, make up for the shortcomings of transfer facilities of multimodal transport and other basic infrastructure, carry out multi-types of multimodal transport such as rail-sea, highway-rail, highway-sea, highway-air, air-rail and built a demonstration base of the New Western Land-Sea Corridor multimodal transport in high standards. It is necessary to promote the New Western Land-Sea Corridor by initially establishing a container allocation sharing system, which connected with China-Europe Railway Express and the golden waterway of the Yangtze River, so as to strengthen the docking of the logistics information platform, realize seamless connection of transportation channels, promote the transformation and upgrading of transportation modes such as "highway-to-railway" and "railway-to-sea" for bulk goods, and enhance the efficiency of multimodal transport.

2) Innovation of the organizational modes of multimodal transport

With continuous optimization and improvement of industrial patterns, the deep-level regional cooperation relationships are constantly strengthened, and the innovation of multimodal transport, which is under the support of advanced technology, can better meet the logistics needs at various levels and dimensions. Therefore, it is necessary to cultivate the main part of the multimodal transportation market and encourage port shipping, railway transportation, shipping agencies and platform-based enterprises to accelerate the transformation into multimodal transportation operators. It is also important to boost the convergence of rules on transportation services and promote the establishment of rules coordination and mutual recognition mechanisms that are compatible with multimodal transport with a focus on the

connection between rail and sea transportation. Then further promoting the “one order system” of multimodal transport, and exploring the real right of waybills of international railway transportation and certificates of multimodal transport. In addition, it is of great significance to accelerate the construction of a safe, convenient, efficient, green, and economical modern comprehensive transportation system to better serve the construction of the new development pattern.

4 Conclusions

The construction of the New Western Land–Sea Corridor is an important measure for the country to deepen the two-way opening up of the land and sea and promote the Great Western Development to form a new pattern, which will effectively improve the transportation capacity and the quality and efficiency of logistics development in western regions, deepen international economic and trade cooperation, promote deep integration of transportation, logistics, commerce and industry, and provide strong support for promoting high-quality development in western regions and building a modernized economic system. Based on the perspective of Chongqing city, this paper sorts out three problems existing in Chongqing’s logistics system oriented to the New Western Land–Sea Corridor, including the unsmooth external transportation channels, the insufficient development of its own hub platforms, and the unsmooth connection of multimodal transport, and proposes the optimizing strategies of further unblocking external transport channels, completing the construction of hub platforms, and optimizing the organization of multimodal transport. Chongqing needs to integrate into and support the construction of the New Western Land–Sea Corridor, build logistics and operational organization centers, convert its location advantages into development advantages, play a key role in leading and driving the opening up, and provide strong support for the high-quality economic development of western regions. In addition, the New Western Land–Sea Corridor covers wide areas, and in the future, research on the logistics system can

be further carried out along other provinces (districts, cities) to jointly promote the construction and cooperation of the New Western Land–Sea Corridor.

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