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Bullets and Trains: Exporting Japan's Shinkansen to China and Taiwan

By Christopher P. Hood

It is over forty years since the Shinkansen ('bullet train') began operating between Tokyo and Osaka. Since then the network has expanded, but other countries, most notably France and Germany, have been developing their own high speed railways, too. As other countries, mainly in Asia, look to develop high speed railways, the battle over which country will win the lucrative contracts for them is on. It is not only a matter of railway technology. Political, economic & cultural influences are also at stake. This paper will look at these various aspects in relation to the export of the Shinkansen to China in light of previous Japanese attempts to export the Shinkansen and the situation in Taiwan.

In 1946, the Chinese Nationalist Party, Kuomintang (KMT), fled to Taiwan as the Communist Party moved toward victory the mainland. The result, from 1949, was two Chinas – the People's Republic of China (China), and the Republic of China (Taiwan). The KMT vowed to unify China by retaking the mainland, a position it has maintained ever since. Unification has, however, become more likely at the initiative of the mainland. Taiwan continues in a state of autonomy with U.S. protection and with a dynamic industrial economy. But it has few formal diplomatic links with other countries, who are wary of hindering their relationship with China.

Japan, like many other countries has a de facto two-China policy with formal recognition of the People's Republic but extensive economic and other ties with the Republic. One example of this dual policy is the use of Haneda Airport by China Airlines (Taiwan), but the use of Narita Airport by airlines from China.

The Shinkansen

The Shinkansen is one of Japan's iconic symbols. The image of Mount Fuji with a passing Shinkansen is one of the most projected images of Japan. The history of the Shinkansen dates back to the Pacific War. Shima Yasujiro's plan for the *dangan ressha* ('bullet train') then included the idea of a line linking Tokyo with Korea and China (1). Although that plan never materialised, the Shinkansen idea was reborn nearly two decades later, as *yume-no-chotokkyu* ('super express of dreams'), with Shima Hideo, son of Yasujiro, among the key figures in its development (2).



Mt. Fuji and Shinkansen

Since the opening in 1964, the network has continued to expand. Figure 1 shows the state of the network in 2007. The first line is shown in blue, whilst subsequent main lines are shown in black. Two 'mini-Shinkansen' lines (where speeds are lower due to the line not meeting full Shinkansen standards) are shown in purple. Current sections under construction are shown in white. Lines which are likely to be built in the future are shown in yellow. The red line is the possible route for the Chuo Shinkansen – which would be built using linear or maglev technology if approved.



(Map by Christopher Hood)

The Shinkansen has a large impact on local economies and populations, as well as on the national economy. Certainly it has been pivotal for Japan's economic growth in the past 40 years. However, the other side of the coin is that many towns and cities not on the route have experienced depopulation and company closures or relocations (3). The Shinkansen has further fuelled the centralization in large cities, ironic in that such proponents of the network as Prime Minister Tanaka Kakuei did so precisely to encourage development of the entire Japanese archipelago and less centralization.

Shinkansen, then, is not simply a bullet train; it is an entire system spanning and transforming the Japanese archipelago. Indeed, 'Shinkansen' literally refers to the line, not the train, although it has come to mean the train also. You cannot just put a bullet train on a railway line in another country and expect it to work to Japanese standards. Railroad bed and tracks must be designed to house the bullet train. Although it runs on 'standard gauge (width)' rails, the body is larger than that of trains found on most standard gauge railways around the world and precise technical specifications are critical to its ability to negotiate high speeds securely.



Ekiben (lunch boxes) on sale on the platform

Whilst visitors to Japan are impressed by the trains, the 'hardware', it is the 'software' which is in many respects of greater importance. People are integral to the smooth functioning of the system. Trains do not move automatically. Indeed underground trains in many cities around the world are more automated than the Shinkansen.

So how are high Shinkansen standards achieved and with what results? The speed is in part a result of the fact that the lines are quite straight and there are no level crossings on main lines that might slow the trains or result in accidents. (Accidents at level crossings account for about 50 percent of all railway accidents in Japan, averaging just over one per day.) (4). To ensure infrastructure maintenance, survey trains regularly travel at normal operating speeds (about 270km/h) to check the lines for any signs of problems with track, overhead cables, etc. There is no service between midnight and 6 a.m. so that timely repairs can be made. The result is that the top speed is now 300km/h. However, research is on-going to introduce a 360km/h train to be introduced in a few years.

Delays on some lines now average less than 10 seconds per train. To achieve this requires not only high skill on the part of drivers (in maintaining the schedule and stopping the train at exactly the right point on the platform), but also the co-operation of passengers. For, if passengers fail to queue up in the correct place, for example, it would be impossible to keep station stops down to 50 seconds. This level of emphasis on time is something that has been criticized by some, particularly in light of the Fukuchiyama Line derailment in 2005 when 105 people were killed when a conventional train derailed travelling too fast round a corner, in part due to the driver trying to make up for a delay on his service. However, the way in which the Shinkansen operates means that such accidents are not possible and in most cases 50 seconds is more than enough time to allow passengers to disembark and embark.

In 1987 Japanese National Railways (JNR) was broken up into six regional passenger companies and one nationwide freight company. The Shinkansen are operated by individual companies. This means that where a train passes from one region to another, the crew all change. Currently the only example of this is at Shin-Osaka with the through running of Shinkansen between the Tokaido Shinkansen linking Tokyo and Nagoya and the San'yo Shinkansen between Osaka

and Fukuoka.

Two more features of the Shinkansen are relevant to this paper. First, the Shinkansen has a system to help deal with the effects of earthquakes. Although the Shinkansen suffered its first passenger-carrying service derailment in 2004 due to an earthquake, this was due to the very close proximity to the epicentre of the earthquake. It is worth noting that despite this, there were no significant injuries. The second feature is that all the trains are Electric Multiple Units (EMU), rather than 'push-pull' locomotive designs. This helps to reduce the weight of trains and damage to the infrastructure.

Exporting the Shinkansen

There are three types of Shinkansen export. First is the export of equipment by Japanese manufacturers. This is the system which tends to be used for conventional (i.e. non-Shinkansen) railways and undergrounds. As this is merely the provision of trains, for example, no involvement from any of the JR passenger companies is required. Second is the export of the complete system. This is a huge undertaking and in the case of the Shinkansen, it is yet to happen. Third, is a consortium export, where training and know-how is exported together with equipment. It is this type of export that happened in the case of the export of the Shinkansen to Taiwan – the first successful export of the Shinkansen.

Possibilities to export the Shinkansen date back to the 1970s during JNR days, but nothing materialized (5). South Korea was the first country in East Asia after Japan to look to develop high speed railway. Various Japanese manufacturers teamed together to bid for the South Korean lines. However, the bid was not flexible – e.g. it did not accommodate the South Korean request to allow trains to run in two directions on the same track, or to use existing track so that the new line could be opened in stages. Other factors working against the Japan bid were anti-Japanese feelings in South Korea and the high yen. Japan lost to France's TGV.

Taiwan's High Speed Railway

Taiwan is the site of the world's largest BOT (Build-Operate-Transfer) project. The Taiwan High Speed Railway Corporation (THSRC) was chosen to run the project after 10 years of government planning. The Taiwan government remains responsible for certain areas (e.g. main line acquisition and handover, station access roads, underground area of Taipei station, project supervision). THSRC was to manage stations and train operations for 35 years, as well as oversee investment in surrounding areas of stations for 50 years. Whilst totally funded by private money, the government has underwritten the project. Despite this, funding remained a problem for THSRC (6).

The technical specifications called for a train length of 300meters and top speed of 300km/h, with each train capable of carrying 900 or more passengers.

Many anticipate that the new line will turn Taiwan into one large metropolis. Comparisons are often made between the line and the Tokaido Shinkansen linking Tokyo and Nagoya. The length is comparable (345km compared with 342km) and the number of stations similar (12 compared with 13 at present on the Tokaido Shinkansen (7)).



Route of Taiwan's High Speed Railway

The main competition for passengers between the two terminals in Taipei and Kaohsiung is the airlines. This airline route is the 11th busiest in the world, carrying approximately 3.5 million passengers a year (8). It is also worth noting that four of the top ten airline routes, including the top three, are Japanese domestic routes. However, Tokyo-Nagoya is not one of them. This is because, since the opening of the Shinkansen, airlines have completely withdrawn flights on this route except for a special service linking Tokyo's New International Airport at Narita and Nagoya. The future for the domestic airline industry in Taiwan is likely to be bleak if the high speed line even approaches the standards set by the Tokaido Shinkansen.

So why was the Shinkansen chosen in Taiwan? Japan has a strong positive image in Taiwan, although some claim that saying "I love Japan" is another way of saying "I don't love China". Japanese railways have a particularly positive image in Taiwan. Chiang Ping-kun, Chairman of the Council for Economic Planning and Development, suggested that the railway will be a symbol of Taiwan-Japan relations (9). Initially the European (Siemens of Germany & Alstom of France) bid seemed to have won after a strong 'negative campaign' against the Shinkansen. In 1998 Europe was the 'preferred bidder' to provide train carriages, locomotives, signalling, electrification, communications and operational control systems. Yet there were problems with the bid such as inability to guarantee the desired level of capacity. There were also question marks as a result of the poor performance of the metro that had been constructed in Taipei by a French consortium. On top of this, the European high speed railway contained no associated offers relating to military purchases (which had been included as part of the metro decision) (10).

Taiwanese President Lee stated his preference for the Japanese bid. Lee, known as a Japanophile, had stressed the importance of relations between Taiwan and Japan in the 1996 Presidential Elections. However, in his book *The Road to Democracy* (1999), he stated that cost and safety should take precedence over political considerations. In 1999 THSRC announced that the project was being postponed due to lack of funds. This opened the door for the Shinkansen. Liu Tai-Ying, the chairman of the China Development Industrial Bank, which also has links with the KMT and was apparently being offered support from the Japan Export & Import Bank, announced that financial support would be given to THSRC if it used the Shinkansen (11). Two further incidents helped the Shinkansen bid. In 1998 a high-speed ICE train in Germany was involved in a major accident. This dented the image of the European bid in terms of safety. Then in 1999 a large earthquake struck Taiwan. Japan not only provided much assistance in the wake of the earthquake, but this also alerted people to the need for the high speed line to help cope with such natural disasters. In this respect the Shinkansen had a proven system in place, whereas, with few significant earthquakes in Europe, their system lacked such features. In the end Japan won the main contract. The European team took legal action and in 2004 THSRC was ordered to pay US\$73m in compensation (12). But Japan retained the contract.

One of the key advisors to THSRC has been Shima Takashi, son of Shima Hideo. The Shima family has been centrally involved in each step of the Shinkansen's progress – from the initial concept, to its inception in Japan, to the first export. Both JR Central and JR West have been involved in providing training and know-how, whereas equipment has come from companies such as Mitsubishi Heavy Industries, Kawasaki Heavy Industries, Mitsui, Mitsubishi Corporation, Sumitomo Corporation and Marubeni Corporation. Equipment orders totalled about ¥600bn. The result has been the 700T-series Shinkansen, based on the 700-series but without the 'duck bill' design which many do not like. The sets have been made by different companies (Kawasaki Heavy Industries, Hitachi and Nippon Sharyo) as is done in Japan. The trains use a combination of orange, white and grey, colours that are associated with no political party in Taiwan or with any side in the independence debate.

However, the line has not been without problems. The opening was long delayed. When it did open in January 2007, a number of problems arose. A key point is that whilst the Shinkansen is a whole system, the THSR is only about 70% Shinkansen, with the remaining 30% being comprised of European and Taiwanese elements (13). Changes made include allowing trains to run both ways on each track (allowing maintenance work to be done on one line during the day), the use of automatic driving, and allowing the conductor to open/close doors of any carriage. Some alterations were apparently made to keep close to original specifications so as to avoid giving further ammunition to the European consortium's legal case. But there is a concern that some alterations could lead to problems. For this reason it is rare to find a Japanese spokesperson alluding to the 'Taiwan Shinkansen' today, referring instead to the 'Taiwan High Speed Railway'.



High speed train in Taiwan

Exporting the Shinkansen to China

The plan for a High Speed Railway line in China dates back over two decades. There was a strong desire to have a Beijing-Shanghai line in place for the 2008 Olympics. Latest estimates are that it will be ready in 2010 at the earliest. After the completion of that line, there are plans for a network of about 10,000km. For many years there was debate about whether to use linear/maglev technology. It was used for the Shanghai Airport line, but it has not done that well. The accident in 2006 on Germany's maglev line raised further questions about the German system (as used in Shanghai) compared to using the Japanese system or standard railways.

From the start Japanese politicians have been involved in the attempt to export the Shinkansen to China. One of the key areas plaguing the Japanese bid has been friction about war memory in general and the Nanjing Massacre in particular. With the memory wars inflaming China-Japan relations, many Chinese have been adamant that no Japanese construction should take place in that city. Visits by Prime Minister Koizumi to Yasukuni Shrine were also widely seen to be poison both Sino-Japanese relations and the Shinkansen bid, even as China-Japan economic relations remained generally on course.

Suddenly, in September 2004, a small announcement declared that the Shinkansen bid had won, albeit a scaled down version of the original plan. This led to protests concerning the failure to hold a public hearing before the decision. But this time, the Chinese government shut down a website dedicated to the protests. Japan is to provide the train equipment – and a limited amount of that. The trains will be a modified version of JR East's E2-1000 series sets made up of 8 carriages. Just 3 sets are to be made by Kawasaki Heavy Industries, while 57 more sets are to be made in China by Nanche Sifang in Qingdao working with Kawasaki. The issue of Chinese production of the trains, that is transfer of the technology, is crucial to the Chinese calculus. The trains will be white and blue – similar to the Shinkansen used by JR Central on the Tokaido Shinkansen. So while one will be able to see Shinkansen-like trains in China, this is not the Shinkansen system, so again it would not be appropriate to use the word in connection with China's high speed line.



E2-1000 series shinkansen (Photo by Christopher Hood)

Conclusion

Kasai Yoshiyuki has said that 'Although the Tokaido Shinkansen may be the best system for Tokyo-Osaka, it does not mean it is the most appropriate for everywhere.' Although this statement refers more to technical considerations, the implications may extend to cultural and political spheres. Railways have always been highly symbolic. The way they operate reflects and impinges on the nature of a region, company or country. One cannot expect to import railway technology – particularly one like the Shinkansen where the human element is so important – without problems. Although the high speed railways in China and Taiwan have their origins in Japan – in both cases the systems constructed have local variations. While the Japanese contribution is important the lines should be seen not as Shinkansen but as autonomous systems created and shaped by priorities and parameters in each country.

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Notes

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