Research on Transport Organization Strategy for the "China-Europe Railway Express" : Postprint

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Abstract

Infrastructure connectivity constitutes the priority domain of Belt and Road Initiative construction. The China-Europe Railway Express represents a novel channel for freight transport across the Eurasian continent and a significant measure for infrastructure "interconnectivity," having emerged as a landmark transportation cooperation platform for the Belt and Road Initiative. Following an exposition of the strategic significance and existing challenges of China-Europe Railway Express operations, this article proposes a framework for correctly understanding this new transport modality, indicating that the China-Europe Railway Express occupies a limited position and function within China' s foreign trade transportation system. It can achieve profitability only when serving central and western regions distant from eastern coastal ports, as well as areas along major international corridors, and when transporting suitable cargo within reasonable geographical ranges. Finally, the author proposes constructing a hub-and-spoke organizational model, establishing key cargo distribution hubs, and coordinating and standardizing the organization of China-Europe Railway Express services to reduce transportation costs and thereby generate economies of scale.

Full Text

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Study on the Transportation Organization Strategy of China-Europe Express Train*

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Abstract

Infrastructure connectivity constitutes a priority domain of the Belt and Road Initiative. The China-Europe Express Train (CEET) represents both a new channel for cargo transport across the Eurasian continent and a crucial measure for achieving infrastructure "interconnectivity," establishing itself as a signature platform for transport cooperation under the Belt and Road framework. This paper first elaborates on the strategic significance of CEET operations and identifies existing challenges. It then advances a scientifically grounded understanding of this emerging transport mode, arguing that CEET plays a limited role in China's foreign trade transport system. Profitability can only be achieved when CEET serves the central and western regions remote from eastern coastal ports—along with areas along major international corridors—within reasonable geographic scopes and carries appropriate cargo types. Finally, the authors propose constructing a hub-and-spoke organizational model, creating key cargo distribution hubs, and implementing coordinated, standardized CEET operations to reduce transport costs and generate economies of scale.

Keywords: China-Europe Express Train (CEET), cross-border land transport, Belt and Road Initiative, infrastructure connectivity, hub-and-spoke model
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Infrastructure connectivity represents a critical domain for cooperation among Belt and Road countries [1]. As the foundation and bond for personnel exchanges, cultural interaction, economic and trade flows, and information sharing among participating nations, infrastructure connectivity—characterized by its small-scale and sub-regional features [2]—has become both a prerequisite condition and priority area for advancing Belt and Road construction. Land-based infrastructure connectivity focuses on strengthening international transport corridor development, promoting cooperation in international transport organization and agreements, and advancing major cross-border infrastructure projects, with the ultimate goal of enhancing land transport capacity and port clearance efficiency between participating countries.

The China-Europe International Railway Express (hereinafter referred to as "China-Europe Express Train" or CEET) denotes fast freight trains from China to countries along the "Silk Road Economic Belt" (primarily Europe), operating primarily as "five-fixed trains" (fixed departure point, fixed route, fixed train number, fixed schedule, and fixed price) using container or full-carload transport. By leveraging the advantages of shorter transport distance and time compared to maritime shipping, CEET transports high value-added products to Europe and other destinations in scheduled train formations [3]. With its speed, high security, and short transit times, CEET provides a new transport channel for cargo movement across the Eurasian continent and serves as an important measure for promoting cross-border transport organization and agreement cooperation among Belt and Road countries.

Since the inaugural "Chongqing-Xinjiang-Europe" train departed on March 19,

2011, numerous Chinese cities have successively launched "XX-Europe" routes to Europe and Central Asia. The country is now forming three major operational corridors—western, central, and eastern—and a regularized train system. The western corridor passes through Alashankou (or Khorgos) from central and western China into Kazakhstan, then through Aktogay, Balkhash, Karaganda, and Astana before entering Russia en route to Europe, or alternatively through Almaty, Shymkent, Kentau, and Oral into Russia. The central corridor departs North China through Erenhot into Mongolia' s Zamyn-Uud, then via Ulaanbaatar and Ulan-Ude to Moscow before continuing to Europe. The eastern corridor (including Northeast China) reaches Dalian or Yingkou ports by sea from China' s southeastern coastal regions, then travels via the Harbin-Dalian railway to Harbin, or reaches Russian coastal ports like Vladivostok by sea before arriving in Harbin via Suifenhe; both routes then exit through Manzhouli into Russia via Chita toward Europe.

After nearly six years of development, five major train systems have emerged – "Chongqing-Xinjiang-Europe," "Zhengzhou-Europe," "Wuhan-Xinjiang-Europe," "Chengdu-Europe," and "Chang' an" –with 39 operational routes serving 31 domestic cities and reaching 28 cities in 15 foreign countries. Since 2011, CEET operations have maintained strong growth, with train frequencies increasing from 17 trains to 1,702 trains in 2016, totaling nearly 3,000 trains. CEET has become the backbone of land transport for trade along the Silk Road and a model for transport cooperation among participating countries.

1. Strategic Significance of CEET Operations

CEET represents a crucial measure for achieving "interconnectivity" in Belt and Road construction. Infrastructure connectivity must address three key issues: first, aligning the layout and planning of Belt and Road infrastructure; second, establishing unified, coordinated management mechanisms or systems; and third, creating convenient trade clearance systems. Across the Eurasian continent, while transport network density is already high in China' s eastern and central regions and in Europe, the continent' s interior, South Asia, and Southeast Asia suffer from severe shortages of modern transport infrastructure, coupled with disparate technical standards and poor transport connectivity among countries. Developing "key channels, key nodes, and missing links" in transport infrastructure [1] helps improve accessibility. Meanwhile, establishing "unified whole-journey transport coordination mechanisms, compatible transport regulations, and convenient international customs clearance" [1] provides essential guarantees for international transport facilitation. Without "connectivity" beyond mere "linkage," economic exchanges and personnel mobility among Belt and Road countries would face enormous obstacles. Therefore, "linkage" serves as the prerequisite for "connectivity," while unified transport organization and customs facilitation constitute important guarantees for "connectivity," with international transport facilitation as the ultimate objective.

CEET has pioneered a multi-country collaborative international train operation

mechanism, creating a new model of close cooperation among railways, ports, and customs authorities along its routes. It has also strongly promoted foreign trade and export-oriented economic development in China's central and western regions, providing robust support for establishing China's railway international intermodal transport brand and advancing Belt and Road construction.

2. Problems in CEET Operation and Organization

Despite its progress, CEET's role in China's foreign trade transport system remains very small and its future potential limited, constrained by differences in railway infrastructure standards and technical levels, operational organization, policies among countries along the routes, and complex geopolitical patterns.

2.1 Lack of Top-Level Systematic Design and Inter-Route Competition

By the end of 2016, 31 Chinese cities had launched "XX-Europe" trains, with many more routes under consideration. The current network comprises 39 routes originating from cities including Chongqing, Chengdu, Xi'an, Wuhan, Zhengzhou, Suzhou, Changsha, Yiwu, Harbin, Wuwei, Guangzhou, and Yingkou. Some "XX-Europe" routes have formed multiple lines lacking overall layout and systematic network design, with organization and operations dependent on local governments. Most routes overlap or run parallel over long distances, while newly launched trains increasingly follow completely identical paths, creating excessive frequencies that waste substantial capital, resources, and transport capacity. Competition has emerged among some "XX-Europe" trains, particularly malignant competition between routes with similar paths or overlapping hinterlands. Without unified pricing, each train negotiates separately with foreign railway operators, making it difficult to secure international segment freight discounts and customs clearance benefits. For example, Russian Railways charges different rates for trains entering through different ports: \$0.7/(TEU · km) for Alashankou and \$0.4/(TEU · km) for Manzhouli. Only the Chongqing-Xinjiang-Europe route is included in the "Smart and Secure Trade Lanes" pilot program; other trains must undergo multiple inspections across countries. To compete for cargo, besides serving their own provinces, various "XX-Europe" trains actively solicit freight from the Yangtze River Delta and Pearl River Delta regions.

2.2 Dispersed Domestic Cargo Sources and Scarce International Return Cargo, Leading to Inefficient Operations

Due to China-Europe trade structures, industrial structures in origin cities, and the low cost of maritime shipping, most current cargo flows to Europe, Central Asia, and Russia still rely primarily on maritime transport. Chinese cities have separately constructed railway yards and bonded zones, each building its own "bridgehead for Europe trade" and soliciting cargo from surrounding regions or

even nationwide. This results in small, dispersed domestic cargo volumes for CEET, with many trains operating with insufficient cargo despite running only once weekly, making regularized operations unsustainable. Meanwhile, European exports to China by rail consist only of small quantities of precision instruments, machinery, and high-end garments. Nearly all "XX-Europe" trains have failed to develop capacity to attract substantial return cargo, operating essentially as one-way freight services with extremely limited international return shipments. CEET operations only achieved their first return cargo breakthrough in 2014, and by 2017, return trains still numbered only half of outbound trains, with balanced bidirectional transport remaining difficult to achieve in the short term.

2.3 Poor Logistics Channel Connectivity, High Operating Costs, and Widespread Losses

China and Western Europe use standard gauge (1,435 mm), while Russia, Mongolia, and Central Asian countries of the former Soviet Union use broad gauge (1,520 mm). This gauge inconsistency [Figure 1: see original paper] requires at least two transshipments for CEET, causing frequent loading restrictions and cargo backlogs at border ports that consume substantial time. Train splitting still occurs en route, with low speeds and excessive transit times abroad. Customs clearance convenience remains inadequate, with non-uniform charging standards, and domestic ports still frequently detain trains and containers due to customs declaration and inspection procedures. Since CEET charges 50% more than regular freight trains, plus transshipment costs, operating expenses far exceed those of rail-sea or river-sea intermodal transport.

3. Scientific Understanding of CEET

3.1 Correctly Understanding CEET' s Limited Role in China' s International Trade

Constrained by differences in railway infrastructure technology and management among countries, complex geopolitical environments, and fundamentally higher land transport costs compared to maritime shipping, China-Europe, China-Central Asia, and China-Russia rail freight volumes remain extremely limited [4,5]. Although CEET rates have dropped from the initial $9,000 per TEU to the current level of over $6,000, they remain significantly higher than maritime shipping. Consequently, traditional international maritime transport still handles 97% of China' s containerized cargo to Europe, Central Asia, and Russia. According to this study' s estimates, in 2012, container volumes transported via the Eurasian Land Bridge accounted for only 0.5% of China's total foreign trade containers and 2.4% of containers bound for Europe, Central Asia, and Russia. Specifically, CEET international container volumes through Alashankou represented merely 0.04% of China' s container flows to these regions and 0.01% of total foreign trade containers. Thus, current westbound rail channel volumes are extremely small and lack strategic freight significance. Nevertheless, we

must recognize the important implications of scientifically operating CEET for Belt and Road construction.

3.2 Scientifically Understanding CEET' s Rational Transport Scope

Government subsidies currently constitute a necessary condition for most CEET operations. To ensure operations and attract cargo, local governments have introduced subsidy schemes covering costs exceeding maritime shipping rates, typically ranging from $2,000-3,000 per container. For instance, Chengdu provides freight subsidies through special funds, Chongqing offers special subsidies to local computer manufacturers based on maritime rates, and Zhengzhou provides fiscal subsidies to train companies referencing maritime prices. Only under these subsidies do many CEET services achieve costs roughly equal to or slightly higher than maritime shipping while saving time. Without local subsidies, all "XX-Europe"trains would struggle to maintain operations. Subsidy policies have escalated competition among "XX-Europe"trains into inter-governmental competition, with local governments not only maintaining but intensifying early-stage subsidies. Many regions, including the Yangtze River Delta and Pearl River Delta with maritime advantages, have opted for rail over sea transport, first transshipping cargo to Zhengzhou, Wuhan, or even distant Chongqing before shipping to Europe. These non-market measures have fostered malignant competition, causing resource waste and economic inefficiency in logistics organization while violating transport economics principles.

Based on a multimodal transport competition analysis model examining current CEET operations along the Silk Road Economic Belt, Mo Huihui et al. [3] selected Chongqing and Xi' an—cities with substantial CEET volumes—as origins and Moscow, Rotterdam, and Istanbul as destinations. Using survey-collected parameters, they quantitatively analyzed the economically adaptive regions for international container land transport from both cost and time perspectives. Case studies reveal that, constrained by maritime shipping rates, for goods of ordinary value, Central Asia, Mongolia, Russia' s Siberian, Ural, Volga, and Central Federal Districts constitute CEET' s comparative advantage zones with clear economic-time benefits. Ukraine, Belarus, Poland, and Russia's Northwestern and Southwestern Federal Districts represent advantage expansion zones with high time benefits but slightly lower economic benefits. For most other European regions, maritime (sea-land) transport advantages far exceed rail intermodal transport, making rail unsuitable for ordinary-value goods [Figure 2: see original paper].

Domestically, CEET is suitable for central and western regions remote from eastern coastal ports and areas along major international corridors. Coastal regions with seaport advantages and central regions connected to seaports by trunk railways lack competitive advantages for CEET and should adopt maritime transport to save costs. However, for international transport of low-weight, high-value-added products, CEET' s applicable scope abroad and origin cities domestically can be appropriately expanded.

4. Recommendations for Coordinated CEET Organization

4.1 Constructing a Systematic Network and Creating Cargo Distribution Hubs

Under the premise of rational division of labor between maritime and rail transport, CEET networks should be systematically designed and organized according to China' s economic layout, port distribution, and international corridor construction. Focusing on cargo organization in Northeast, North, and Central-West China, three major CEET corridors should be constructed: eastern, central, and western lines, using Manzhouli/Suifenhe, Erenhot, and Alashankou/Khorgos as border ports respectively. Adhering to comparative advantages of maritime and rail transport, CEET services should primarily originate from central and western regions remote from seaports, while controlling blind follow-up in eastern coastal regions, particularly the maritime-advantaged Yangtze River Delta and Pearl River Delta.

Innovating domestic cargo organization models, a hub-and-spoke network should be established with a few cities as hubs [Figure 3: see original paper]. Various regions should share train numbers for consolidated transport, shipping only after achieving full loads to achieve "group assembly, decentralized transshipment," ensuring high-frequency regular operations. In the National Development and Reform Commission' s "China-Europe Express Train Construction and Development Plan (2016-2020)," 12 inland major cargo source nodes, 17 railway hub nodes, 10 coastal port nodes, and 5 border land port nodes were designated [6]. From an organizational perspective, these hub designations appear excessive and may fail to effectively consolidate cargo. Initially, we recommend selecting a few cities such as Lanzhou, Zhengzhou, and Harbin as cargo distribution hubs, consolidating regional cargo to these hubs before dispatching full trains. Specifically, Lanzhou would concentrate cargo from Northwest and Southwest China, Zhengzhou from areas north of the Yangtze River, and Harbin from Northeast China.

4.2 Forming Unified Organization and Creating a Common Brand

Breaking the pattern of "fighting alone and competing separately," we should promote "resource integration and collaborative prosperity" to create a unified national chessboard and railway network, jointly building an international logistics brand. Under China Railway Corporation' s organization, unified brand identity, transport organization, whole-journey pricing, service standards, management teams, and coordination platforms should be established. Train routes should be rationally configured to form unified whole-journey timetables and schedules, enabling "public train-style" services. A unified voice should negotiate whole-journey preferential pricing.

4.3 Improving Multilateral Coordination Mechanisms and Accelerating Overseas Cargo Development

Strengthening bilateral and multilateral governmental communication along routes, cooperation among railways, customs, inspection and quarantine authorities, and logistics service providers should be enhanced. Consular and agency offices should be mutually established in cities along routes with regular communication mechanisms to promote whole-journey network design. Customs clearance facilitation should be advanced, pushing for unified supervision and inspection standards across countries to reduce whole-journey transport time. We recommend promoting information exchange, mutual recognition of supervision, and mutual assistance in law enforcement among domestic provinces and cities and countries along routes. Secondary transit should be liberalized according to market demand, and the "Smart and Secure Trade Lanes" program should be expanded on CEET to reduce cargo inspection frequency.

The CEET brand should be jointly promoted to create a unified whole-journey service center. Return cargo should be expanded to enable bidirectional trains at equal frequencies. Through various trade fairs and business negotiations, cooperation should be promoted between Chinese enterprises and traders and those from Central Asia and Europe. Chinese logistics enterprises should be encouraged to jointly build logistics centers with major cities in countries along routes and to establish branch offices or joint-venture logistics companies to organize and develop return cargo.

4.4 Establishing a Reasonable Government Subsidy Exit Mechanism

The role of local governments in CEET should be defined with reasonable entry and exit mechanisms. Long-term subsidy policies targeting origin cities should be discouraged, and personalized policies violating market principles should be restricted. A "China-Europe International Express Train Fund" should be established, managed by China Railway Corporation and funded by cities along routes or origin cities according to their shipping volumes, transforming government subsidies into capital injections. Coordination mechanisms among provinces and cities should be improved to create benefit-sharing mechanisms and efficient working mechanisms involving customs, inspection and quarantine, and railway departments.

References

1. National Development and Reform Commission, Ministry of Foreign Affairs, Ministry of Commerce. *Vision and Actions on Jointly Building Silk Road Economic Belt and 21st-Century Maritime Silk Road*. Beijing: Foreign Languages Press, 2015.
2. Liu Weidong, Tian Jinchen, Ou Xiaoqi, et al. *The Belt and Road Initiative: A Study of Its Strategic Framework*. Beijing: The Commercial Press, 2017.

3. Mo Huihui, Wang Jiao' e, Song Zhouying. Economic adaptive region of international container land transport on the Silk Road Economic Belt. *Progress in Geography*, 2015, 34(5): 581-588.
4. Otsuka S. Central Asia's rail network and the Eurasian land bridge. *Japan Railway & Transport Review*, 2001, 28: 42-49.
5. Xu S. The new Asian-Europe land bridge: Current situation and future prospects. *Japan Railway & Transport Review*, 1997, 14: 30-38.
6. National Development and Reform Commission. *China-Europe Express Train Construction and Development Plan (2016-2020).* [2016-10-17]. http://xbkfs.ndrc.gov.cn/gzdt/201610/P020161017546978452480.pdf.

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Note: Figure translations are in progress. See original paper for figures.