THE CHINESE GOVERNMENT'S STRATEGY TO INCREASE THE COMPETITIVENESS OF HIGH-SPEED RAILWAY TECHNOLOGY (2015 - 2025)

UNDERGRADUATE THESIS

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FACULTY OF SOCIAL AND CULTURAL SCIENCES

UNIVERSITAS ISLAM INDONESIA

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Proposed to the Department of International Relations
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No other materials are used other than those contained. I have read and understood the university's rules and procedures regarding plagiarism.

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Ratri Ayu Permatasari

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ABSTRACT

China has established itself as a leading player in the global high-speed railway (HSR) sector, leveraging HSR diplomacy through the Belt and Road Initiative (BRI) to enhance its economic and geopolitical reach in Southeast Asia, Europe, and Russia. While existing research has thoroughly investigated the external and geopolitical aspects of China's HSR growth, there is a scarcity of studies focusing on the domestic tactics that bolster its competitiveness. This research utilizes Porter's Diamond Model to examine how the Chinese government has improved the competitiveness of its HSR industry across four dimensions: factor conditions, demand conditions, related and supporting industries, and firm strategy, structure, and rivalry. The model posits that these four factors operate as an interconnected framework intentionally designed and maintained by the state, rather than arising spontaneously from market forces. The results of this study indicate that state funding and a centrally organized research ecosystem crafted factor conditions, while demand was strategically stimulated through tourism incentives and subsidized rural access. Coordination of related and supporting industries, notably steel and semiconductors, was achieved through centralized planning, and the competition among major state-owned enterprises was regulated via a "managed competition" model, which was subsequently applied to international projects under the BRI.

Keywords: High-speed railway, China, Porter's Diamond Model, Competitiveness, Belt and Road Initiatives.

CHAPTER I

INTRODUCTION

1.1 Background

This era of globalization has increased the interconnectivity between countries across various sectors especially in trade, investment, and mobility. This transformation is largely supported by the rapid advancement of technologies which aims to facilitate the efficient movement of people, goods, and services across borders. As global economic activities become increasingly dependent on connectivity, the demand for a modern and fast reliable transportation system has grown substantially. High-speed railway (HSR) has become one of the most transformative innovations and plays a crucial role in addressing this demand. The development of HSR provides solutions and strategic opportunities for many countries to enhance their global competitiveness and technological influence.

China has aggressively developed and expanded their HSR industry, as a part of its national strategy to strengthen its competitiveness in transportation infrastructure. This has enabled China to export its HSR technology widely, particularly across Southeast Asia, as part of its broader strategy to expand political influence through the Belt and Road Initiative (BRI). Launched in 2013, the BRI plays an important role as an economic diplomacy instrument and as a tool to promote the superiority of China's infrastructure. Through BRI, China promotes its construction project of HSR to its partner countries, such as Indonesia, Laos, and Thailand with the aim of increasing its geopolitical influence and the competitiveness of China HSR in the global market (Anh 2024, p. 66)

China's relative success in securing HSR contracts in Southeast Asia, compared with competitors such as Japan, can be traced to several factors. China's financing terms have generally been more flexible than Japan's, particularly in regards willingness to forgo a sovereign-guarantee requirement in favor of a business-to-business financing structure. This dynamic is illustrated clearly by the Jakarta-Bandung HSR project in Indonesia, where the China Development Bank agreed to finance 75% of the total project cost, while the remaining 25% was borne by PT Kereta Cepat Indonesia China (KCIC): a joint venture between the Indonesian state-owned consortium PT Pilar Sinergi BUMN Indonesia (PSBI, holding 60%) and China's Beijing Yawan HSR Co. Ltd. (holding 40%), formally established on 16 October 2015 (*KCIC*, n.d.; Yusuf, 2022). Indonesia had, in fact, already been negotiating with Japan over the same project since 2009; however, Japan's proposal required a sovereign guarantee and a government-to-government financing scheme, terms that the Indonesian government ultimately found less attractive than China's business-to-business offer (Otele, Lim, and Alvesis 2022, pp. 8-9).

China also has demonstrated superiority in the terms of construction time, energy use, environmental and social impact, China’s HSRs are able to be finished in a relatively short time with greater cost efficiency compared to other countries (Chunfang 2015). Gerald Ollivier, a World Bank Senior Transport Specialist, observed that China built more than 10,000 kilometres of HSR line within roughly six to seven years, at a construction cost per kilometre generally lower than comparable projects elsewhere (World Bank Group 2014). These efficiency gains have led some researchers to project that China's HSR performance could converge

with that of established leaders such as Japan and South Korea within the coming decade (Li, Hilmola, and Wu 2019, pp. 693, 700).

Lastly, China's HSR development not only reflects advancements in transportation technology but also represents a strategic integration with broader economic and political agendas. The preference of several Southeast Asian governments for Chinese HSR technology over Japanese reflects, in part, the relative flexibility of China's overall commercial approach; these countries have generally viewed cooperation with China as an opportunity to expand connectivity without depending on Western capital (Anh 2024, pp. 67-69).

While China's HSR expansion is often associated with Southeast Asian countries, its overseas ambitions have also extended to Europe. One notable example is the Budapest-Belgrade Railway connecting Serbia and Hungary, which was announced in 2013 as a part of the BRI and China-Central and Eastern European (17+1) Cooperation. Although the project experienced delays due to concerns regarding European Union public procurement and tender regulations, construction activities continued after relevant agreements were signed in 2019. The project demonstrates both the opportunities and challenges faced by China's railway expansion in Europe, where regulatory requirements and political scrutiny are generally more stringent than in many developing countries. Nevertheless, the continuation of the project illustrates China's ability to maintain its presence and expand railway cooperation beyond Asia, including in the European region (Rencz 2019).

Beyond Europe, China's railway ambitions further expanded into Eurasia through cooperation with Russia, particularly in the proposed Moscow-Kazan

High-Speed Railway, which was envisioned as part of a broader Moscow-Beijing Eurasian transport corridor. In supporting the project, China contributed technological expertise, industrial cooperation, and financing arrangements through Chinese institutions (AGICO Group, n.d.). This cooperation developed amid Russia's broader efforts to expand its high-speed railway network, with plans for several major HSR corridors, including the Moscow-St. Petersburg, Moscow-Yekaterinburg, Moscow-Adler, and Moscow-Minsk routes (Xinhua 2025).

The expansion of China's HSR system has posed strategic challenges for Japan, which is striving to maintain its competitive edge in railway technology. While Japan is generally regarded as superior in technological maturity and safety standards, its financing model, which has typically required sovereign guarantees and government-to-government arrangements, has made it comparatively less flexible, and in some cases less attractive to developing Southeast Asian governments, than China's offers (Otele, Lim, and Alvesis 2022, pp. 8-9; Kratz and Pavlićević 2018, p. 9).

This research holds significant relevance as HSR is not solely an infrastructure initiative but also a strategic instrument in economic diplomacy and geopolitical influence. China's global success in this sector is closely linked to its strategies for enhancing competitiveness. The Chinese Government has deliberately positioned HSR as part of its broader industrial policy, combining technological innovation, large scale infrastructure investment, and state-supported research and development to strengthen domestic capacity. One notable example is the Chinese government's 4 trillion-yuan stimulus package announced in November 2008, of which infrastructure comprised 72%, and an estimated 1 trillion yuan was

allocated specifically to high-speed rail development (McKissack and Xu 2011). This demonstrates how HSR was deliberately embedded within China's broader crisis-response and industrial strategy, combining fiscal stimulus with long-term technological capacity building.

Through the construction of the world's largest HSR network, China has been able to drive down production costs, improve operational efficiency, and continuously advance its technological capabilities. These achievements serve not only national development goals but also act as a platform to project China's influence abroad. Therefore, analysing the strategies adopted by the Chinese Government to enhance HSR competitiveness is crucial to the understanding of how they sustain global dominance in this strategic sector.

1.2 Research Question

How did the strategies and policies implemented by the Chinese government raised its competitiveness in the high-speed railway industry as viewed through Porter's Diamond Model?

1.3 Research Objectives

The objectives of analysing the Chinese government's strategy to raise the competitiveness of the high-speed railway (HSR) industry globally as viewed through Porter's Diamond Model were:

a. To identify and evaluate the role of factor conditions to raise the competitiveness of China's high-speed railways industry;
b. To examine how domestic and international demand raise the competitiveness of China's high-speed railway industry;

c. To analyse the role of supporting industries in fostering the competitiveness of China's high-speed railways industry; and
d. To analyse the Firm Strategy, Structure, and Rivalry of China in attempts to raise the competitiveness of China's high-speed railways industry.

1.4 Research Scope

This research focused on analysing the Chinese government's strategy to enhance the competitiveness of the HSR industry, using Porter's Diamond Model as the primary analytical framework, with state policy referring to the specific instruments that carry out the 13th 7 14th FYP, BRI, and Made in China 2025 strategies. The scope includes government policy, the role of SOEs, infrastructure development, related industries and technological research. China is the primary subject, while overseas HSR projects serve as empirical case studies reflecting the international context. Ten-year timeline period from 2015, marking China's breakthrough in Southeast Asia by securing the Jakarta-Bandung HSR project over Japan, to 2025, a period of domestic consolidation and overseas expansion.

1.5 Literature Review

China's HSR industry has become a prominent subject in academic discourse, particularly in relation to the domestic institutions, policies, and technological mechanism that underpins its growth. Zhen (2016) locates the roots of its growth in three institutional conditions: the state's monopoly over key market resources, a tightly centralized management structure, coordinated backing from multiple departments under the State Council. According to Zhen, these conditions combine to produce what he terms a "government-oriented integration innovation

model" in which resources were deliberately concentrated behind large-scale projects rather than left emerge from ordinary market competition.

Complementing this institutional account, Sun (2015) proposes an "entrepreneurial state" framework to describe the government's own role inside the HSR sector. Drawing on a case study of the industry, Sun argues that the state does not merely support innovation from the outside but behaves much like an entrepreneur itself, moving the sector toward technology-driven growth through three interlocking behaviours: sensing emerging opportunities early, actively gathering and combining resources around those opportunities, and continuously adjusting strategy as new lessons are learned. This reframes the state not as a passive facilitator, as is common in the wider literature on developmental economies, but as a strategic actor directly shaping the pace and direction of technological change.

Wu and Mei (2022) take a longer historical view, tracing how policy responsibility for HSR shifted between central ministries and more localized bodies over time. They show that this shifting division of authority, rather than a single fixed policy, produced what they call a "policy-driven open strategy," in which the sector's openness to outside technology and partners expanded or contracted depending on which level of government was steering it at a given moment.

A related strand of research examines the content of HSR policy itself rather than the institutions issuing it. Li, Dong, Jiang, and Dong (2021) analysed the text of Chinese government policy documents on HSR and identified five distinct phases in the sector's policy evolution, each associated with a different dominant theme, from early technology development and financial support to later emphasis

on large engineering projects and safety regulation. Their analysis further finds that regulatory instruments, rather than market incentives, have been the government's preferred tool throughout, typically deployed alongside informational measures such as public guidance and reporting requirements.

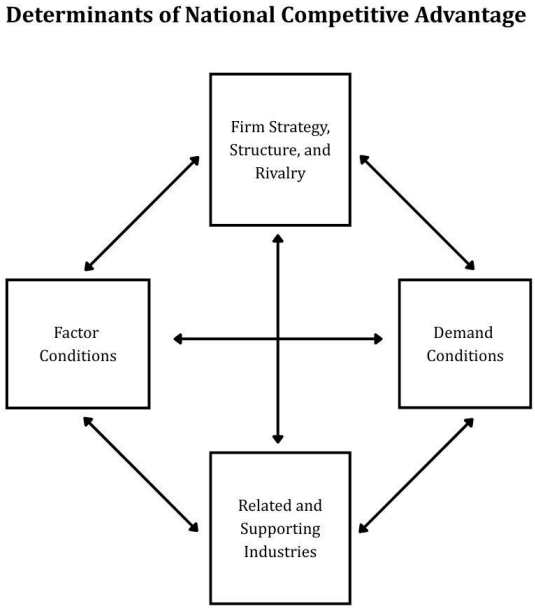
At the firm level, Lin, Qin, and Xie (2021) tested whether the technology transferred from foreign manufacturers during HSR's early development years actually translated into new domestic innovation. By comparing patenting activity among firms located near the state-owned CSR and CNR research centre with firms located farther away, they found that proximity to the transferred technology was associated with a measurable, though gradual, increase in domestic patenting, suggesting that state-brokered technology transfer produced a real spillover effect on local innovation.

Taken together, these five studies establish that China's HSR competitiveness has institutional roots, reflects an unusually active entrepreneurial role for the state, has been shaped by shifting divisions of policy authority, follows an identifiable and regulation-heavy policy trajectory, and has generated measurable innovation spillovers at the firm level. Even so, each study isolates a single institutional, strategic, policy, or technological dimension of the sector. None applies a framework broad enough to show how these dimensions interact as a single, interconnected system, which is precisely the gap Porter's Diamond Model, with its four simultaneously operating determinants, is used to address in this study.

1.6 Research Framework

In The Competitive Advantage of Nations, Michael E. Porter (1990) argues that a nation's competitiveness depends on its domestic industry's capacity for innovation and upgrading, achieved through a localized process rooted in differences in national values, culture, economic structures, institutions, and histories. Since no nation can be competitive across every industry, a nation's capacity to thrive in specific industries depends on a home environment characterized by foresight, dynamism, and challenges (Porter 1990, p. 73).

Diagram 1. Porter's Diamond Theory



Source: Porter, Michael E. 1990. *The Competitive Advantage of Nations*. *Harvard Business Review*, 1990, p. 78

In the Diamond of National Advantages, Porter pursued four determinants to explain why states are capable of consistent innovation, pursue improvements and seek sophisticated sources of competitive advantages. The determinants are;

1. ***Factor Conditions.*** The examples of factor conditions are labour, land, natural resources, capital and infrastructure, which determine trade flows as nations export commodities utilizing their most abundant resources (Porter 1990, p. 79).
2. ***Demand Conditions.*** A nation gains its competitive advantage in an industry where the home demand gives the companies a crystal clear or quick illustration of emerging buyers' needs, and where demanding buyers pressure the companies to innovate faster and achieve more sophisticated competitive advantages compared with their foreign rivals (Porter 1990, p. 82).
3. ***Related and Supporting Industries.*** National advantages stems from the presence of internationally competitive related and supporting industries (Porter 1990, p. 82).
4. ***Firm Strategy, Structure, and Rivalry.*** National context and circumstances shapes how companies are created, organized, managed, and as well as what the nature of domestic rivalry will be (Porter 1990, p. 83). In China's case, this determinant will be examined through the lens of "managed competition" (Chan 2022), a concept explaining how a state can deliberately regulate rivalry between enterprises.

These determinants operate not as isolated factors but as a self-reinforcing system, since the effect of one often depends on the others; for instance, suppliers can become new entrants in the industries they once supplied, and nations are rarely competitive in only a single industry (Porter 1990, p. 86). Before applying this

framework to China, it is necessary to situate China's economic structure within its own context. China's political economy is often characterized as a form of "party-state capitalism" (Pearson, Rithmire, and Tsai 2023), in which the state functions as owner, regulator, and strategic director of economy, with markets expected to serve state-defined objectives. Within this setting, the early growth of an industry in China cannot be separated from, and in many cases is dominated by, the role of the government. Porter's Diamond Model is therefore useful precisely because it helps map how the Chinese government's strategies and policies work to help domestic firms meet each of the four determinants.

1.7 Provisional Argument

This study argues that Porter's Diamond Model can explain the competitiveness of China's high-speed railway industry through four interlinked determinants, each deliberately constructed and sustained by the state rather than emerging organically through market dynamics. Factor Conditions are shaped through state capital and a state-directed research ecosystem. Demand Conditions are engineered through tourism subsidies, tiered pricing, and subsidized rural connectivity, extending market demand beyond what organic growth would produce. Related and Supporting Industries are coordinated through centralized planning across the steel, semiconductor, and rolling-stock sectors. Firm Strategy, Structure, and Rivalry is maintained through a state-designed "managed competition" between China's leading state-owned enterprises. Together, these determinants function as an interlinked, state-directed system that drives China's global HSR competitiveness.

1.8 Research Method

1.8.1 Type of the Research

Qualitative research favors language over quantitative metrics in data gathering and analysis (Bryman 2012). It seeks to explore and appreciate the significance individuals or groups place on a social issue (Creswell and Creswell 2018).

1.8.2 Subject and Object of the Research

The subject of this research is the Chinese Government. The object is the Chinese government's strategy to raise HSR competitiveness globally, viewed through Porter's Diamond Model.

1.8.3 Method of Data Collection

Data collection was conducted through library research using secondary sources such as international institutional reports (e.g., World Bank), peer-reviewed journals, official Chinese government documents, and media release (e.g., Xinhua, CGTN). Source triangulation was applied to strengthen data trustworthiness, by cross-checking facts across these independent source categories.

1.8.4 Process of the Research

Data were analysed deductively: founded data was categorized into Porter's four determinants; factor conditions, demand conditions, related and supporting industries, and firm strategy, structure, and rivalry and interpreted against Porter's propositions for each, then synthesized to show their interconnection as a state-directed system answering the research question.

1.9 Thesis Outline

CHAPTER I: Introduction

The chapter discusses several essential components including the background, problem identification, research objectives, scope of research, literature review, conceptual framework, research methods, and the systematic structure of discussion.

CHAPTER II: High-speed Railway Global Development and China's Strategic Position

This chapter provides the development of China's HSR industry domestic and globally.

CHAPTER III: Analysing HSR Competitiveness Based On Four Interrelated Determinants

This chapter will conduct an analysis based on the four indicators of Porter's Diamond Model, which consist of factor conditions, demand conditions, related and supporting industries, and firm strategy, structure, and rivalry

CHAPTER IV: Conclusion

This chapter concludes the research and suggestions.

CHAPTER II

HIGH-SPEED RAILWAY GLOBAL DEVELOPMENT AND CHINA'S STRATEGIC POSITION

High-speed rail (HSR) has become a transformative mode of transportation worldwide, reshaping intercity travel since Japan's pioneering Shinkansen service in 1964 (International Union of Railways (UIC) 2018, p. 6). This chapter examines China's position within that development. Section 2.1 describes the evolution of China's HSR policies and planning framework, from the Medium and Long-Term Railway Network Plan (MLTRP) through subsequent reforms and on to the technological advances. Section 2.2 examines China's HSR expansion abroad, examining its diplomatic and infrastructure engagement in Southeast Asia, Europe, and Russia.

2.1 The Development of China's High-Speed Rail Policies, Planning Framework, and Quality Assurance

China is a relative newcomer to HSR, yet it has outpaced other countries in network scale and speed. As of the mid-2020s, China's roughly 45,390 km network accounts for more than two-thirds of the world's total high-speed track (Lawrence, Bullock, and Liu 2019, p. 1; International Union of Railways (UIC) 2024, p. 5).

The institutional foundation of HSR development in China was laid by the Medium and Long-Term Railway Network Plan (MLTRP) approved by the State Council in 2004. As the first industry plan for which the State Council has decided on the approval of the plan, the MLTRP is the single highest level of government and rarely changed once it is published and is then implemented in phases. Contrary to the common assumption that HSR began mainly to expand passenger mobility,

the original motivation was largely freight-driven. Freight traffic was growing at about 7.5 percent a year, straining the shared passenger-freight network, while conventional passenger trains were too slow to compete over medium and long distances. The 2004 MLTRP therefore proposed passenger-dedicated lines (PDLs) and chose conventional HSR technology over maglev (Lawrence, Bullock, and Liu 2019, pp. 9-11).

Full implementation began under the 11th Five-Year Plan (2006–2010). The 2008 opening of the Beijing-Tianjin line, timed to the Beijing Olympics, served as both a demonstration project and a symbol of China's commitment to HSR. Later that year, in response to the global financial crisis and growing local pressure, the MLTRP was revised upward to accelerate the 2004 program. This adjustment raised the 2020 construction target and cemented HSR's role as the centrepiece of the government's infrastructure-led stimulus effort; within a few years, the resulting build-out made China's network the largest in the world (Lawrence, Bullock, and Liu 2019, pp. 1, 11).

This rapid expansion exposed weaknesses in safety governance. The July 2011 Wenzhou collision, officially the Yong-Tai-Wen accident, triggered public criticism and a review of safety oversight (Fan et al. 2015, p. 41), triggering a 2011-2013 stagnation phase in which attention shifted from expansion to institutional reform (Li et al. 2021, pp. 41-42). Pre-2011 regulation had relied mainly on post-accident emergency response rather than systematic prevention (Li et al., 2021, p. 44). In 2013 the Ministry of Railways was split: the National Railway Administration took over regulation and safety, while the new China Railway

Corporation ran operations, sharpening accountability (Lawrence, Bullock, and Liu 2019, pp. 7-8; Li et al. 2021).

HSR was also folded into industrial policy. Imported EMU technology gave way to domestic re-innovation through the China High-Speed Train Independent Innovation Joint Action Plan of 2008 (Li et al. 2021, p. 43), which produced the "Fuxing" trainset (Lawrence, Bullock, and Liu 2019, p. 18). Common technical standards let projects follow a shared template, while joint ventures between central and provincial governments coordinated financing and land acquisition (Lawrence, Bullock, and Liu 2019, pp. 4, 8-9). This model helped keep HSR construction costs in China at least 40 percent below comparable European projects (Lawrence, Bullock, and Liu 2019, p. 49).

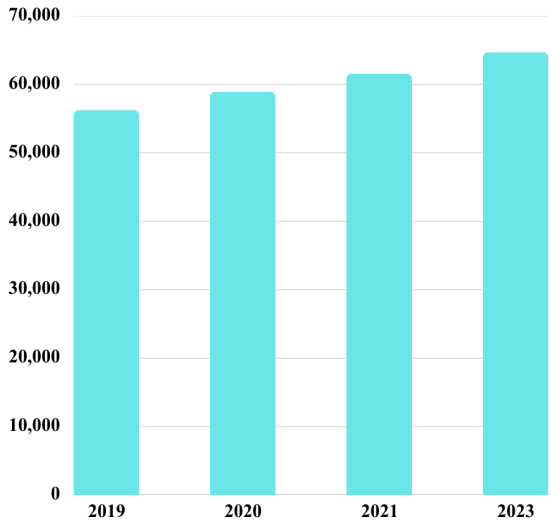
Consolidation followed under the 2016 MLTRP revision and the 13th Five-Year Plan (2016–2020), which emphasized efficiency and safety while expanding the network to an "eight vertical, eight horizontal" template (Lawrence, Bullock, and Liu 2019, p. 12; (Li et al. 2021, p. 44). The 2013 BRI opened a parallel phase of internationalization, as China began exporting its HSR capacity abroad (Li et al. 2021, p. 42).

The most recent stage of this development is the late-2024 launch of CR450 high-speed train prototypes, with test speeds of up to 450 km/h and a planned operational speed of 400 km/h, a significant leap from the previous Fuxing generation. The CR450 reflects an innovation-driven phase in which quality assurance and technological leadership have become central to both China's domestic HSR needs and its position in the global industry (“China debuts prototype of fastest high-speed train in the world” 2024).

2.2 China's High-Speed Railway Global Expansion

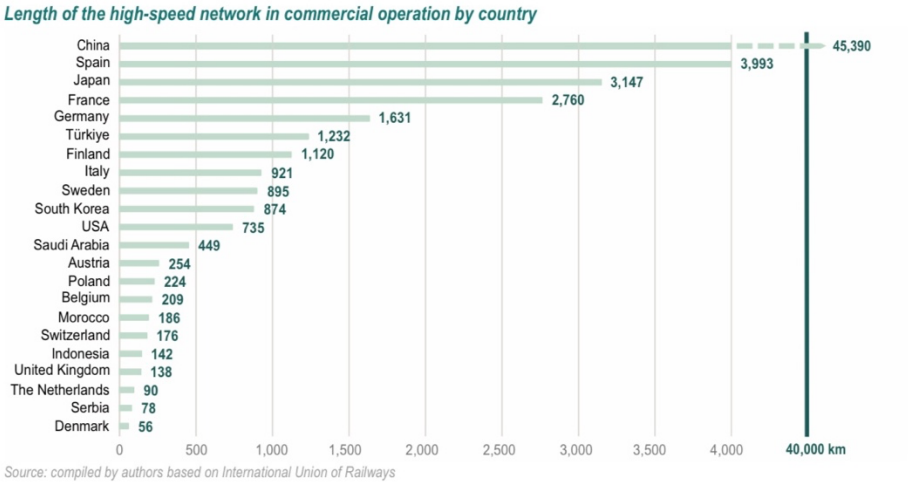
China's capacity to expand HSR abroad rests on the sheer scale of its domestic network. By the early 2020s, nearly 60,000 km of HSR lines were in commercial operation worldwide, heavily concentrated in Asia-Pacific (International Union of Railways (UIC) 2024, p. 16; see Graph 1). China alone accounts for 45,390 km of this total (International Union of Railways (UIC) 2024, p. 14; see Graph 2), the largest share of the world's HSR infrastructure. This dominance extends to ridership, China carried roughly 1.27 billion passengers in 2022, the highest of any country (International Union of Railways (UIC) 2024, p. 19; see Graph 3). Graph 3 presents two distinct metrics, namely the number of passengers, which measures ridership regardless of trip length, and passenger-kilometres, which account for both ridership and distance travelled. This domestic scale underpins China's pursuit of HSR diplomacy and infrastructure exports abroad.

Graph 1. Length of high-speed rail lines in commercial operation worldwide



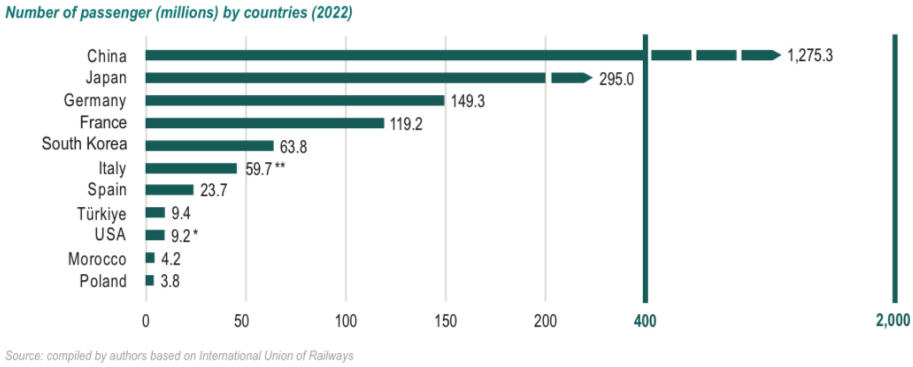
Source: International Union of Railways (UIC), High-Speed Rail Atlas 2024

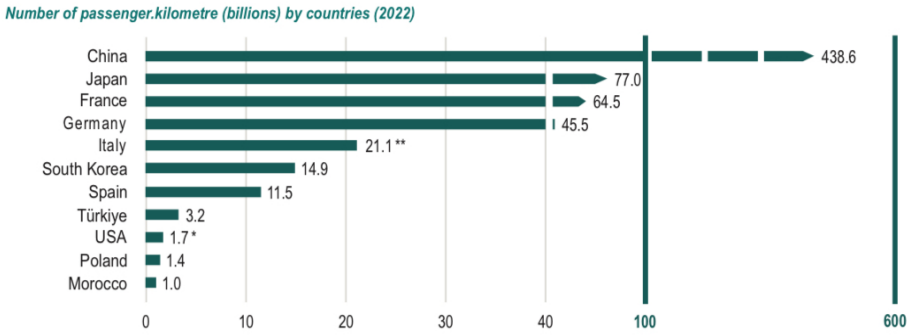
Graph 2. Length of the high-speed network in commercial operation by country



Source: International Union of Railways (UIC), High-Speed Rail Atlas 2024

Graph 3. High-speed rail passenger volumes by country, 2022





Source: International Union of Railways (UIC), High-Speed Rail Atlas 2024
*Note: Global passenger volume is calculated by aggregating national-level data reported by UIC.

Under the BRI exporting HSR technology helps realize China's connectivity vision while addressing domestic overcapacity in the railway industry and the need for state-owned enterprises to find markets abroad (Yu 2014, pp. 23-24; Huang 2025, p. 62). China Railway International Group (CRIG), a subsidiary of China Railway Group Limited (CREC), supports the implementation of these overseas railway projects (China Railway International Group, n.d.). In Southeast Asia, this strategy operates as a diplomatic tool through bilateral agreements combining technology offers (Yu 2014, p. 17), concessional financing from Chinese policy banks, and direct SOE involvement in construction and operation (Huang 2025, pp. 67-68). Yet contrary to the assumption that this fosters trust automatically, implementation in the region has not consistently translated into greater political trust or security (Huang 2025, p. 62). HSR projects there are better understood as a blend of domestic economic interest, industrial strategy, and foreign policy (Yu 2014, p. 24). This logic extends into China's Pan-Asian Railway vision, a long-term strategy linking Yunnan Province to Laos, Thailand, Malaysia, Singapore, Myanmar, and Vietnam to deepen regional connectivity and China's economic presence in ASEAN (Huang 2025, p. 66; (Yu 2014, pp. 19-20).

The record of implementation, however, has been mixed. Several flagship projects have been completed: the Jakarta-Bandung HSR in Indonesia, agreed in 2014 after competing with a Japanese bid and financed primarily through the China Development Bank, is often presented as a showcase of China's technology and financing capacity abroad (Huang 2025, pp. 66, 69). The Laos-China Railway, operational since 2021, forms the backbone of the Pan-Asian Railway network in mainland Southeast Asia. The China-Thailand line, agreed upon in 2014 and

linking Bangkok to the Laotian border, remains in phased implementation as a strategic link between the China-Laos network and central Southeast Asia (Huang 2025, p. 67; Li and Zhang 2025).

Other projects illustrate the limits of this strategy. The Kuala Lumpur-Singapore line was cancelled before construction due to policy shifts and cost concerns, and Vietnam's north-south HSR plan was shelved (Huang 2025, pp. 66-67). In Myanmar, the planned rail link to the deep-water port of Kyaukpyu has stalled entirely on the Myanmar side, held back by local distrust, ethnic-conflict dynamics in the north, and competition from a Japanese-backed upgrade of the rival Yangon–Mandalay line (Olander, Philipson, and Nguyen 2025). Domestic political dynamics, particularly elite contestation and varying degrees of centralized authority in the host country, have played a significant role in slowing or blocking such projects (Lim, Li, and Syailendra 2021, pp. 2-4).

Taken together, these outcomes suggest that China's HSR diplomacy in Southeast Asia produces a complex image of competitiveness: successful cases reinforce perceptions of technical and financial capability, while delays and cancellations show that outcomes depend as much on partner countries' political and social conditions as on China's own capabilities (Huang 2025, pp. 72-74).

China's HSR ambitions extend beyond Southeast Asia into Europe and Russia, revealing further variation in outcomes. In Europe, the Budapest-Belgrade railway, first announced in 2013 and later folded into the BRI framework via the 17+1 Cooperation platform (Rencz 2019), stands as the most consequential case. Construction proceeded fastest on the non-EU Serbian side, which was completed in 2025 to full EU technical standards (ETCS Level 2), making it the first Chinese-

built high-speed line in Europe to meet this benchmark, while the EU-member Hungarian section, subject to stricter procurement rules and a 2017 European Commission investigation, remains under construction with completion expected in 2026 (Xinhua News Agency 2025; Rencz 2019). The project's financing, heavily reliant on loans from the China Export-Import Bank, and its escalating costs have raised sustained questions about fiscal viability, reflecting a broader tension in BRI infrastructure diplomacy between developmental framing and host-country fiscal realities (Rencz 2019). Even so, the completed Serbian segment demonstrates China's capacity to deliver technically compliant infrastructure within a European regulatory context, reinforcing its image as a competitive global provider despite continued skepticism within EU institutions.

Russia's engagement follows a markedly different path. A 2015 agreement between Presidents Putin and Xi laid the basis for the Moscow-Kazan HSR, with Russia agreeing to adopt Chinese technology and equipment for construction and operation (Carr 2015) in April 2016, China Railway International Group formalized its role by agreeing to finance the project's design and construction. The project subsequently stalled amid financing disputes and geopolitical complications following Western sanctions after Russia's 2014 annexation of Crimea and did not progress to an operational line (Turner 2018). More tellingly, for its flagship Moscow-Saint Petersburg HSR, Russia awarded construction to the domestic Sinara Group rather than Chinese firms, despite Sinara's limited HSR experience and Russia's constrained access to global supply chains under sanctions (RailTech.com 2025). This reflected broader strategic security concerns: Russian officials have reportedly been wary since 2022 of excessive dependence on Chinese

technology for critical infrastructure, a concern said to be shared by the Russian General Staff and Security Council (Vialko 2026). China's exclusion from this flagship project, despite its technological maturity and financing capacity, shows that the competitiveness of Chinese HSR exports is highly context-dependent, shaped as much by host-country strategic priorities as by technical or financial advantage.

Across Southeast Asia, Europe, and Russia, China's HSR diplomacy reflects a consistent underlying logic of domestic industrial overcapacity, state-led financing through policy banks, and foreign-policy objectives pursued through infrastructure (Yu 2014, p. 24; Huang 2025, p. 62), yet produces divergent outcomes depending on host-country institutions and strategic priorities. In Southeast Asia and the EU, political constraints delay but do not necessarily prevent project realization; in Russia, strategic sovereignty concerns can override technical and financial advantages altogether. China's global image of competitiveness in high-speed rail is therefore not fixed but continuously shaped by the interaction between its technical-financial capabilities and the political economies of the countries it engages.

CHAPTER III

COMPETITIVE ADVANTAGE IN CHINA'S HIGH-SPEED RAILWAY INDUSTRY: A PORTER'S DIAMOND THEORY PERSPECTIVE

This chapter examines how the Chinese Government's strategy has shaped the competitiveness of HSR industry, using Porter's Diamond Model as the analytical lens. Porter's central claim runs counter to conventional economic thinking, which tends to treat cheap labour, favourable currency conditions, or a country's natural endowments as the main drivers of competitiveness. Instead, the true source of national advantage is located in a country's continuous capacity to raise productivity, innovate, and push its industries toward higher levels of sophistication (Porter 1990, p. 74). No industry becomes internationally successful purely on its own merits. Its trajectory is shaped by the wider national setting that determines how companies within it come into being, how they operate, and how they respond when confronted with competitive pressure (Porter 1990, p. 78).

To capture this national setting, Porter built the Diamond Model around four determinants that operate together: factor conditions, demand conditions, related and supporting industries, and firm strategy, structure, and rivalry. Taken as a whole, these four determinants shape whether firms are able to build and sustain an edge over international rivals (Porter 1990, pp. 78-79). Because the framework foregrounds innovation, specialized capability, and the pressure generated by industrial linkages and market rivalry, it lends itself particularly well to analysing technology-intensive sectors where long-term competitiveness hinges in precisely those dynamics.

China's high-speed rail sector is a case in point, since its growth trajectory is inseparable from Beijing's wider push toward industrial transformation and technological upgrading. This orientation can be traced back to the early 2000s, when the government approved the Medium and Long-Term Railway Plan in 2004 (Lawrence, Bullock, and Liu 2019, p. 10), a decision that set the tone for treating HSR not merely as transport infrastructure but as a strategic lever for building national innovation capacity and driving industrial modernization more broadly ("The sky is the limit: China's rise as a transportation superpower challenges the EU" 2023, pp. 8, 11). The remainder of this chapter discusses each of the four determinants in turn to assess how government policy and institutional design have jointly contributed to the competitiveness of China's HSR technology.

Before turning to each determinant, it is necessary to situate Porter's framework within China's institutional context. Porter's Diamond Model was built primarily on the experience of market economies, where the four determinants interact through the decentralized decisions of private firms and consumers responding to price signal (Porter 1990, pp. 74, 78). China's political economy departs from this baseline. Scholars of Chinese state capitalism describe a system in which the state steers economic development not only through direct ownership stakes but through a wider set of institutional and financial levers, with its influence exercised selectively and concentrated in strategic sectors such as defense, energy, communications, and finance (Pearson, Rithmire, and Tsai 2023, p. 13).

Consistent with this, the same scholars note that China has preserved state ownership at the commanding heights of the economy and in globalized or strategic sectors such as shipping, telecommunications, natural resources, and aviation, even

as market mechanisms were introduced elsewhere (Pearson, Rithmire, and Tsai 2023, p. 20). Therefore, Porter's Diamond Model is useful precisely because it helps map how the Chinese government's strategies and policies work to help domestic firms meet each of the four determinants.

To keep this distinction visible across the four determinants, this study distinguishes **state strategy**, the government's overarching, macro-level, and long-term direction for national industrial development, from **state policy**, the more specific instrument, plan, or regulation issued to carry that direction into effect within the HSR sector (Chandler 1962; Hemphill 2024). Three macro state strategies are especially relevant to China's HSR sector within the 2015-2025 period this study covers. The first is the Five-Year Plan (FYP) cycle, the state's central instrument for setting domestic economic direction: the 13th FYP (2016–2020) committed roughly CNY 3.5 trillion to railway construction and explicitly prioritized extending the high-speed network into China's less-developed western regions through an "eight vertical, eight horizontal" grid, while the 14th FYP (2021–2025) carried this expansion forward, emphasizing completion of that grid, deeper technological self-reliance, and higher-quality, more market-oriented growth (Han 2017; State Council Information Office 2020; WANGSHU 2026). The second is Made in China 2025, launched in 2015, which named advanced rail equipment as one of ten priority sectors for reducing dependence on foreign technology and moving Chinese manufacturing up the global value chain ("China's High-Speed Rail Diplomacy | U.S.- CHINA | ECONOMIC and SECURITY REVIEW COMMISSION" 2017, p. 7; New Zealand Ministry of Foreign Affairs and Trade 2026). The third is the Belt and Road Initiative (BRI), launched in 2013,

which extends this domestically built capacity outward, positioning HSR exports as an instrument of economic diplomacy and an outlet for the capacity the first two strategies helped create (Yu 2014; Huang 2025). Together, the FYPs and Made in China 2025 set the direction for expanding and upgrading HSR at home, while the BRI channels that domestic capacity abroad. The sector-specific policies discussed in each determinant below were designed to carry each of these three strategies out.

3.1 Factor Conditions

Within the Diamond Theory framework developed by Michael E. Porter (1990) in *The Competitive Advantage of Nations*, Factor Conditions constitute the first determinant explaining a country's position regarding the production factors required to compete in a particular industry. Porter explicitly distinguishes two categories of factors: 1) basic factors, which are resources naturally inherited or available without significant investment such as natural resources, unskilled labour, land, and basic capital, and 2) advanced factors, which are created through long-term and sustained investment, encompassing skilled labour, modern infrastructure, scientific research capabilities, and specialized technical knowledge.

Porter argues that sustainable competitive advantage is derived primarily from advanced factors, as basic factors can be easily replicated or accessed through global markets and therefore provide limited long-term differentiation, whereas, advanced factors are considerably more difficult for competitors to imitate (Porter, 1990, p. 79). In the context of China's HSR industry, the analysis of factor conditions encompasses four main dimensions: capital and government investment; strategic natural resources including steel, aluminium, copper, and cement; the

university-based research; and technology transfer through joint ventures with foreign companies.

One of the most significant basic factors supporting the development of China's HSR industry is the availability of capital, systematically supported by the Chinese government, given that projects of this scale and with long investment recovery periods cannot be financed solely through private market mechanisms. According to data from the National Bureau of Statistics of China, compiled by the Statista Research Department (2026), the manufacture of railway, ship, aerospace, and other transport equipment sector recorded an R&D expenditure of 76.46 billion yuan in 2024, placing it among the nation's top ten industries for research and development spending.

Consistent with the industrial-upgrading direction set under the Five-Year Plans and Made in China 2025 discussed above, this capital support was structured to concentrate the HSR value chain’s innovation capacity inside entities the state could directly steer, rather than leaving capital allocation to independent market intermediaries: critical inputs such as materials, infrastructure construction, rolling stock manufacturing, and service operations were all held by state-owned enterprises (SOEs), with the Ministry of Railways coordinating the 2015 merger of CSR and CNR into CRRC so that domestic innovation capacity could be concentrated within a single entity aligned with national strategic priorities (“The sky is the limit: China's rise as a transportation superpower challenges the EU” 2023, p. 11). This extensive state-led financial support reflects the role of the government identified by Porter (Porter 1990, p. 87) as a catalyst for competitive advantage: rather than competing directly in the marketplace, governments create

an environment and provide resources that enable domestic firms to innovate and grow. In China's HSR industry, the state acted as a provider of initial capital that facilitated the accumulation of more sophisticated, advanced factors over time.

Beyond capital, the development of large-scale HSR infrastructure requires enormous quantities of construction materials, qualifying as basic factors precisely because they are either naturally abundant within China's domestic resource base or readily accessible through global commodity markets. This is consistent with Porter's characterization of basic factors as resources companies can access easily through a global strategy rather than needing to create through specialized investment (Porter 1990, p. 79).

According to Mao et al. (2023) in *Communications Earth & Environment*, rapid HSR development has driven the manufacture of 1,744 megatons of gravel, 896 megatons of sand, and 561 megatons of cement, all of which China produces domestically at scale as the world's leading aggregate and cement producer ("White Paper on Sand and Aggregates Industry", n.d.; Mao et al. 2023, pp. 4, 6; "Cement Statistics and Information | U.S. Geological Survey", n.d.). Metallic materials account for a much smaller share of total production, with steel, aluminium, and copper amounting to 133, 1.3, and 1.6 megatons respectively, together representing only 3.7 percent of total material production (Mao et al. 2023, p. 6).

Steel is a clear example of a basic factor rooted in domestic industrial capacity large enough that the country alone supplies over half of the world's steel (Shen 2024, p. 1), even though Chinese steel mills remain dependent on imported iron ore as the core input for their dominant blast furnace-basic oxygen furnace (BF-BOF) production (Shen 2024, p. iii). This does not disqualify steel from the

basic factor category, since sourcing inputs abroad illustrates exactly the kind of resource Porter describes as ‘obtainable through global markets rather than something a nation must build from scratch’. Copper, used in smaller volumes, similarly fits the basic factor category as a naturally occurring raw material sourced through domestic production capacity, with additional potential as a resource for future urban mining once HSR infrastructure components reach end of their service life (Mao et al. 2023, p. 6).

While these basic factors provided the material and financial foundation for HSR development, China's long-term competitive advantage has been driven more decisively by its systematic cultivation of advanced factors, particularly skilled human capital and indigenous technological capabilities, which Porter identifies as the most sustainable source of competitive advantage because they require long-term investment that competitors find difficult to replicate (Porter 1990, p. 79). The government built an integrated education and research ecosystem directly connected to the railway industry, consistent with the broader technological upgrading agenda in which technological mastery is treated as a long-term strategic objective rather than a by-product of infrastructure development.

According to the article *University and Majors Supporting China's High-Speed Rail Technology*, the government has embedded railway research directly into its university system rather than leaving such expertise to emerge from market demand for graduates. A handful of flagship institutions illustrates the pattern: Beijing Jiaotong University, jointly run by the Ministry of Education and China Railway Corporation, leads research on HSR systems and traction technology and even exports training programs to Thailand, India, Mongolia, and several African

countries; Southwest Jiaotong University, founded in 1896 as China's first engineering school, anchors the country's civil and transportation engineering traditions; and Tongji, Central South, Zhejiang, Tsinghua, and the University of Science and Technology Beijing each contribute specialized capacity, from vehicle-body design tunnel engineering and traction system (JTRH 2025).

This integrated university-industry ecosystem, in which research outputs are directly connected to industrial application, aligns with Porter's argument that advanced factors emerge through sustained investment in education and knowledge creation rather than natural endowment alone (Porter, 1990, p. 79).

Alongside the development of domestic human capital, technology transfer through joint ventures with foreign companies constituted another critical mechanism through which China acquired advanced technological capabilities in a compressed timeframe, consistent with Porter's emphasis on the role of internationally competitive supporting industries in generating national advantage (Porter 1990, p. 82). According to MERICS, China leveraged the sheer size of its expanding railway market to effectively oblige major foreign players such as Alstom, Bombardier, Siemens, and Kawasaki Heavy Industries to hand over technological know-how to local partners in exchange for market access ("The sky is the limit: China's rise as a transportation superpower challenges the EU" 2023, p. 11).

This arrangement created mutual benefits, and its outcomes became increasingly evident over time. By 2010, China introduced its first indigenous model, the CRH380, and by 2017, the CR400A demonstrated a substantially reduced reliance on foreign technology. This success is further reflected in the

growth of CRRC's patent portfolio, from only 88 patents in 2006 to approximately 1,800 in 2019, illustrating China's transformation from a technology adopter into a producer of indigenous innovation (“The sky is the limit: China's rise as a transportation superpower challenges the EU” 2023, pp. 11-12).

Aluminium represents a further advanced factor requiring deliberate policy effort, as China has not yet achieved full self-sufficiency in bauxite. Consistent with the broader push toward material self-sufficiency and industrial upgrading set out in the 14th FYP and Made in China 2025, the government issued the Action Plan for the High-Quality Development of the Aluminium Industry (2025–2027), issued jointly by the Ministry of Industry and Information Technology (MIIT) and nine other central government bodies on March 28, 2025 (Li 2025; Shanghai Metals Market 2025).

Rather than setting a single aspirational figure, the plan works through several linked mechanisms spanning the whole supply chain. On the raw-material side, it directs mining firms to intensify exploration of lower-grade and high-sulphur bauxite deposits and to make fuller use of associated minerals recovered alongside bauxite, with the aim of lifting domestic reserves by 3 to 5 percent, while a parallel push toward regional recycling hubs and industrial clusters is intended to raise recycled aluminium output above 15 million tonnes by 2027. On the refining side, the plan tightens approval standards for new alumina plants: capacity built around boehmite-type ore will no longer be approved at all, and any new refinery must now show that it holds matching bauxite mining rights and a workable plan for using its own red mud waste, a long-standing environmental liability of alumina production. For smelting, rather than raising China's existing ceiling on national

primary aluminium capacity, the plan pushes for that capacity to relocate toward regions with abundant clean electricity such as Inner Mongolia and Xinjiang, and ties new smelting lines to a maximum energy-consumption threshold per tonne of metal and a minimum cell-size requirement, effectively phasing out smaller, less efficient plants over time (Shanghai Metals Market 2025).

These mechanisms demonstrate that the policy is a coordinated restructuring of the aluminium supply chain from mining to smelting rather than a target without a roadmap. This serves as a concrete, time-bound instrument that illustrates the strategy-policy distinction. Ultimately, it underscores that unlike basic materials like cement, aluminium requires active state intervention to secure supplies for strategic industries like high-speed rail.

Overall, China has developed strong factor conditions for its HSR industry by effectively utilizing basic factors, particularly state capital, and domestic steel, cement, and aggregate supplies, to build the physical infrastructure of the world's largest HSR network, while complementing these with advanced factors cultivated, Through an integrated university-research-industry ecosystem and structured joint ventures. Aluminium also illustrates a further layer of this effort, this trajectory aligns with Porter's argument that sustainable competitive advantage arises not from inherited basic factors alone, but from a nation's continuous ability to create, and upgrade advanced factors within specific industries (Porter 1990, p. 79). In China's HSR industry, competitive advantage was actively constructed through strategic government intervention, long term investment in education and research, and selective openness to foreign technology as a catalyst for accelerated learning and technological upgrading.

3.2 Demand Conditions

Demand is the determinant where the gap between Porter's market-led assumptions and China's state-led practice is widest, because home demand in Porter's framework is meant to reveal the independent preferences of private buyers rather than the priorities of the government (Porter 1990, p. 82). The Chinese state treats domestic demand less as a signal to respond to and more as a strategic instrument to construct, segment, and, where useful, export abroad in support of the country's broader industrial and diplomatic objectives, including the Belt and Road Initiative (BRI) discussed later in this section.

Each of the three sub-dimensions below is carried out through its own specific state policy. The first two sub-dimensions, the composition of home demand and the presence of sophisticated buyers, are addressed respectively through the tourism ticket subsidy scheme, the local state-backed Southern Sichuan subsidy formula for underdeveloped regions, and the local government's tiered commuter ticket packages, all of which operationalize the 13th and 14th Five-Year Plans' broader goal of using the HSR network to integrate underdeveloped regions and extend domestic connectivity (Han 2017; State Council Information Office 2020; WANGSHU 2026). The third sub-dimension, the anticipatory or early-warning character of home demand, is instead addressed through government-to-government BRI financing, extending China's domestically cultivated demand model abroad as part of the Belt and Road Initiative strategy.

China's HSR expansion can be regarded as a driver of local economic development and a tool for narrowing regional gaps (Wang and Dong 2022, pp. 77-78), reflected in the scale of the network itself. China's HSR network has expanded

into an extensive, nationally integrated system rather than a set of isolated corridors. The State Council's Medium-to-Long-Term Railway Network Planning (2016–2020) explicitly targeted coverage of 80% of large cities through an "eight vertical and eight horizontal" grid, with the network projected to reach 30,000 km by the end of 2020 (Wang and Dong 2022, p. 68). Between 2000 and 2020, China's overall railway network grew from 69,000 km to 146,000 km, of which more than a quarter (38,000 km) is high-speed rail (Otele, Lim, and Alvesis 2022, p. 2). This near-universal connectivity helps explain how the state has pursued Porter's second determinant, *demand conditions*, which are defined as the nature and composition of home-market demand for an industry's product or service (Porter 1990, pp. 78, 82).

Porter argues that globalization does not diminish the importance of home demand, since "the composition and character of the home market usually has a disproportionate effect on how companies perceive, interpret, and respond to buyer needs", identifying three sub-dimensions: *the composition of home demand*, where advantage arises when a particular industry segment is larger or more visible domestically than abroad, since the larger segments receive the most attention, investment, and priority from a nation's companies. The second is the presence of *sophisticated and demanding buyers* where domestic buyers pressure companies "to meet high standards," and to "innovate, and to upgrade into more advanced segments". The third is the *anticipatory* or *early-warning* character of home demand where local buyer needs generate competitive advantage when they foreshadow or actively shape the needs that will later emerge in other nations, including through a nation's export of its own values, standards, and tastes via

media, political influence, and the foreign activities of its own citizens and companies (Porter 1990, p. 82).

The following analysis employs Porter's three sub-dimensions as analytical lenses while explicitly reinterpreting how each manifest within a state-directed demand creation apparatus. Applied to China's HSR industry, all three sub-dimensions can be identified empirically and each is examined below, showing that the Chinese state has actively cultivated, segmented, and exported domestic demand across distinct buyer groups and geographies: leisure and tourist travellers, residents of underdeveloped regions, regular commuters, and ultimately foreign governments encountering the Chinese HSR model abroad.

On the *composition of home demand*, the clearest illustration is the tourism-linked ticket subsidy scheme announced by China's Ministry of Culture and Tourism in April 2026 which has committed more than 1 billion yuan (about 146 million US dollars) to subsidize travel-related spending during a month-long promotion tied to the 16th China Tourism Day. Under this, over 70 partner organizations rolled out more than 9,000 promotional measures nationwide, including discounts accessible through valid HSR tickets (Xinhua 2026). This indicates that HSR ticketing has been deliberately woven into a broader state-driven demand-generation apparatus rather than being left to organic market growth. By bundling transport with leisure incentives, this structure explicitly shapes domestic consumer behavior, cultivating a market segment that views HSR not merely as transit, but as an integrated component of lifestyle and tourism consumption.

Beyond leisure demand in prosperous corridors, Chinese demand conditions are also shaped by explicit policy efforts to sustain HSR usage in remote and

financially unviable areas, a case where the relevant "segment" is not a customer type but a geographic market that the state has decided to enlarge relative to what unassisted demand would produce. Local governments "frequently subsidise train services" precisely because the operating losses associated with less commercially attractive routes would otherwise discourage China Railway Corporation (CRC) from running trains in these areas at all (Zhang et al. 2025, p. 1).

The Stackelberg game model of the Southern Sichuan Intercity Railway shows government subsidies structured as a per-additional-train-pair payment intended "to enable the CRC to operate additional trains," reflecting the state's recognition that railways can "effectively promote communication between regions" only if demand in less profitable corridors is artificially sustained through subsidy rather than left to unassisted market pricing (Zhang et al. 2025, pp. 6-7). In the equilibrium solution calculated for the Southern Sichuan case, the optimal government subsidy is 0.943 million CNY per train pair per month, inducing the CRC to operate 32 pairs of trains, with a stated minimum subsidy of approximately 0.4 million CNY per train pair per month required simply to keep the line operating normally (Zhang et al. 2025, p. 1). This confirms that a meaningful share of China's domestic HSR demand is not purely organic but is actively manufactured and stabilized through deliberate fiscal design.

This policy-engineered demand appears to generate disproportionately large economic returns precisely where it is most artificially sustained. Wang and Dong's county-level panel analysis found that less-developed county-level districts benefit more from HSR connection than municipal districts, since "the underdeveloped areas may gain more benefits from the HSR connection". Their regressions show

that a one-year increase in HSR operation raises local economic growth by 0.1% in county-level districts, compared with an effectively negligible effect in municipal districts (Wang and Dong 2022, pp. 73-74), while HSR-unconnected counties adjacent to connected areas exhibit a "spillover effect" rather than a "siphon effect" (Wang and Dong 2022, p. 76) The authors conclude that "the HSR network should connect the core cities and neighbouring underdeveloped cities to achieve an optimal effect," and underdeveloped areas "should strengthen their cooperation with the HSR-connected neighbouring areas" (Wang and Dong 2022, p. 78). Otele, Lim, and Alves drew a parallel conclusion at a more general level, noting that many studies find positive economic spillovers from Chinese high-speed rail, but "the impact is not even and mostly favours under-developed or remote regions." (Otele, Lim, and Alvesis 2022, p. 3). Taken together, demand in China's HSR sector has been deliberately extended into segments that classical and unassisted market demand would otherwise bypass, and this extension yields the industry's largest marginal economic returns, reinforcing rather than undermining the case for continued subsidy-driven demand creation.

The second is the presence of *sophisticated and demanding buyers*, which is illustrated by the everyday commuter market. In a strategic move to accelerate regional integration, the Chinese government, through its Yangtze River Delta transportation authorities, implemented a new public tariff policy in March 2025 by introducing eleven new high-speed rail ticket packages across five major regional corridors. Designed as a public service initiative to ease intercity commuting costs, these packages utilize a multi-ride system ranging from 10-ride/30-day to 55-ride/30-day passes that slashes standard fares by 10% to 38%. Passengers are also

able to book in advance through the 12306 platform, mobile app, or self-service kiosks, and the maximum number of reservations for trip-based tickets has been raised from four to ten, reflecting continual refinement of the service to match increasingly frequent, high-volume travel patterns (Shanghai Municipal Government 2025).

The introduction of graduated, multi-tier pricing instruments for frequent riders demonstrates precisely the kind of buyer sophistication that Porter identifies as a driver of upgrading: a domestic buyer base large and price-sensitive enough to justify eleven distinct package tiers is, by definition, a demanding buyer base that, as Porter puts it, "pressures companies to meet high standards and prod them to improve, to innovate, and to upgrade into more advanced segments" (Porter 1990, p. 82). Operators must continuously refine pricing, booking infrastructure, and service design to satisfy this demanding, high-frequency segment of the domestic market, which in turn pressures the industry toward more advanced revenue-management and customer-segmentation capabilities than a less exacting home market would require.

The last is the *anticipatory* or *early-warning* character of home demand. Home-market needs also generate advantage when it foreshadows or actively shapes demand that will later emerge abroad, including through a nation's export of its own standards. HSR exports are negotiated government-to-government, with financing, technical standards, and diplomatic relationships bundled into a single package under the Belt and Road Initiative (BRI), so that winning a foreign HSR tender is as much a matter of state-to-state diplomacy and concessional finance. The clearest case is the Jakarta-Bandung HSR, "a flagship project for China's rail

diplomacy". China won the contract in 2015 against Japan and entered commercial operation in 2023, demonstrating that Chinese rail technologies developed to serve domestic demand are not only affordable but also feasible once transplanted abroad (Wu 2024, pp. 5-6). However, Beijing's actual influence over these countries is not uniform: in Thailand and Myanmar, China has struggled to secure the political cooperation needed to keep projects on schedule, while in Laos, China holds considerable financial leverage, since the country's HSR project cost nearly 40% of its entire national GDP (Wu 2024, pp. 6-7).

It is worth taking a closer look at a critical distinction that the three sub-dimensions above do not explicitly spell out: domestic and international demand for China's HSR sector operate on completely different logic, and they serve entirely different purposes for the firms involved. Domestic demand, as we have seen, is essentially manufactured by the state and heavily propped up by subsidies across most of the network. Crucially, this market has a hard ceiling. It is fundamentally bottlenecked by China's own infrastructure rollout, which will inevitably grind to a halt once the national grid hits its planned expansion targets. International demand is a whole different ball game. Out in the global market, Beijing and its firms cannot simply subsidize demand into existence. Instead, they have to fight tooth and nail to win contracts from foreign governments and operators, going head-to-head with deeply entrenched giants like Alstom and Siemens.

This distinction is a matter of pure survival for China's HSR manufacturing base, and CRRC's own order book perfectly captures why. When new domestic orders plummeted by roughly 18 percent in 2020 as China's rail-investment boom

began to cool down, overseas contracts stepped in to fill the gap. The international share of CRRC's order book climbed to nearly 15 percent, a multi-year high even though their absolute value dipped only slightly to around 42 billion yuan (Rolling Stock Agency 2022). We see the exact same pattern playing out more recently. In fiscal year 2025, CRRC's overseas orders surged by about 37 percent to roughly 65 billion yuan. This growth easily outpaced the company's domestic equipment business, even though the local market still brought in just over half of its quarterly revenue (Diemer 2026). Taken together, these numbers prove that international demand is far more than just a supplementary revenue stream. It acts as a vital stabilizing buffer that keeps production lines humming and protects jobs when China's domestic infrastructure cycle slows down. It provides a survival mechanism that the domestic market, no matter how massive, simply cannot deliver once it reaches saturation.

Overall, the demand conditions of Porter Diamond Model in China's case are deliberately constructed by the state rather than emerging as an autonomous market signal. Layered onto this pattern is the further distinction between domestic and international demand: where domestic demand is subsidised into existence and bounded by China's own infrastructure build-out, international demand must instead be won from foreign competitors, and increasingly functions as the buffer that sustains CRRC's production when the domestic cycle slows, won and financed through the same government-to-government channels. This suggests that China's HSR demand conditions function less as a market signal the state merely responds to, and more as a policy variable the state actively constructs across all three of

Porter's sub-dimensions to generate the pressure for innovation and upgrading that Porter identifies as the defining function of home demand.

3.3 Related and Supporting Industry

The third determinant in Porter's Diamond Theory, *Related and Supporting Industries*, states that a nation's competitive advantage in a particular industry is strongly determined by the presence of domestic supplier and related industries that are internationally competitive, because competitive domestic suppliers provide cost-effective, timely inputs and an intensive flow of information and interaction between geographically proximate suppliers and users, accelerating innovation and technological upgrading (Porter 1990, pp. 82-83).

The macro strategy this determinant serves is primarily Made in China 2025's push for technological self-reliance across the HSR supply chain, reinforced by the 14th Five-Year Plans' parallel goal of consolidating and optimizing China's heavy-industry capacity. This determinant examines whether the domestic industries that supply and surround HSR are themselves internationally competitive, since Porter treats this as a separate, though related, source of national advantage (Porter 1990, pp. 82-83). Achieving self-reliance in this sense requires the state to act on three distinct segments of the value chain in turn: upstream suppliers of raw materials and components, midstream manufacturers who assemble those inputs into finished infrastructure and rolling stock, and downstream operators who finance and run the resulting network.

To examine this in China's HSR industry, this study broke the HSR value chain into three layers: an upstream layer including the steel and semiconductor industries, which supply essential materials and important components. The

midstream layer consisting of CRRC Corporation Limited, China Railway Construction Corporation (CRCC) and China Railway Group (CREC) which together transform into physical infrastructure. And finally, the downstream layer which is China Railway Corporation (CRC), which oversees the financing and governance of HSR infrastructure and operates the resulting network.

The first layer, upstream, refers to the industries supplying the basic materials and components that serve as initial inputs for high speed train production, which in this study consists of two main supplier groups: the steel industry, providing structural materials, and the power semiconductor industry, providing critical components for the traction system. China's steel industry holds the position of the world's largest producer and consumer of steel (Mysteel 2025), a critical material given that HSR safety ultimately hinges on how well steel rails withstand wheel-rail stress (Solano-Alvarez and Bhadeshia 2024, p. 1). Steel track construction alone required approximately 54 million tons of steel for China's HSR network (Mao et al. 2023, p. 4). Despite steel accounting for only about 4% of the network's total in-use material stock by mass, it is responsible for 47% of the network's total carbon replacement value, reflecting the carbon intensity of steel production relative to its mass share (Mao et al. 2023, p. 6).

China's steel industry itself still depends on imported iron ore for over 80% of its supply (National Development and Reform Commission 2022), which means the upstream layer's most important structural input is only partly a domestic factor: the ore itself is sourced internationally mostly bought from Australia and Brazil (Zhang and Arora 2021) even though the smelting and rolling capacity that turns it into rail-grade steel is overwhelmingly domestic. This qualifies as exactly the kind

of basic factor Porter describes as obtainable through global commodity markets rather than needing to be built domestically from scratch (Porter 1990, p. 79), and it shows that “international supply” in China's HSR upstream layer operates mainly at the level of raw-material sourcing rather than finished-component manufacturing.

As compounded by domestic oversupply amid weak domestic demand linked to the property market downturn, prompting exporters to lower prices and triggering a surge in anti-dumping cases abroad. In response, Chinese authorities introduced a new steel export licensing regime effective January 2026 covering nearly all steel products (Mysteel 2025; Lv et al. 2025), alongside a draft MIIT regulation issued in October 2025 restricting new steel capacity and encouraging electric-arc furnace and hydrogen metallurgy adoption (Cheng 2025). This was later reinforced in the draft 2026 Development Plan capping steel production to stabilize industry profitability, with national output in 2025 falling below 1 billion tons for the first time since 2018 (GMK Center 2026). Taken together, this relevant to Porter's notion that selective factor disadvantages can spur innovation and this also shows that the Chinese state actively managing the price stability and international standing of a key related industry, extending beyond the market-driven supplier competitiveness assumed in Porter's original framework (Porter 1990, p. 79).

This management accompanies a longer-term structural upgrading process: during the 13th Five-Year Plan (2016-2020), crude steel output was cut by more than 150 million tons while labor productivity rose from 527 to 850 tons per person. The steel industry development guidelines, jointly issued by MIIT, NDRC, and the

Ministry of Ecology and Environment (MEE), targeted a numerical control rate of key metallurgical processes of 80% and a digital production equipment ratio of 55% by 2025. By comparison, actual 2020 achievements stood at only 65.4% and 47% respectively (National Development and Reform Commission 2022). This push toward digitalization and precision manufacturing is significant not only because it makes production more efficient and productive, but also because it serves as a foundation for deeper collaboration within the domestic economy.

According to Porter, when a nation's supplier base operates in close proximity to the companies it serves, this closeness allows those companies to steer their suppliers' technical direction from within, effectively turning supplier facilities into an extension of the companies' own research and innovation efforts, and shortening the feedback loop between research and production (Porter 1990, p. 83). While Porter's original argument centers on firm-to-firm proximity, this study extends the logic to the national level given the state-coordinated nature of China's steel industry: because steel production and digitalization targets are all directed within the same centrally planned framework rather than through independent market transactions, the proximity effect Porter describes at the firm level plausibly operates at the level of an entire coordinated national supplier base. Applied at this scale, as China's steel industry undergoes systematic digitalization, the accumulated effect strengthens the country's aggregate capacity to support technically demanding downstream sectors like HSR manufacturing, rather than being limited to any single firm-to-firm relationship.

Despite China has achieved self-sufficiency in bulk materials like steel and cement, but it still relies on global specialists for a handful of high-precision, safety-

critical components. Instead of importing finished goods, foreign players like Germany's Knorr-Bremse supply vital braking systems to CRRC through joint-venture factories built right inside China, as seen in their 2023 contract to equip 36 metro trains (May 2023). Similarly, for critical parts like gearbox bearings, China's high-speed rail network has long trusted established European giants like SKF and SNR, the very same firms backing Europe's top trains with domestic alternatives only recently hitting the tracks (Yang 2022). Ultimately, this setup proves Michael Porter's classic theory: whether a supplier is homegrown or a foreign firm operating on Chinese soil, keeping suppliers and manufacturers close together is what truly fast-tracks innovation and tightens the loop between R&D and production (Porter 1990, p. 83).

The second group within the upstream layer is the power semiconductor industry, supplying critical electronic components for the high-speed train traction system. Zhuzhou CRRC Times Semiconductor, a subsidiary under CRRC Times Electric, handles the semiconductor business operations of its parent company. Its roots trace back to 1964 when power semiconductor R&D first began, and the 2008 acquisition of the UK-based Dynex Semiconductor later broadened its technological base. Over the following decade, sustained capability-building positioned the company among a small number of global IDM players capable of covering the full spectrum of power device types, from high-power thyristors and IGCTs to IGBT and SiC-based modules, all within a single integrated design-and-manufacturing platform (Zhuzhou CRRC Times Semiconductor Co., Ltd., n.d.).

This is directly relevant to HSR because IGBT modules function as the central switching component in a train's traction converter, transforming raw

electrical input from the grid or onboard power source into the precise voltage and frequency required to drive the traction motor. Given that rail traction systems must operate reliably across wide temperature ranges, constant vibration, and heavy electrical loads over a service life spanning decades, the quality of IGBT design directly shapes the energy efficiency, safety, and long-term reliability of the entire train (Dynex Semiconductor, n.d.). Against this backdrop, the presence of a domestic producer that has internalized this capability, instead of depending entirely on imported modules, illustrates the kind of internationally competitive domestic supplier that Porter identifies as strengthening a nation's downstream industries through accelerated innovation and technological upgrading (Porter 1990, pp. 82-83).

A sustainability dimension also accompanies this upstream transformation. China's steel sector is responsible for approximately 15% of the country's total carbon emissions, with more than 90% of production still based on coal-fired blast furnaces. To support the 2030 emissions peak and 2060 carbon neutrality targets, the Industrial Sector's Carbon Peak Implementation Plan sets a target EAF production share of 15% by the end of 2025 and 20% by 2030 (Climate Bonds Initiatives 2025, pp. 3, 5-6), with the capital expenditure required for this transition estimated at a minimum of USD 18 billion over the next five years (Climate Bonds Initiatives 2025, pp. 17-18). Hebei Province has even issued dedicated transition finance guidelines for the steel sector since December 2023, while since March 2025 the steel sector has also been included in China's national compliance emissions trading system (Climate Bonds Initiatives 2025, pp. 7-8).

Thus, the upstream layer displays two mutually reinforcing pillars: a steel industry, currently undergoing consolidation, tighter export controls, and a low-carbon transition to secure a supply of high-quality structural materials, and the power semiconductor industry built through long-term investment and technology acquisition to ensure self-sufficiency in critical components. Affirming Porter's argument that competitive advantage in a downstream industry cannot be separated from the strength of internationally competitive suppliers and related industries (Porter 1990, p. 82).

The second layer is midstream, referring to the industry that transforms the raw materials and components from the upstream layer into the finished product itself, high-speed rolling stock. In China, this layer is represented by the CRRC Corporation Limited (CRRC), formed through the 2015 merger of two rolling stock manufacturers, China CNR Corporation (CNR) and CSR Corporation (CSR). The merger was first announced on October 30, 2014, and was approved by the State Council, China's cabinet (Global Times 2015), before officially taking effect on June 1, 2015, with each CNR share exchanged for 1.1 CSR shares and the merged company renamed CRRC. CRRC inherited all the businesses and assets of both companies, which together had already held a combined market share of more than 90% prior to the merger, and the company describes itself as the world's largest rolling stock supplier with 175,700 employees (Railway Gazette International 2015). Bloomberg News described the resulting company as the world's second-largest industrial company after General Electric, worth nearly $130 billion, giving China the economies of scale to compete more aggressively for overseas rail contracts (Bloomberg News 2015).

While CRRC represents the manufacturing segment at this midstream layer, producing the rolling stock itself, another two state-owned enterprises, namely China Railway Construction Corporation (CRCC) and China Railway Group Limited (CREC), represent its construction segment, serving as the largest contractors responsible for building HSR's physical infrastructure, including rail tracks, bridges, tunnels and stations. Both companies were formerly civil engineering organizations under the Ministry of Railways and are comparable in scale to one another, each reporting annual revenues of approximately 1,000 billion yuan and employing around 280,000 staff (Chan 2022, pp. 454, 458; (Lawrence, Bullock, and Liu 2019, p. 42).

Beyond firm-level supplier relationships and centrally planned output targets, the state has also cultivated this midstream layer through spatial industrial policy under 14th FYP (People's Government of Hunan Province 2021) centred on Zhuzhou, in Hunan province, the home of CRRC's rolling-stock subsidiary, this strategy is operationalized through two main policy instruments. First, Zhuzhou has been designated China's only national pilot city for the strategic emerging industrial agglomeration development of rail transit equipment, a status that channels central support specifically toward clustering rail-equipment suppliers and manufacturers in one location (The Publicity Department of Zhuzhou City 2023).

Second, within this zone, CRRC Zhuzhou Locomotive has been formally named the "chain leader" under China's Chain Leader System, an institutionalized mechanism through which a government-recognized lead firm coordinates resource allocation, technology diffusion, and supply-chain resilience across the more than 400 upstream and downstream component makers clustered around it, achieving an

80 percent local-content rate (People's Government of Hunan Province 2025). It is precisely this state-assigned chain-leader role rather than spontaneous market clustering that allows a locomotive built for export, requiring close to 10,000 individual parts, to be delivered in about eighteen months, roughly half the lead time of international peers (Wang 2023).

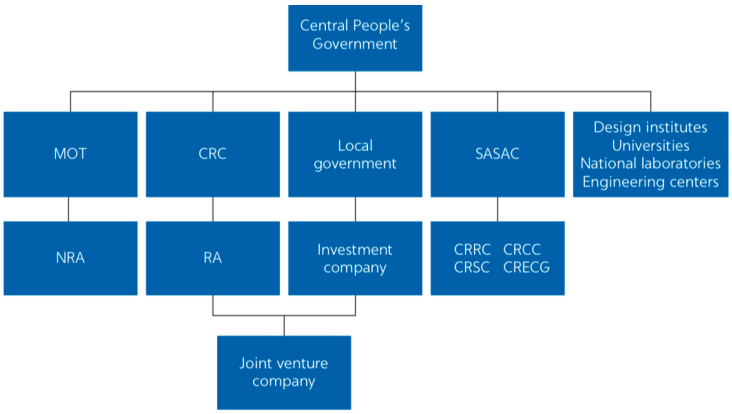
These facts reveal that the midstream layer is led by state-owned enterprises but is not uniformly monopolistic. The manufacturing segment, represented by CRRC, consists of a single state entity with no domestic rival at all. The construction segment, however, presents a different pattern, CRCC and CREC remain two comparably sized SOEs competing directly for the same HSR construction contracts (Chan 2022, p. 458), reflecting Porter's argument about domestic rivalry (Porter 1990, p. 85), that will be examined further in the next determinant.

The downstream layer refers to China Railway Corporation (CRC), which finances, governs and operates HSR infrastructure once built. Prior to 2013, oversight of China's entire public rail system rested with a single body, the Ministry of Railways (MOR), which the World Bank characterizes as having wielded such sweeping authority over the sector that it stood as one of the last holdouts of China's planned economy, shaping both the pace at which HSR infrastructure was built and the way HSR technology was introduced and localized domestically. That arrangement changed in 2013, when MOR was split into the National Railway Administration (NRA), taking on regulatory duties such as setting technical standards and enforcing safety rules, and monitoring the sector under the Ministry

of Transport, and CRC which is responsible for HSR management and operation (Lawrence, Bullock, and Liu 2019, pp. 7-8).

CRC itself is a wholly state-owned enterprise, with the Ministry of Finance holding its shares. Its mandate spans several functions: coordinating and controlling rail traffic nationwide, running passenger and freight services, fulfilling public-service transport obligations, planning investment in new rail construction jointly with the National Development and Reform Commission (NDRC), and managing construction projects (Lawrence et al., 2019, p. 8). Eighteen Regional Administrations (RAs) sit beneath CRC as its main subsidiaries, and the World Bank attributes the pace of China's HSR expansion partly to the tightly centralized nature of both operations and construction management across this network, with the entire industrial chain of construction and equipment manufacturing entities supporting the sector, most of these entities are state-owned and fall under the oversight of the State-Owned Assets Supervision and Administration Commission (SASAC) (Lawrence, Bullock, and Liu 2019, p. 8).

Diagram 2. Structure of China's HSR Sector



Note: CRC = China Railway Corporation; CRCC = China Railway Construction Corporation; CRECG = China Railway Engineering Corporation; CRRC = China Railway Rolling Stock Corporation; CRSC = China Railway Signal & Communication Corporation; MOT = Ministry of Transport; NRA = National Railway Administration; RA = Regional Administration; SASAC = State-Owned Assets Supervision and Administration Commission.

Source: Lawrence et al. (2019), China's High-Speed Rail Development, p. 8, World Bank

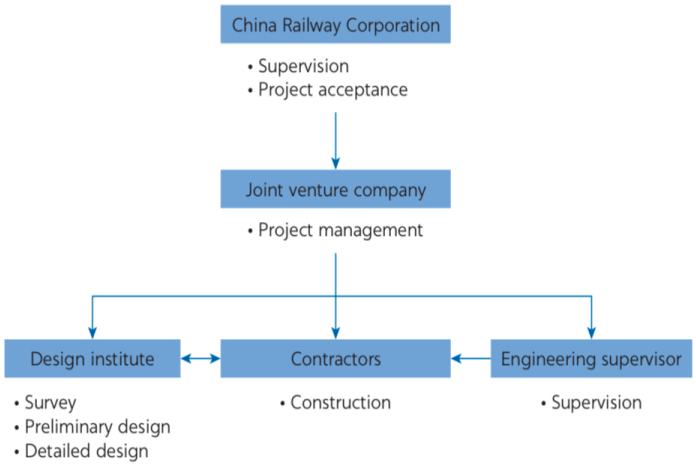
In practice, most HSR lines in China are delivered through a joint venture (JV) arrangement, with main shareholders, usually the central government, represented by CRC, alongside provincial governments through their own railway investment entities to manage their ownership interests. The financing arrangement typically divides approximately equally between equity and debt, with provincial contributions often provided in the form of land, while the rest is secured by the joint venture through loans. Although the JV owns the infrastructure, it does not operate the railway directly, contracting with the local RA to handle operational management infrastructure, equipment management, rolling-stock management, safety, revenue management, and land management (Lawrence, Bullock, and Liu 2019, pp. 8-9). At the construction stage, the JV engages one or more of China's eight railway survey and design institutes for design work, and contracts construction and supervision to the midstream layer's construction contractors, CRCC and CREC (Lawrence, Bullock, and Liu 2019, pp. 41-42).

Although the JV arrangement engages with multiple stakeholders, substantive control remains concentrated in CRC. As CRC is the largest equity holder in most JVs, the majority of HSR tenders including those spanning project design, construction services, and rolling stock, are in fact handled through the central tendering and bidding center in Beijing rather than through the provincial center where the project is located. While CRC and local governments are involved in construction oversight, with the JV's supervision consultant handling day-to-day monitoring, the primary oversight bodies involved within CRC departments are the Construction Management Department, the Safety Supervision and Administration

Bureau, the Project Management Center, and the Engineering Quality Supervision Bureau (Lawrence, Bullock, and Liu 2019, pp. 44-45).

The construction management structure in the **Diagram 4** shows a clear hierarchy, in which CRC maintains oversight of JV and construction standards, as well as evaluating design, monitoring their execution and overseeing final project acceptance, while the JV functions as project manager in the middle tier, assigned to coordinate with designers, contractors, and engineering supervisors carrying out implementation at the bottom and providing reports to CRC (Lawrence, Bullock, and Liu 2019, pp. 46-47). The World Bank's own concluding assessment frames the JV mechanism not as a means of opening ownership or market competition, but essentially as a tool for securing local government backing and co-financing for HSR projects (Lawrence, Bullock, and Liu 2019, p. 82). This finding should be read proportionally within the Related and Supporting Industries framework; it is not direct evidence of the competitive-advantage mechanism Porter describes, namely cost-efficient input delivery or the exchange of information and innovation between suppliers and users (Porter 1990, pp. 82-83), but rather a description of the JV's ownership and financing structure.

Diagram 3. Construction Management Structure



Source: Lawrence et al. (2019), China's High-Speed Rail Development, p. 47, World Bank

The state-driven character of this downstream layer is further reinforced by how its expansion trajectory is entirely shaped by top-down national planning. In February 2021, the Central Committee of the Communist Party of China and the State Council jointly released a high-level guideline aimed at building a more convenient, higher-quality transportation network by 2035, targeting a system in which most residents would be within 15 minutes of a national highway, 30 minutes of a freeway, and an hour of a railway. Specifically for the rail sector, the National Transport Planning Outline 2021-2035 reaffirmed the goal of expanding the national rail network to 70,000 km of high-speed lines and 130,000 km of conventional lines by 2035, with priority given to developing inter-city networks in the Jingjinji (Beijing-Tianjin-Hebei), Yangtze River Delta, Greater Bay, and Chengdu-Chongqing areas (The State Council of the People's Republic of China 2021; Benton 2021).

Five key goals for the rail sector were unveiled at a State Council press conference on March 1, attended by Liu Zhenfang, director of the National Railway Administration: boosting innovation through reform of the rail supply sector using "Internet+" and "Internet of Things+" concepts alongside 5G and artificial intelligence; better integrating rail with other transport modes through multimodal hubs; improving the quality of rail transport services through a high-capacity, HSR-based inter-regional passenger system, including new high-speed and cold-chain freight services; developing a safer, more environmentally friendly, low-carbon railway; and delivering better international rail services through improved connections with neighbouring countries and new land-sea corridors in western China. The plan also envisions exploring a trial maglev system linking major cities, with two projects already under early-stage development aiming for operating speeds of around 600 km/h (Benton 2021).

This broader national guideline frames HSR expansion as part of a much larger overhaul of China's entire transport system, prioritizing development across the country's most economically significant regions rather than treating rail expansion as an isolated sectoral effort (The State Council of the People's Republic of China 2021). This broader planning approach is consistent with the priority areas named in the rail-specific plan discussed above (Benton 2021), underscoring that HSR development in China is embedded within, rather than separate from the state's overall long-term transportation strategy.

Viewed as a whole, the downstream layer's apparent multiplicity of actors, the JV structure, provincial governments, and a formal NRA-CRC division of authority, masks a single, centrally directed state framework, with the National

Transport Planning Outline 2021-2035 dictating the layer's trajectory decades in advance (Benton 2021; The State Council of the People's Republic of China 2021).

Overall, the competitiveness of China's related and supporting industries is not an accidental byproduct of market forces, but a direct construct of deliberate state strategies. Upstream, the government engineered material self-sufficiency by restricting raw material outflows through steel export licensing, mandating low-carbon modernization via the Carbon Peak Plan, and funding domestic power semiconductor capabilities. Midstream, state policy acts as the primary architect of cluster competitiveness. The state consolidated manufacturing power by mandating the CNR-CSR merger into CRRC, while utilizing the Zhuzhou pilot-city framework and the Chain Leader System to compress production lead times through government-orchestrated supplier networks. Furthermore, the state manages domestic rivalry by balancing the market sizes of CRCC and CREC to maintain competitive friction without losing state control. Downstream, the government secures absolute market certainty through the National Transport Planning Outline 2021-2035, subordinating all financing and operations to long-term state goals. Consequently, the input quality, coordination, and innovation Porter attributes to autonomous clusters are structurally generated by state intervention, proving that the Chinese government does not merely support competitive clusters, it manufactures them.

3.4 Firm Strategy, Structure and Rivalry

The last determinant in Porter's (1990) diamond model is *firm strategy, structure, and rivalry,* which refers to the conditions that shape how companies within a given nation are founded, organized, and managed, together with the

character of domestic competition among them. Because Porter treats domestic rivalry as arising spontaneously from firms independently pursuing market share (Porter 1990, pp. 85-86), applying this determinant to CREC and CRCC first requires recognizing that their rivalry is itself a designed object rather than a spontaneous market outcome. The discussion below accordingly treats the rivalry between China's two largest rail construction SOEs not as evidence of a free market at work, but as evidence of how far a state-led system can engineer market-like competitive pressure without ceding actual market control.

Porter rejects the notion of a single, universally correct management model: whether a country's typical way of organizing and managing firms helps or hinders competitiveness depends on how well it matches what a given industry actually requires to succeed (Porter 1990, p. 83). He further regards domestic rivalry as the most consequential element of the diamond, since competitive pressure among firms based in the same country continually drives them toward lower costs, higher quality, and faster innovation, and firms that have already withstood such pressure at home tend to enter international markets considerably better prepared and less apprehensive about foreign competition (Porter 1990, pp. 85-86).

As already noted in the discussion of related and supporting industries, among the entities that make up China's HSR value chain, CREC and CRCC are the two state-owned enterprises whose business lines overlap most closely, placing them in direct competition with one another (Chan 2022, pp. 454, 458). What matters for this determinant, however, is not simply that the two firms are comparable, but how that comparability is actively preserved by the state through a deliberate government strategy that Chan terms "managed competition." Under

this strategy (Chan 2022, p. 456), the Chinese state actively regulates and fine-tunes the rivalry between railway SOEs to capture the efficiency and innovation benefits of market competition while preventing destructive market dominance and safeguarding public interest.

This managed-competition mechanism operates through a three-tier corporate structure, which Chan first outlined as a general feature of China's central SOEs before demonstrating that the same structure applies directly to CREC and CRCC. At the top, the two parent enterprises which are CREC and CRCC are responsible for overall coordination; at the middle tier, operating subsidiaries are the ones that actually compete for contracts; and at the lowest tier, a set of engineering companies functions less as independent competitors and more as internal units of the subsidiaries above them, carrying out assigned tasks rather than bidding for work in their own right, a division that Chan summarizes as coordination at the top, operation in the middle, and support at the bottom (Chan 2022, pp. 456- 458, 460, 462).

Within the infrastructure construction sector specifically, this middle tier consists of ten groups under CREC (No. 1 Group through No. 10 Group) and fifteen under CRCC (No. 11 Group through No. 25 Group), and it is these twenty-five subsidiaries that compete directly with one another for construction contracts (Chan 2022, p. 459). What the parent enterprises manage, then, is not whether this rivalry exists but how evenly matched it remains: staff numbers, production capacity, total assets, and equipment holdings across the subsidiaries are kept within a comparable range so that none stands out as markedly stronger or weaker than the others (Chan 2022, p. 457). This balance does not arise on its own, the parent enterprises maintain

it by jointly funding costly equipment purchases on behalf of their subsidiaries and by circulating technical expertise between them. During the early years of China's HSR program, for example, several subsidiaries acquired ballastless-track construction methods through partnerships with foreign firms such as Germany's Max Bögl Group. Once acquired, that expertise was subsequently passed on to other subsidiaries through formal technical manuals and through engineers transferring between firms (Chan 2022, p. 460).

A second control mechanism takes the form of a formal scorecard, the railway construction firm credit evaluation, issued twice a year by China State Railway Group (CRC) in the form of an A, B, or C grade. The distribution of grades changes little from one evaluation period to the next: approximately ten firms receive an A, three receive a C, and the remainder, comprising the large majority, receive a B (Chan 2022, p. 462). Each firm's score begins from a common baseline and is then reduced for so-called "harmful actions," each assigned its own penalty within a detailed schedule of violations: a minor lapse, such as failing to follow the most recent design blueprint, results in only a one- or two-point deduction, whereas a serious problem, such as an accident caused by substandard construction quality, can lower a firm's grade to a C regardless of its numerical score. Firms may likewise earn additional points for positive contributions such as exemplary standardization practices (Chan 2022, p. 464).

Evaluation records from 2013-2020 show that almost no subsidiary remains consistently at either the top or the bottom of the rankings; even a subsidiary with a generally strong record can drop abruptly to a C following a single accident, as occurred with the No. 1 Group in 2020. Chan interprets this volatility as evidence

that competition among the subsidiaries is regulated not only through the resources allocated to them but also through the outcomes they are permitted to achieve. A further mechanism reinforcing this balance concerns leadership appointments: heads of second-tier subsidiaries are appointed by the parent enterprise's Party Committee Cadre Department, and their careers typically follow one of two patterns, rising through the ranks within a single corporate group or moving between several groups over time (Chan 2022, p. 464). This reflects a broader pattern Chan identifies within China's multi-level SOE structure, in which parent enterprises use the reallocation of managerial personnel as one further means of keeping the competitive field balanced, ensuring that no subsidiary becomes strong enough to dominate the market or weak enough to fail (Chan 2022, p. 457).

This same arrangement extends once CREC and CRCC's rivalry moves onto the international stage, most visibly through projects associated with the BRI. Even abroad, construction work continues to be carried out primarily by the second-tier subsidiaries, while the parent enterprises retain a coordinating role and frequently take the lead in dealings with foreign governments and foreign firms. Domestically, subsidiaries of both firms operate across the country without being confined to any particular region. Internationally, however, a more geographically fixed pattern tends to emerge, in which a single subsidiary often remains active in the same country or region for an extended period, since the added complexity of language, regulatory systems, and local political relationships makes it difficult for more than one subsidiary from the same parent enterprise to compete simultaneously within the same foreign market (Chan 2022, pp. 466-467).

In Indonesia, for instance, the Jakarta-Bandung high-speed rail project has largely been carried out by CREC's own subsidiaries, including No. 3 Group, No. 4 Group, the China Railway Electrification Bureau Group, and the China Railway International Group, operating under a regional office CREC established in Indonesia to function as a "sharing platform" for these secondary units. CRCC, meanwhile, has established a comparable long-term presence elsewhere, most notably in Saudi Arabia, where its subsidiary, No. 18 Group, played a central role in constructing the Mecca-Medina high-speed railway as part of the firm's sustained presence in the Middle East (Chan 2022, p. 466). This is a claim corroborated by CRCC's own profile on the Chinese government's Belt and Road Initiative portal, which recorded the line's official opening in September 2018 (“CRCC on the Belt and Road”, n.d.). CREC's corporate profile makes a comparable claim regarding its own standing, describing the firm as one of the world's largest engineering and construction contractors and a seventeen-time entrant on the Fortune Global 500 (“CREC | CHINA RAILWAY GROUP LIMITED”, n.d.).

Domestic managed competition, however, is only one half of the state's strategy for extending CREC's and CRCC's rivalry abroad; the other half is financial rather than organizational. Because most HSR-importing countries cannot self-finance a project of this scale, Chinese policy banks routinely bundle construction contracts for CREC, CRCC, or CRRC subsidiaries together with concessional loans, which removes the financing constraint that would otherwise decide a foreign tender on commercial terms alone. The Jakarta-Bandung project clearly illustrates this dynamic. The China Development Bank provided the Indonesian consortium with a highly favourable financing package, featuring a

concessional interest rate of around 2 percent. This aggressive pricing created a financial baseline that the competing Japanese bid reportedly found impossible to match (Chen 2024).

A starker example is the China-Laos Railway, where the Export-Import Bank of China supplied 3.54 billion US dollars of debt financing, roughly 60 percent of the project's total cost, to a joint-venture operator in which Chinese state-owned enterprises hold a 70 percent equity stake, structured on a 60:40 debt-to-equity basis (AidData, n.d.). The Asian Infrastructure Investment Bank (AIIB), a Beijing-headquartered multilateral lender founded in 2016, occupies a complementary role by co-financing regional infrastructure, giving Chinese rail contractors a further financing channel beyond bilateral policy-bank lending, even where its own project portfolio extends beyond rail specifically (Export.gov 2019). The managed-competition mechanism described above shows that the state does not merely referee which SOE wins a foreign contract. Instead, it actively engineers the credit conditions under which that contest is decided. This extends the logic of state-constructed rivalry from the domestic market into the international arena. Consequently, it reinforces the earlier point in this chapter that China's domestic rivalry and export strategy are two sides of the same state-directed apparatus, rather than independent market processes.

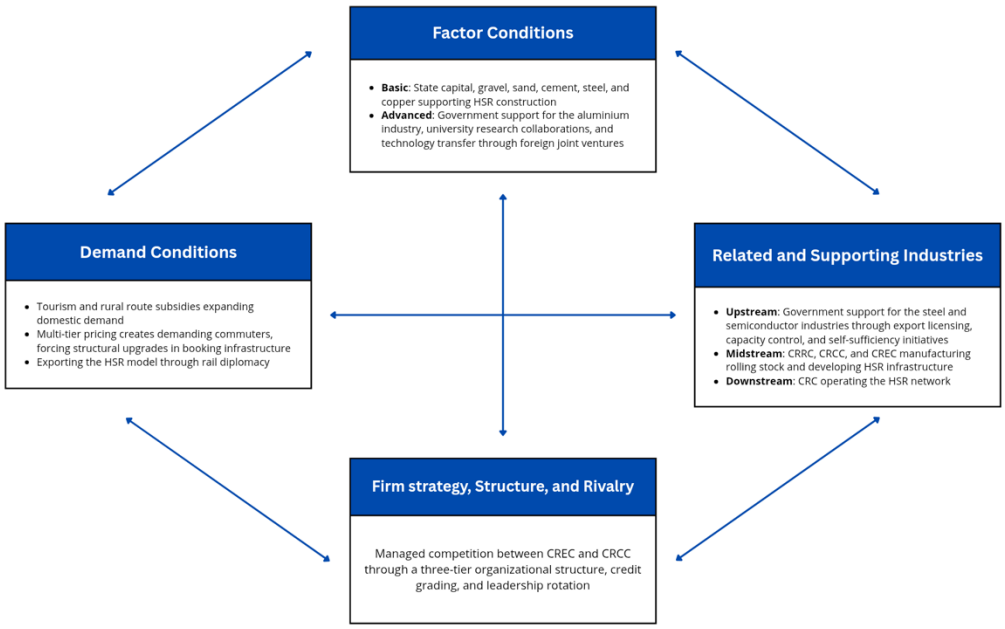
These findings indicate that the rivalry between CREC and CRCC, carefully balanced at home through a layered corporate structure, a formal grading system, and rotating leadership appointments, ultimately extends into a strategic contest between the two firms for high-speed rail contracts across different countries, a contest the state shapes further by engineering the concessional financing terms,

through the China Development Bank, the Export-Import Bank of China, and the AIIB, that determine which contracts are winnable at all. In the case of CREC and CRCC that rivalry is instead deliberately constructed and maintained by the state through the parent enterprises and falls under the oversight of SASAC (Lawrence, Bullock, and Liu 2019, p. 8).

CHAPTER IV

CONCLUSION

Diagram 4. The Chinese Government's Diamond of National Competitiveness



Source: Compiled by the author

4.1 Conclusion

The interconnectedness of Porter's four determinants underlies the strategic success of China's HSR industry. Basic factors, state capital, steel, cement, and aggregates, and advanced factors, the 2025-2027 aluminium policy, university research, and technology transfer through joint ventures with Alstom, Siemens, Bombardier, and Kawasaki, together built the physical capacity of a nationally integrated network. This capacity in turn let the state direct Demand Conditions across all three of Porter's sub-dimensions: enlarging demand through tourism and rural subsidies, refining tiered pricing for commuters, and exporting the resulting

model abroad through rail diplomacy. This engineered demand pressured Related and Supporting Industries to upgrade, self-reliance in semiconductors and coordinated digitization of steel upstream, CRRC's rolling-stock manufacturing and the CRCC-CREC construction rivalry midstream, and CRC's centralized operation downstream. That construction rivalry between two comparably sized SOEs in turn necessitated the final determinant, Firm Strategy, Structure, and Rivalry: a ‘managed competition’ built on three-tier organization, credit grading, and leadership rotation, later extended internationally through BRI projects financed by the China Development Bank, China Eximbank, and the AIIB.

Across all four determinants, this chain of mutual reinforcement does not emerge organically from market dynamics but from systematic and continuous state intervention at every link.

4.2 Recommendations

This research focused on how the competitive advantage of China's HSR industry was built through the interrelation of Porter's four determinants, but has not evaluated in depth the financial sustainability of the model. Future research could enrich these findings by specifically examining the debt burden of joint venture schemes between the CRC and provincial governments, as well as the dependence of some HSR routes on ongoing state subsidies, as found in the case of the Southern Sichuan Intercity Railway. This would allow the assessment of the extent to which China's HSR expansion model is fiscally sustainable in the long term.

BIBLIOGRAPHY

AGICO Group. n.d. “CHINA WILL GIVE RUSSIA'S FIRST HIGH-SPEED RAIL A $6.2 BILLION LOAN WITHOUT STATE GUARANTEES.” AGICO Rail Fasteners. https://www.agicorailfasteners.com/news/china-give-russia-high-speed-rail-loan.html.

AidData. n.d. “China Eximbank provides $3.54 billion of debt financing for China-Laos Railway Project (Linked to Record ID#33726).” AidData. Accessed 2026. https://china.aiddata.org/projects/85304/.

Anh, Hyunh N. 2024. “Analyzing China’s Influence by China’s High-Speed Railway Diplomacy in Southeast Asia Countries.” *Integrated Journal for Research in Arts and Humanities* 4, no. 2 (March): 66-71. https://doi.org/10.55544/ijrah.4.2.11.

Benton, AJ. 2021. “China releases 2021-2035 transport plan.” International Railway Journal. https://www.railjournal.com/policy/china-releases-2021-2035-transport-plan/.

Bloomberg News. 2015. “With a Rail Merger, China Is Forging an Industrial Giant Second Only to GE.” Bloomberg. https://www.bloomberg.com/news/articles/2015-06-07/china-forges-industrial-giant-second-only-to-ge-with-rail-merger.

Bryman, Alan. 2012. *Social Research Methods*. N.p.: OUP Oxford.

Carr, Collin. 2015. “China and Russia strengthen high-speed rail cooperation.” Rail UK. https://railuk.com/rail-news/china-and-russia-strengthen-high-speed-rail-cooperation/.

“Cement Statistics and Information | U.S. Geological Survey.” n.d. USGS.gov. Accessed August 3, 2026. https://www.usgs.gov/centers/national-minerals-information-center/cement-statistics-and-information.

Chan, Kyle. 2022. “Inside China’s state-owned enterprises: Managed competition through a multi-level structure.” *Chinese Journal of Sociology* 8 (4): 453-473. 10.1177/2057150X221123388.

Chandler, Alfred D. 1962. *Strategy and Structure: Chapters in the History of the Industrial Enterprise*. N.p.: The MIT Press.

Chen, Muyang. 2024. “Five Questions on Chinese Development Finance and the Foreign Aid Regime.” UC Institute on Global Conflict and Cooperation. https://ucigcc.org/blog/five-questions-on-chinese-development-finance-and-the-foreign-aid-regime/.

Cheng, Yu. 2025. “China unveils draft rules to curb new steel capacity, tighten green standards.” China Daily. https://www.chinadaily.com.cn/a/202510/27/WS68ff0f4ea310f735438b72a0.html .

“China debuts prototype of fastest high-speed train in the world.” 2024. The State Council The People's Republic of China. https://english.www.gov.cn/news/202412/29/content_WS6770e6d6c6d0868f4e8ee5b8.html.

China Railway International Group. n.d. “Company Profile.” China Railway International Group. Accessed august 4, 2026. https://www.crec.cn/crecien/index/index.html.

“China's High-Speed Rail Diplomacy | U.S.- CHINA | ECONOMIC and SECURITY REVIEW COMMISSION.” 2017. U.S.-China Economic and Security Review Commission. https://www.uscc.gov/research/chinas-high-speed-rail-diplomacy.

Chunfang, LU. 2015. “Highlights of China high speed railway.” *Science & Technology Review* 33 (18): 13-19. 10.3981/j.issn.1000-7857.2015.18.001.

Climate Bonds Initiatives. 2025. “Financing the Decarbonisation of China’s Steel Sector: Insights from the Transition Finance Pilot and Market Progress.” Climate Bonds Initiative. https://www.climatebonds.net/files/documents/publications/CBI-Financing-the-Decarbonisation-of-China’s-Steel-Sector_EN.pdf.

Cory, Nigel. 2021. “Heading Off Track: The Impact of China's Mercantilist Policies on Global High-Speed Rail Innovation.” *Information Technology & Innovation Foundation*, (April).

“CRCC on the Belt and Road.” n.d. Belt and Road Portal. Accessed August 4, 2026. https://eng.yidaiyilu.gov.cn/z/230720-1/index.shtml.

“CREC | CHINA RAILWAY GROUP LIMITED.” n.d. 中国中铁. Accessed August 4, 2026. https://www.crecg.com/zgztywz/index/index.html.

Creswell, John W., and J. D. Creswell. 2018. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. N.p.: SAGE Publications.

Diemer, Dominik. 2026. “CRRC Company Profile and Market Insights.” Stock Counterparts. https://www.stockcounterparts.com/companies/crrc.

Dynex Semiconductor. n.d. “Why IGBT Module Selection Matters in High-Power Traction Drives.” Dynex Semiconductor. https://www.dynexsemi.com/Resources/News/why-igbt-module-selection-matters-in-high-power-traction-drives.

Export.gov. 2019. “China - Financing.” Export.gov. https://legacy.export.gov/article?id=China-Project-Financing.

Fan, Yunxiao, Zhi Li, Jingjing Pei, Hongyu Li, and Jiang Sun. 2015. “Applying systems thinking approach to accident analysis in China: Case study of “7.23” Yong-Tai-

Wen High-Speed train accident." *Safety Science* 76 (July): 190-201. https://doi.org/10.1016/j.ssci.2015.02.017.

Global Times. 2015. "High-speed rail maker CRRC officially established." Global Times. https://www.globaltimes.cn/content/944882.shtml.

GMK Center. 2026. "China has committed to reducing its steel production capacity by 2026." GMK Center. https://gmk.center/en/news/china-has-committed-to-reducing-its-steel-production-capacity-by-2026/.

Han, Qiao. 2017. "Chinese high-speed rail expansion on the fast track." International Railway Journal. https://www.railjournal.com/in_depth/high-speed-rail-expansion-on-fast-track/.

Hemphill, Thomas A. 2024. "Industrial policy and strategy: a contextual perspective and descriptive typology." *Science and Public Policy* 51, no. 5 (October). https://doi.org/10.1093/scipol/scae027.

Huang, Wenjie. 2025. "Struggle to Balance National Interests: China's High-Speed Rail Diplomacy in Southeast Asia." *Journal of Globalization Studies* 16, no. 1 (May).

International Union of Railways (UIC). 2018. *HIGH SPEED RAIL FAST TRACK TO SUSTAINABLE MOBILTY*, Report. N.p.: International Union of Railways (UIC). https://www.uic.org/com/IMG/pdf/uic_high_speed_brochure.pdf.

International Union of Railways (UIC). 2024. "UIC High-Speed Railway Atlas 2024." In *Report*. N.p.: International Union of Railways (UIC). https://uic.org/IMG/pdf/uic_high-speed_atlas_2024.pdf.

JTRH. 2025. "University and majors supporting China's high-speed rail technology." JTRH Study in China. https://eastjuntai.com/university-and-majors-supporting-chinas-high-speed-rail-technology/.

KCIC. 2023. “Negara dengan Perkembangan Kereta Api Cepat Terpesat di Dunia Hadirkan Teknologinya di Indonesia.” KCIC. https://kcic.co.id/kcic-siaran-pers/negara-dengan-perkembangan-kereta-api-cepat-terpesat-di-dunia-hadirkan-teknologinya-di-indonesia/.

“KCIC.” n.d. KCIC. Accessed July 2, 2025. https://kcic.co.id/tentang-kami/profil/.

Kien-hong, Peter Y. 2010. “Near-bankruptcy of the Taiwan High Speed Rail Corporation: What Went Wrong?” *International Journal of Business and Management* 05, no. 12 (December). https://doi.org/10.5539/ijbm.v5n12p14.

Kratz, Agatha, and Dragan Pavlićević. 2018. “Norm-making, norm-taking or norm-shifting? A case study of Sino–Japanese competition in the Jakarta–Bandung high-speed rail project.” *Third World Quarterly*. 10.1080/01436597.2018.1523677.

Lawrence, Martha, Richard Bullock, and Ziming Liu. 2019. *China's High-Speed Rail Development*. N.p.: The World Bank. 10.1596/978-1-4648-1425-9.

Li, Hui, Xiucheng Dong, Qingzhe Jiang, and Kangyin Dong. 2021. “Policy analysis for high-speed rail in China: Evolution, evaluation, and expectation.” *Transport Policy* 106 (June). https://doi.org/10.1016/j.tranpol.2021.03.019.

Li, Jiaying. 2025. “China aims to boost bauxite reserves, aluminum production.” China Daily. https://www.chinadaily.com.cn/a/202503/28/WS67e6377fa3101d4e4dc2b6c5.html.

Li, Weidong, Olli-Pekka Hilmola, and Jianhong Wu. 2019. “Chinese High-speed Railway: Efficiency Comparison and the Future.” *Promet-Traffic & Transportation* 31 (6). https://doi.org/10.7307/ptt.v31i6.3220.

Li, Xuanmin, and Weilan Zhang. 2025. “Golden rail corridor in Southeast Asia starts to take shape as China-Thailand HSR accelerates.” Global Times. https://www.globaltimes.cn/page/202502/1327976.shtml.

Lim, Guanie, Chen Li, and Emirza A. Syailendra. 2021. “Why is it so hard to push Chinese railway projects in Southeast Asia? The role of domestic politics in Malaysia and Indonesia.” *World Development* 138.

Lin, Yatang, Yu Qin, and Zhuan Xie. 2021. “Does foreign technology transfer spur domestic innovation? Evidence from the high-speed rail sector in China.” *Journal of Comparative Economics* 49, no. 1 (March). 10.1016/j.jce.2020.08.004.

Lv, Amy, Joe Cash, Mark Potter, and Clarence Fernandez. 2025. “China to regulate steel exports with a licence system.” Reuters. https://www.reuters.com/world/asia-pacific/china-require-export-licences-some-steel-products-2025-12-12/.

Mao, Ruichang, Yankun Wu, Jian Chen, Peng Chen, and Xiaodong Li. 2023. “Development patterns, material metabolism, and greenhouse gas emissions of high-speed railway in China.” *Communications Earth & Environment* 4 (1): 312. https://doi.org/10.1038/s43247-023-00972-6.

May, Tiana. 2023. “Knorr-Bremse to Supply Braking Systems for CRRC Metros in Chengdu.” Railway News. https://railway-news.com/knorr-bremse-to-supply-braking-systems-for-crrc-metros-in-chengdu/.

McKissack, Adam, and Jessica Xu. 2011. “Chinese macroeconomic management through the crisis and beyond: 4. China's stimulus package.” Australian Government Treasury. https://treasury.gov.au/publication/chinese-macroeconomic-management-through-the-crisis-and-beyond/2011-01-chinese-macroeconomic-management-through-the-crisis-and-beyond/4-chinas-stimulus-package.

Mysteel. 2025. “China steel industry tightens export control, strengthens self-discipline to stabilize market.” Mysteel Global. https://www.mysteel.net/news/5107464-china-steel-industry-tightens-export-control-strengthens-self-discipline-to-stabilize-market.

National Development and Reform Commission. 2022. “China issues roadmap for high-quality development of iron and steel industry.” National Development and Reform Commission (NDRC) People's Republic of China. https://en.ndrc.gov.cn/news/mediarusources/202203/t20220325_1320408.html.

New Zealand Ministry of Foreign Affairs and Trade. 2026. “Made in China 2025: From assembly line to MARKET REPORT advanced manufacturing.” New Zealand Ministry of Foreign Affairs and Trade. https://www.mfat.govt.nz/en/trade/mfat-market-reports/made-in-china-2025-from-assembly-line-to-advanced-manufacturing-june-2026.

Olander, Eric, Alice Philipson, and Lam Nguyen. 2025. “China Myanmar Railway Stalled: Current Status Update.” The China-Global South Project. https://chinaglobalsouth.com/2025/12/02/china-myanmar-railway-stalled-kyaukpyu-corridor-politics/.

Otele, Oscar M., Guanie Lim, and Ana Alvesis. 2022. “China-Driven Rail Development: Lessons from Kenya and Indonesia.” South African Institute of International Affairs (SAIIA). https://saiia.org.za/research/china-driven-rail-development-lessons-from-kenya-and-indonesia/.

Pataki, Zoltán. 2023. “The staggering story of China’s high-speed rails.” *Eurasia Magazine*, 2023.

Pearson, Margaret M., Meg Rithmire, and Kellee Tsai. 2023. *The State and Capitalism in China*. N.p.: Cambridge University Press. 10.1017/9781009356732.

People' s Government of Hunan Province. 2021. "[Zhuzhou City] Build a national important advanced manufacturing highland." People' s Government of Hunan Province. https://www.hunan.gov.cn/hnyw/szdt/202111/t20211109_21026347.html.

People's Government of Hunan Province. 2025. "Hunan Rail Transit Equipment Intelligent Supply Chain Conference Opens in Zhuzhou." hunan.gov.cn. https://www.enghunan.gov.cn/hneng/Business/KeyIndustries/202511/t20251111_33845821.html.

People's Government of Hunan Province. 2026. "Zhuzhou National High-Tech Industrial Development Zone." Hunan Government Official Portal. http://www.enghunan.gov.cn/hneng/Business/IPZones/StateDZ/202302/t20230224_29256297.html.

Porter, Michael E. 1990. "The Competitive Advantage of Nations." *Harvard Business Review* 68 (2): 73-93.

The Publicity Department of Zhuzhou City. 2023. "2023 China International Rail Transit & Equipment Manufacturing Industry Exposition unveils in Zhuzhou." PR Newswire. https://www.prnewswire.com/news-releases/2023-china-international-rail-transit--equipment-manufacturing-industry-exposition-unveils-in-zhuzhou-302010042.html.

RailTech.com. 2025. "Russia begins building trains for new HSR: 'We don't want to involve China,' says expert." Infrastructure Now. https://www.infrastructure-

now.co.uk/article/367153/russia-begins-building-trains-for-new-hsr-we-dont-want-to-involve-china-says-expert.

Railway Gazette International. 2015. “Chinese rolling stock manufacturers merge to form CRRC Corp.” Railway Gazette International. https://www.railwaygazette.com/business/2015/06/02/chinese-rolling-stock-manufacturers-merge-to-form-crrc-corp/.

Rencz, Flora. 2019. “THE BRI IN EUROPE AND THE BUDAPEST-BELGRADE RAILWAY LINK.” European Institute for Asian Studies (EIAS). https://www.eias.org/wp-content/uploads/2019/07/EIAS-Briefing-Paper-The-BRI-in-Europe-and-the-Budapest-Belgrade-Railway-Link-Final.pdf.

Rolling Stock Agency. 2022. “CRRC’s expansion into international markets is stagnating.” Rolling Stock. https://rollingstockworld.com/economy/crrcs-expansion-into-international-markets-is-stagnating/.

“Russian economy remains critically dependent on foreign technology.” 2026. RBC-Ukraine. https://newsukraine.rbc.ua/news/caught-in-china-s-trap-intelligence-exposes-1770397843.html.

Shanghai Metals Market. 2025. “China Unveils 2025–2027 Aluminium Industry Action Plan.” Shanghai Metals Market. https://news.metal.com/newscontent/103253226-china-unveils-2025%E2%80%932027-aluminium-industry-action-plan.

Shanghai Municipal Government. 2025. “New ticket packages offer more discounts for rail commuters.” Government Online-Shanghai. https://english.shanghai.gov.cn/en-Latest-WhatsNew/20250321/d3ef0a57055a4ef8a9dbf109bfb3255c.html.

Shen, Xinyi. 2024. “Steel sector decarbonisation in China stalls, with investments in coal-based steel plants since 2021 exceeding USD 100 billion despite overcapacity and

climate goals." Centre for Research on Energy and Clean Air (CREA). https://energyandcleanair.org/publication/steel-sector-decarbonisation-in-china-stalls/.

"The sky is the limit: China's rise as a transportation superpower challenges the EU." 2023. Mercator Institute for China Studies (MERICS). https://merics.org/en/report/sky-limit-chinas-rise-transportation-superpower-challenges-eu.

Solano-Alvarez, W., and H. K. D. H Bhadeshia. 2024. "Steels for rails." *Progress in Materials Science* 145. https://doi.org/10.1016/j.pmatsci.2024.101313.

State Council Information Office. 2020. "SCIO Briefing on achievements in transport during the 13th Five-Year Plan period (2016-2020)." State Council Information Office. http://english.scio.gov.cn/m/pressroom/2020-10/28/content_76853028_7.html.

The State Council of the People's Republic of China. 2021. "Nation ready for transport expansion." The State Council of the People's Republic of China. https://english.www.gov.cn/policies/policywatch/202102/26/content_WS60382fe7c6d0719374af993a.html.

Statista Research Department. 2026. "Research and development (R&D) spending in China 2024, by industry." Statista. https://www.statista.com/statistics/234726/research-and-development-spending-in-china-by-industry/.

Sun, Zhe. 2015. "Technology innovation and entrepreneurial state: the development of China's high-speed rail industry." *Technology Analysis & Strategic Management* 27 (6). doi.org/10.1080/09537325.2015.1034267.

Turner, Julian. 2018. “Russian revolution: is the Moscow-Kazan high-speed rail project on track?” Railway Technology. https://www.railway-technology.com/features/moscow-kazan-high-speed-rail/?cf-view.

Vialko, Daryna. 2026. “Russian economy remains critically dependent on foreign technology.” RBC-Ukraine. https://newsukraine.rbc.ua/news/caught-in-china-s-trap-intelligence-exposes-1770397843.html.

Wang, Ruoting. 2023. “CRRC Accelerates Innovation, Serving Domestic and Intl Markets.” State-Owned Assets Supervision and Administration Commission of the State Council. http://en.sasac.gov.cn/2023/05/09/c_15217.htm.

Wang, Yao, and Weijia Dong. 2022. “How China’s high-speed rail promote local economy: New evidence from county-level panel data.” *International Review of Economics & Finance* 80:67-81. https://doi.org/10.1016/j.iref.2022.02.040.

WANGSHU, LUO. 2026. “China's railway network sets new records in 2025 - Chinadaily.com.cn.” China Daily. https://www.chinadaily.com.cn/a/202601/04/WS6959e0bba310d6866eb31c92.html.

“White Paper on Sand and Aggregates Industry.” n.d. Aimix Group. Accessed August 3, 2026. https://aimixgroup.com/white-paper-on-sand-and-aggregates-industry/.

World Bank Group. 2014. “Cost of High Speed Rail in China One Third Lower than in Other Countries.” World Bank. https://www.worldbank.org/en/news/press-release/2014/07/10/cost-of-high-speed-rail-in-china-one-third-lower-than-in-other-countries.

Wu, Shang-su. 2024. “China’s Rail Diplomacy in Southeast Asia.” *The Asia Pacific Journal: Japan Focus* 22, no. 9 (September). https://apjjf.org/2024/9/wu.

Wu, Xintong, and Liang Mei. 2022. “Policy-driven open strategy: Lessons from China’s high-speed rail industry.” *Journal of Engineering and Technology Management* 63. 10.1016/j.jengtecman.2022.101671.

Xinhua. 2025. “Assessment work on 4 new high-speed railway projects underway in Russia.” Xinhua Net. https://english.news.cn/20250908/b1e5c23b6d02415b94db9764a2d23d5b/c.html.

Xinhua. 2026. “China to invest 1 bln yuan to subsidize tourist trips.” The State Council of the People's Republic of China. https://english.www.gov.cn/news/202604/24/content_WS69eabfcfc6d00ca5f9a0a9cf.html.

Xinhua News Agency. 2025. “China-built high-speed rail line begins operation in Serbia.” CGTN. https://news.cgtn.com/news/2025-10-04/China-built-high-speed-rail-line-begins-operation-in-Serbia-1Hcey44q0zm/p.html.

Yang, Helen. 2022. “High-speed rail bearings technical challenge.” linkedin. https://www.linkedin.com/pulse/high-speed-rail-bearings-technical-challenge-helen-yang-mby-.

Yu, Hong. 2014. “China's Eagerness to Export Its High- speed Rail Expertise to ASEAN Members.” *The Copenhagen Journal of Asian Studies* 32 (2).

Yusuf, M. F. 2022. “Kereta Cepat Jakarta Bandung, Upaya Meningkatkan Kinerja Transportasi Massal di Indonesia Read more: https://setkab.go.id/kereta-cepat-jakarta-bandung-upaya-meningkatkan-kinerja-transportasi-massal-di-indonesia/.” Sekretariat Kabinet Republik Indonesia. https://setkab.go.id/kereta-cepat-jakarta-bandung-upaya-meningkatkan-kinerja-transportasi-massal-di-indonesia/.

Zhang, Min, and Neha Arora. 2021. “China bought most iron ore from Australia, Brazil in 2020, but imports from India up nearly 90%.” Reuters. https://www.reuters.com/world/china/china-bought-most-iron-ore-australia-brazil-2020-imports-india-up-nearly-90-2021-01-20/.

Zhang, Shoushuai, Rui Yan, Yongji Luo, Jiahui Rao, and Haifeng Yan. 2025. “Optimizing subsidy strategies for high-speed railways: A Stackelberg game approach between local governments and railway operators.” *Research in Transportation Business & Management* 63. https://doi.org/10.1016/j.rtbm.2025.101498.

Zhao, Hong. 2018. “China–Japan Compete for Infrastructure Investment in Southeast Asia: Geopolitical Rivalry or Healthy Competition?” *Journal of Contemporary China*. https://doi.org/10.1080/10670564.2018.1557946.

Zhen, Zhihong. 2016. “Institutional Origins of the Development of China’s High-speed Railway.” *China: An International Journal* 14 (1). 10.1353/chn.2016.0001.

Zhuzhou CRRC Times Semiconductor Co., Ltd. n.d. “Company Profile.” Zhuzhou CRRC Times Semiconductor Co., Ltd. https://ctsc.csrzic.com/protalen/gywm/gsjj/gsjj_1.htm.