China’s new high-speed rail system, projected to span the country by 2020, will do more than just whisk passengers from one place to another, write Lee Chor Pharn and Sim Phei Sunn. It can be expected to usher in major sociological and economic changes as some cities are connected and others aren’t.

China’s New Silk Railroads

By Lee Chor Pharn & Sim Phei Sunn
A TRANSPORT RENAISSANCE in Asia, via trains traveling at jet-like speeds, is creating a new Silk Road. These are trains that can operate at top speeds of 350 km per hour (220 mph). One Maglev line in Shanghai reaches speeds of 431 km per hour. This is being driven by two potential game changers. The first is the projected completion by 2020 of China’s domestic high-speed rail network, already the largest in the world. The second, also originating in China, is a proposed transcontinental rail network (see figure 1 on the previous page) that would bind the mainland countries of the Association of Southeast Asian Nations (ASEAN) and central Asia closer to China’s economy.

Some cities will win, and some will lose. In the mature high-speed rail markets of Japan and Europe, a few cities have gained over the long term at the expense of others that are bypassed. Even though both China’s domestic and transcontinental high-speed network are being built on a scale never seen before, what might be the likely economic clustering effects and which are the possible new winner cities?

China’s goal is to reshape its landscape around train services in much the same way that the inter- terate highways reshaped America. The upcoming decade of network-building will coincide with extreme urbanization and the formation of mega-city clusters, allowing for a day’s travel to reach any major city. This will accelerate the formation of a unified Chinese domestic market.

In the short term, high-speed rail decimates existing air routes of less than 800 km, or three-hour short hauls. In Europe, airlines have either seen their share slashed by up to 80 percent, or passengers quit flying the routes altogether. For tourism, the number of tourists in cities linked by high-speed rail tends to increase, but the number of nights spent in hotels is reduced.

In the longer term, economic studies compiled by the Research Institute of Applied Economics at the University of Barcelona show that the agglomeration and dispersion effects lead to a relocation of activities. These studies of mature markets in Europe and Japan have shown that high-speed rail doesn’t cause growth, but rather concentrates it. For regions and cities that compare economically unfavorably to their neighbors, a connection to the high-speed network may result in economic activities being siphoned away, resulting in a net negative impact. Medium-sized cities may suffer most as activities drain to more dynamic and bigger cities.

However, cities with a service-heavy economic structure will benefit. “Face-intensive” activities that benefit from clustering of talent like education, finance, business services, media and R&D will consolidate in big node cities. “Rent-intensive” activities like manufacturing and agriculture are indifferent. This means that while high-speed rail does not accelerate the hollowing out of industrial activity, it also does not slow it down.

These developments will most certainly strengthen the economic positions of coastal megacities in the Pearl River Delta, Yangtze Delta and Bohai Delta. Identifying potential winners from among inland cities is more challenging given concurrent developments in urbanization, inland transportation networks and government policies to transfer growth from the coast to the interior.

Nonetheless, we can make some educated guesses via the interior routes of the planned network. The developed “dumbbell” regions of Beijing and Hong Kong will be joined by the high-speed rail “barbell” of Changsha-Wuhan-Zhengzhou-Shijiazhuang. Similar configurations exist for the “barbells” of Hangzhou-Nanchang that will join Shanghai to Changsha, Zhengzhou-Xi’an-Baoji and Xuzhou to Lanzhou. These mega-city corridors (see figure 2 opposite) bear watching.

The strategy of transcontinental high-speed lines is obvious when seen in the context of China’s regional plans for a parallel trade infrastructure. China is already investing in highways, sea and airports and oil and gas pipelines in neighboring countries, like Burma and Pakistan. This allows China to open up alternative energy supply routes, establish new trading routes through its own secured trading infrastructure and open up new markets that border its outer provinces. The proposed transcontinental high-speed rail lines further consolidate China’s role as the major hub of Asia.

China is proposing four transcontinental high-speed lines and South Korea is exploring a transoceanic line that would involve massive tunnels. The transcontinental lines extend westward across Central Asia to Europe and southwards across ASEAN, ending at Singapore. The transoceanic line would extend eastward to join the networks of Korea and Japan.

The Urumqi-Central Asia line is planned from the Western Chinese city of Urumqi towards Kazakhstan, Uzbekistan and Turkmenistan, possibly connecting through Pakistan, Iran, and Turkey through to Germany. The intention of this westward line is twofold. First is to develop China’s western regions, and second to acquire natural resources.

The Harbin-Russia line is planned from Heilongjiang, across Mongolia to Siberia and Europe. In November 2010, China signed an MOU with Russia and Belarus to explore connections to Russia’s high-speed network.

The Kunming-Middle East line is planned from Kunming to Burma, Bangladesh, north India, south Pakistan and finally Tehran. The railway could later be extended to London. China is building considerable infrastructure (highways, ports, and oil and gas lines) to bypass the Straits of Malacca via Bangladesh, Pakistan and Burma. The rail line does not appear to link with the rest of India’s proposed system. Another variant of the...
Vietnam, Russia and India are all concerned about deepening Chinese links into their territories and could frustrate the building of a continuous transcontinental link — and a fragmented link would be of little use.

line starts in Kunming via the ASEAN line through Rangoon and Bangladesh. However, this line may be fragmented, as it is not clear that India would allow China’s system to run through the country. The Kunming-ASEAN line is planned from Kunming through Vietnam, Cambodia, Thailand, Malaysia and Singapore. This would likely run parallel to the proposed China-ASEAN conventional railway line between Kunming and Singapore.5 Two additional legs would be from Kunming through Burma and Kunming via Laos, to be built by 2015. Vietnam has turned down a 1,630-km high-speed line based on Japanese technology between Hanoi and Ho Chi Minh City due to its high costs. China is reported to have offered an alternative at lower cost, but Vietnam has yet to accept. Bangkok has already agreed to deploy Chinese technology and management to help build four domestic high-speed lines, including one from Bangkok that would connect to Laos.4

Aside from transcontinental links, there is also talk of a transoceanic connection linking the systems of northeast China (via Shandong-Weihai) to Korea via Busan to Fukuoka in Japan. South Korea has commissioned a feasibility study into undersea rail tunnels. There are major technical, funding and geopolitical considerations. One Korean minister official said it might take “tens of years” before the project starts, if it is technically possible. Nonetheless, South Korea’s neutrality may place it in a good position to drive such a development for further integration in Northeast Asia.6

Malaysia’s YTL Corporation proposed a Kuala Lumpur-Singapore high-speed line in 2006, but it was put on hold by the government in 2008 in the wake of the global financial crisis. YTL revived talks on the project in 2009. The Malaysian government also recently referred to a Penang-KL-Singapore high-speed line when it announced its Economic Transformation Projects (September 2010). The Malaysian media has reported a proposal to use maglev technology for the KL-Singapore leg.

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WHAT MIGHT DERAIL THE RAILS?

The cost will be enormous — high-speed track is three times more expensive than conventional rail, and the vast majority of the routes would require laying new tracks. Some countries are preparing to offer trade incentives in exchange for financial backing on the high-speed routes, for instance Burma may offer its rich reserves of lithium. Customs issues (quarantine, visa requirements and so on) need to be harmonized, although this can be overcome by treating cross-border rail in the same way as airports.

Nor are any operating profits assured. Despite impressive ridership figures, virtually every completed line has incurred losses in its first years of operation. For example, the Beijing-Tianjin Intercity Railway in its two full years of operation delivered more than 41 million rides. To break even, the line must deliver 30 million rides annually. To be able to repay principal, ridership would need to exceed 40 million a year.

The Chinese also expect to face intellectual property challenges from their former joint venture partners when they move overseas. Currently, 65 percent of the global railway equipment market is dominated by Bombardier of Canada, Alstom of France, Siemens of Germany and GE of the United States. For historical reasons, Japan’s Shinkansen is not one of the big three.7 However, foreign railway equipment manufacturers have a minor slice of China’s railway equipment market. In 2002, China had no high-speed rail and the Ministry of Railways tried introducing a homegrown system, the China Star. The China Star did not meet expectations, and was quietly shunted aside as “immature.” The ministry used its huge market demand to leverage the manufacture of foreign systems with local integrated operation and control through joint ventures with foreign partners. These included Bombardier, Alstom, Siemens and Japanese companies.

However, by 2010, Chinese train makers and builders, such as China South LORIC, ended their joint ventures.8 They now compete with their former partners for local and overseas contracts. Chinese companies have signed agreements to build rail systems in Turkey, Venezuela and Argentina, and are also bidding on projects in the United States, Russia and other countries (see story on next page).

The challenge from the former joint-venture partners can be sidestepped by focusing on emerging markets where the intellectual property challenge will be weaker. However, this issue cannot be ignored in developed markets such as the United States.

Another persistent weakness is a lack of overseas experience. Chinese operators pulled out of the Saudi Arabia high-speed rail bid in July 2010 due to lack of familiarity with the bidding process. This can be overcome with time and increased exposure.

GEOPOLITICS REARS ITS HEAD

The unseen wild card will be geopolitics. Vietnam, Russia and India are all concerned about deepening Chinese links into their territories and could frustrate the building of a continuous transcontinental link — and a fragmented link would be of little use. This may change as China’s economic and political influence grows and alters the balance. For now, the Kunming-ASEAN line seems more plausible, as it rides on an existing China-ASEAN conventional railway agreement for the line to be completed by 2015. Finally, the studies show that high-speed rail has only marginal impacts on population and housing growth. There is a caveat. Existing studies are of mature systems that do not face the simultaneous urban, migration and transport-network transformations underway in China. It is entirely possible that China’s plans, amplified by these concurrent changes, may result in quite unexpected effects.

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4. India’s HSR network plan is contained in Indian Railways’ Vision 2020 proposal, which selects six priority routes (“Golden Rail Corridors”) designated for trains to operate at speeds above 150 mph (250 km/h). These six lines would connect the nation’s largest cities, including Delhi, Mumbai, Bangalore, Chennai, and Calcutta. High-speed trains in India would operate in corridors reserved for passenger trains, unlike the mixed routes shared with freight trains that slow down the system today.

5. The conventional rail line is targeted for completion by 2015 and is expected to open up internal trade between China and mainland ASEAN and be a land bridge between China and India’s east coast.

6. The Korea Transport Institute has suggested the Chinese city of Weihai in Shandong Province as a suitable connection for the South Korea-China underwater train tunnel project, although the Chinese city is over 300 kilometers from South Korea’s coast. The South Korea-Japan project will likely connect the Korean port city of Busan to the Japanese port of Fukuoka on Tsushima Island, some 220 kilometers away. Government officials estimate that each tunnel project could cost around $86 billion and if when they are approved. By comparison, Europe’s Channel Tunnel connecting France and the UK. stretches 50.5 kilometers and costs roughly $15 billion.

7. Interestingly, Japan established the world’s first and biggest high-speed rail network but failed to become one of the big three due to fragmentation. In Japan, railway operators have strong control over the market, contracting to 10 different manufacturers for one project. However, different operators have control over regional routes. As a result, companies have difficulties in achieving economies of scale and at the same time, rail operators, who manage entire systems, lose competitiveness on the global stage. The Shinkansen currently does not have an international representative. Therefore, the Japanese government is pursuing exports with individual railway operators, but it is having some difficulties due to the dispersion of capabilities.

8. China National Railway Locomotive and Rolling Stock Industry Corp (LORIC Group) was formed by the Ministry of Railways in 1998 to focus on railway research and production. LORIC was separated from the Ministry in 2000, forming two rival groups, China North LORIC (2000) and China South LORIC (2002). China South has slightly more than half of China’s market share.
China’s HSR Network: A Brief Introduction

The development of the high-speed rail (HSR) network in China was initially held up by a debate between conventional rail vs maglev. Maglev received a big boost in 2000 when the Shanghai Municipal Government agreed to purchase a turnkey Transrapid train system from Germany for the 30.5 km rail link connecting Shanghai Pudong International Airport and the city. In 2004, the Shanghai Maglev Train became the world’s first commercially operated high-speed maglev. It remains the fastest train in China with peak speeds of 431 km/h (267 mph) and makes the 30.5 km run in less than 7.5 minutes.

Despite unmatched advantage in speed, maglev has not gained widespread use in China due to high cost, German refusal to share technology and concerns about safety. The Shanghai Maglev had a price tag believed to be $1.3 billion and was partially financed by the German government. The refusal of the Transrapid Consortium to share technology and source production in China made large-scale maglev production much more costly than high-speed train technology for conventional lines.

In 2006, the State Council in its Mid-to-Long Term Railway Development Plan adopted conventional track HSR technology over maglev. This decision ended the debate and cleared the way for rapid construction of standard gauge, passenger-dedicated HSR lines in China.

At the same time, China started construction of its first HSR, called “China Star” and based on domestic technology, for the Qinhuangdao-Shenyang passenger-dedicated line. This opened in 2003 with a designed speed of 200 km/h, but speeds of only 180 km/h were achieved. The State Council decided to put aside the “China Star” as “unsuitable” and turn to advanced foreign technology but made clear that China’s HSR expansion could not only benefit foreign economies. China’s expansion must also be used to develop its own technology transfers. The State Council, Ministry of Railways (MOR) and state-owned train-builders the China North Car (CNC) and China South Car (CSC) used China’s large market and competition among foreign train-makers to induce technology transfers.

Alstom of France, Siemens of Germany, Bombardier Transportation based in Germany and a Japanese consortium led by Kawasaki had to adapt their HSR train-sets to China’s own standard and assemble units through local joint ventures. The foreign companies had thought they could increase their market share of rail projects in China (70 percent in 2002) but their local partners had “digested and innovated” into low-cost competitors so quickly they were caught by surprise. Today, foreign companies’ share of the rail projects is 15-20 percent. The transformation of local state-owned train builders was aided by the MOR’s unofficial “70 percent local content” requirement.

Today, China’s high-speed rail expansion is entirely managed, planned and financed by the government. After committing to conventional-track high-speed rail in 2006, the state has embarked on an ambitious campaign to build passenger-dedicated high-speed rail lines, which accounts for a large part of the growing state budget for rail construction. Total investment in new rail lines grew from $14 billion in 2004 to $22.7 billion in 2006 and $26.2 billion in 2007. In response to the global recession, the government accelerated the pace of HSR expansion to stimulate economic growth. Total investment in new rail lines including HSR reached $49.4 billion in 2008 and $88 billion in 2009. In all, the state plans to spend $300 billion to build a 25,000 km HSR network by 2020.

The centerpiece of the MOR’s plans is a new national high-speed rail grid that will be overlaid on the existing railroad network. This grid is to be composed of eight high-speed rail corridors, four running north-south and four east-west, with a total length of 12,000 km. Most of the new lines follow the routes of existing trunk lines and are designated for passenger travel only. They are known as passenger-dedicated lines (PDL). High-speed trains on PDLs can generally reach 300-350 km/h.

Several sections of the national grid, especially along the southeast coastal corridor, were built to link cities that had no previous rail connections. Those sections will carry a mix of passenger and freight, but are sometimes mislabeled as PDLs.

There are four main corridors being readied for very high-speed rail: Beijing-Hong Kong; Beijing-Shanghai; Xuzhou-Lanzhou; and Shanghai-Changsha. Since the vast majority of China’s population is located near its eastern coast, the majority of the country’s large cities would be well served by the network. The Beijing-Hong Kong line would be the largest single element of the system, at more than 1,600 km long.

China’s system leaves open the use of the high-speed tracks for trains originating from or arriving at stations or cities without high-speed service. In other words, a train could, for example, leave Nanning in southern China on slow tracks, travel to Guangzhou, and then continue to Beijing on high-speed tracks. This interoperability makes trips shorter for everyone, because a passenger traveling from Nanning to Beijing would not have to either transfer at Guangzhou to another train or take the entire trip on slow tracks, nor does the government have to invest in a high-speed line from Guangzhou to Nanning in order for passengers from Nanning to take advantage of the high-speed system. China’s decision allows cities throughout the nation to benefit directly from rail service, with all cities getting at least some rail and the larger cities getting fast rail.

There have been fierce criticisms domestically that question the need for HSR in a developing country like China. There is also concern over project financing. Currently, all HSR projects are financed by state-owned banks to the MOR’s financing arm China Rail Investment Corp. (CRIC). It issued an estimated 1 trillion yuan in debt to finance HSR construction from 2006 to 2010. As of 2010, the CRIC-bonds are considered to be relatively safe investments because they are backed by assets (the railways) and implicitly by the government.

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The MOR faces a debt-repayment peak in 2014. Some economists recommend further subsidies to lower fares and boost ridership and ultimately revenues. Others warn that the financing side of the existing construction and operation model is unsustainable. If the rail-backed loans cannot be fully repaid, they may be refinanced or the banks may seize ownership of the railways. To prevent that eventually, the MOR is trying to improve management of its rapidly growing HSR holdings.