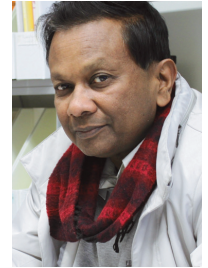


Japanese Shinkansen Technology Modernizing Indian Railways

By Mukesh Williams



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The Japanese shinkansen technology of the mid-1960s that brought together the chariot wheel, medieval clock, crowbar, electric telegraph, electric power and aeronautical technologies, and was perfected during subsequent decades, is now getting globalized through MoUs to developing countries such as India, Malaysia and Singapore. It was not just technology that gave rise to the rapid transit train but the special needs of the country, such as concentrated demography, mountainous terrain and linear city development. Over half the Japanese population is concentrated in the four major cities of Tokyo, Osaka, Yokohama and Nagoya. India must walk the path of a rapid transit train system with both suppressed joy and trepidation. India neither shares the concentrated demography nor the financial culture of Japan. Once the dust settles over the economic and political hype, Indian Railways has to reckon with the right volume of passenger traffic and how to repay the 81% soft loan to Japan and absorb the 19% expenditure it will incur in building the system.

Moreover India has to create feeder infrastructure such as buses, taxis, suburban trains and bicycles to provide easy and smooth access to the 11 shinkansen stations that will be constructed. Though it is a good idea to keep the management of the shinkansen with Indian Railways and then after five years of moratorium lease the operation to private companies, if the shinkansen does not make a profit it would be difficult to find prospective buyers. Japan hopes that it will be able to offer its services to bring together urban, suburban and local train networks in India with the shinkansen

network and modernize India's railways. India on the other hand hopes to enter the world of advanced nations with a safe and fast railway system that will be both convenient and profitable. Whether the partnership between Japan and India will reach fruition only the next decade will tell.

Implications of Japanese Shinkansen for India

The insertion of Japanese shinkansen technology into the sprawling railway network of India will not only modernize the 19th century colonial railway system but also introduce modern Japanese values of safety, punctuality, comfort and *omotenashi* or superior hospitality. The 1.6 trillion yen project will start next year and will be executed in six years, reducing travel time between Mumbai and Ahmedabad, a distance of 500 kilometers, from 6 hours 20 minutes to just two hours. The eco-friendly train corridor will produce 16% of CO2 that a passenger automobile produces and save 15,000 tons of CO2 emissions annually. It holds promise to present a new eco-friendly face of India to the world and a new Asian partnership with one of the most developed nations in the world.

Even if Japan has granted unparalleled financial concessions to India, drawn out of ODA yen loans, it is a profitable venture for both countries as India possesses large areas of rail track to be modernized and Japan is looking at these very areas to develop. After striking a business deal with India, Japan hopes to win the Singapore and Malaysia markets in the same area and provide business to Hitachi Ltd. which manufactures bullet trains and to Mitsubishi Heavy Industries Ltd. which manages train infrastructure. The web of benefits that will accrue to Japanese companies will also go to American companies such as Westinghouse Electric Corp. with which Japan is allied. The globalizing of shinkansen technology will triple Japanese infrastructure exports to 30 trillion yen by 2020 and also intensify competition with China, France and Germany seeking markets in the same area.

Global Dynamics of Shinkansen Technology Transfer

Japan has worked hard to clinch the shinkansen technology transfer deal amid strong competition from China and France. Japan was able to win the contract with generous funding of an 81% loan with an interest rate of 0.1% repayable in 50 years. Japan is proud of



Photo: Author

Passengers boarding a Japanese shinkansen

its cutting-edge technology which is now being duplicated by other tech-savvy countries. Japanese teams conducted surveys on commuter volume and the standard price of commuting between the two cities. According to the survey, about 40,000 commuters will use the fast train every day from the date of the commencement of service in 2023 until 2030. This number will ensure reasonable returns to pay back the loans. But a report by G. Raghuram and Prashant Udayakumar of the Indian Institute of Management Ahmedabad entitled “Dedicated High Speed Railway (HSR) Network in India: Issues in Development” concludes that in order for the high speed train to remain financially viable and pay back the loan and interest on it, the shinkansen will have to make 100 trips a day and carry between 88,000 and 118,000 passengers daily. With this estimation the success of the shinkansen business seems tough if not impossible.

The Japanese survey also fixed a one-way ticket price equivalent to 4,564 yen after consultation with potential Indian commuters. The average price of a shinkansen ticket from Tokyo to Osaka covering the same distance is at present 18,320 yen. The fare for the Chinese Jinghu High Speed train from Beijing to Shanghai is 8,154 yen. As compared to international pricing the Indian pricing is rather low but when compared to Indian air travel is somewhat higher. Jet Airways for example charges 2,953 yen from Mumbai to Ahmedabad. The local Shatabdi Express costs 3,135 yen for first class with food and 1,634 yen for the AC Chair Car with food, and a general passenger train costs 302 yen for a sleeper. This stipulated price for the shinkansen may increase in the next decade when the train becomes operational.

In India critics of the shinkansen project complain of creating a parallel rail system for the super rich at a staggering cost and the problem of paying back huge loans which India can ill afford. They contend that aside from the 81% soft loan of 1.6 trillion yen, India still has to pay 19% to Japan for the goods bought. Since the era of former prime ministers Manmohan Singh and Junichiro Koizumi, these two arguments forced India and Japan to shelve the idea of creating a rapid train transit system and instead agree upon jointly modernizing the Indian railway system. But some believe that current Prime Minister Narendra Modi pushed aside such objections and moved ahead with Japanese Prime Minister Shinzo Abe to garner support in his home state Gujarat. Japan agreed to sign the MoU after it lost the Indonesian train deal to China. In India critics argued that the project will only benefit the rich who can afford an expensive ticket. Also the high investment returns will be below 4% and therefore train traffic must be maintained at high levels to be cost effective. The acrimonious debate of getting cutting-edge technology and not spending will not go far. Nothing in this world is free.

Obviously the shinkansen will have to reckon with fare wars with the airlines in the future. Though the executors of the shinkansen



Reserved seat ticket vending machines for Japanese shinkansen

project may have some trepidation about showcasing the economic viability of the project, the Indian public at large is thrilled with the prospect of experiencing the “sophisticated engineering marvel” of Japanese technology, as the BBC calls it. Undoubtedly Japanese high-speed train technology is reliable; its history is proof of its trustworthiness.

The Evolution of Shinkansen Technology

The shinkansen technology which developed in Japan after World War II was a product of aircraft technology that depended on speed, safety, aeronautics and aesthetics. The technical development was conducted by engineers who worked on aircraft development during the war. The English name bullet train, as the shinkansen is often called, is the nickname of the high-speed train project called *dangan ressha* that began the shinkansen and the first O Series shinkansen looked more like a bullet than a train. The actual meaning of shinkansen is new trunk line. The shinkansen is one of the most prized series of trains in Japan, and has ferried over 5.6 billion passengers since its inception in the mid-1960s. The shinkansen that plies between Tokyo to Osaka on the Tokaido tracks takes just two hours and is perhaps the busiest pathway in Japan. In its long history of 50 years it has been derailed twice — once in a blizzard and once in an earthquake, both without fatalities. Over the years Japanese engineers have worked on it to reduce delays to an average of 36 seconds. It now possesses an advanced earthquake warning system that can bring the train to a halt within 300 meters even when travelling at 300 km an hour.

The efficiency of the Japanese shinkansen depends on its dedicated rail tracks, terminals, computerized signaling and speed switching system. The stand-alone system allows trains to leave every eight minutes from Tokyo Station to different parts of Japan,



Photo: Author

Shinkansen terminal in Japan

with a total of 325 trains a day. Japanese knowhow and technology, adept at tunneling through mountainous and undersea terrain, will help propel India into the post-modern age. The electric railcar with its many wheels and motors allows the shinkansen to accelerate and decelerate at high speeds. Since the motor works as brakes the problem of disc breaking is avoided. The decentralized power distribution system allows a reduction of maximum load on the axles, helping it on weak terrain. Since the train passes through densely populated areas noise and vibration control are of utmost importance. Though the construction of electrical, signaling, power and communication systems are costly, 70% of the cost is taken up by bridge, tunnel and banking construction. In Japan, because of the mountainous terrain, 31% of the cost goes in the drilling of tunnels.

Since the shinkansen is safe, comfortable and luxurious it is ideally suited for business trips, conferences and sightseeing. The shinkansen stops have large departmental stores and hotel accommodation, and these facilities keep the price of travel rather high.

Topography, Demography & Profitability

The inter-city transport system of a country largely depends on its topography, demographic distribution, economic needs and cultural ethos. Since mountains dominate the center of Japan, urban and industrial development has taken place along the flat coastal regions. Of this linear coastal land only 20% is habitable and Japan's four big metropolises, Tokyo, Osaka, Nagoya and Yokohama, hold 57 million people which is nearly half its population.

The case of India is somewhat different. Of the 11 stations on the planned shinkansen route, the population of the five major cities —

Mumbai, Surat, Anand, Vadodra and Ahmedabad — is around 32 million, of which only 10% may be able to afford the shinkansen. The profitability of the shinkansen is a highly contentious issue. In Japan when you travel on the shinkansen it is possible to see rows and rows of densely packed houses along the train tracks. Lacking in natural resources and fringed by the sea there is hardly any demand for a freight railway transport system in Japan, where trucks and ships dominate freight transport. Though Japan has an excellent network of airlines and highways, inter-city passenger railways, especially the shinkansen, capture 30% of the travel market. The high frequency of the shinkansen and the short distances between stations attract large numbers of commuters. For example, the Tokaido Shinkansen from Tokyo Station departs every six minutes and carries 23,000 passengers. With an average distance between stations of 35 km, the shinkansen attracts large numbers of commuters, and also caters to shorter distance commuters with its variety of shinkansen trains, such as Nozomi, Hikari and Kodama. India will have to introduce trains for shorter distances along the shinkansen route to benefit from greater access to shinkansen stations.

Feeder Network to Access Shinkansen Stations

Obviously speed trains need good feeder networks that allow commuters easy access via suburban rail, subway, bus, taxi or bicycle. Since Japanese railways were built before or along with urban development, railway stations are located in the heart of cities. Indian feeder networks are not efficient and often over-crowded, resulting in traffic jams and delays. If large numbers of commuters cannot reach the shinkansen stations on time the train itself might be delayed and this raises several questions. At present both Mumbai and Ahmedabad railways stations are not clear where the new shinkansen stations will be built. Mumbai is embroiled in a land acquisition controversy, while the proposed site of the Ahmedabad shinkansen station is somewhat away from the present Ahmedabad railway station.

Privatization & Local Operation of Shinkansen

Another important issue relates to initial control of state-of-the-art train systems by the national railways carrier and then their transfer to private operators. The privatization and division of Japan National Railways in 1987 and the leasing of shinkansen facilities to passenger railways companies helped JNR to pay back its debts. As the shinkansen continued to make profits it was bought by Japan Railways for 9.2 trillion yen, about 700 billion yen more than the original price. In Japan, apart from the creation of employment and new industries, it also contributes to the growth of local economies. People from smaller

cities can now experience concerts, exhibitions and theaters in cities like Tokyo, Osaka, and Kyoto. In India this is not the case. India is a different story where in commercial cities people are more interested in moving up the social hierarchy than consuming cultural goods.

Upon the recommendation of the Arvind Panagariya Committee on Innovative Collaborations, the operation and maintenance of the shinkansen will be placed in the hands of Indian Railways for the first five years, after which it will be given to private operators. Indian Railways will get a fee from private companies as part of the transfer. This policy has been approved by the Indian cabinet. The committee recommended private operators to safeguard Indian Railways from the crippling financial burden of running one of the costliest train systems. Japan too shifted to private companies but only after two decades of keeping the infrastructure under government control. Indian Railways was rather reluctant to give away this huge and costly infrastructural project with a viability gap to private companies. It argued that it needs the expertise to run high-speed trains.

High Cost of Shinkansen Project

Both in India and Japan most of the big projects connected with railways, road transport, city development or banking happen top down. Often big political leaders see such projects as their brain child and do everything they can to make them succeed. What Indira Gandhi did for Maruti-Suzuki Motors, Modi is doing for the high-speed train system. Abe saw the Indian initiative as a great moment of Indo-Japan business friendship amid acrimonious debates regarding territorial claims and economic competition with China. By allowing Indian companies to sub-contract staff hiring Japan will further create goodwill to cash in on in the future. To pay a small fee for a high-tech dream that would change the face of India in half a century is no great sacrifice. A science fiction dream whizzing past Indian plains and through mountains will become a symbol of modern India, just as the tiger is now a symbol of the government's "Incredible India" marketing campaign.

Modernizing Indian Railways

The introduction of the shinkansen is not just a one-off project. The plan is to connect the entire rail system with it. Indian trains do a stupendous task in carrying 23 million commuters every day. In a year they transport 8.4 billion commuters covering a distance of 65,000 km, most of which was built during the British Raj. Only 9,600 km of the rail tracks were built after 1947. India's dreams are



A Japanese shinkansen on the move



Second-class compartment of a Japanese shinkansen

soaring. There are visions of a Calcutta-Delhi fast train track which will allow the commuter to cover a distance of 1,485 km in just nine hours against the present 36 hours. The first train built during the colonial period covered a distance of 33 km between Bombay and Thane; it started operation on April 16, 1853. Many of the British engineers who learned train technology in Britain gained field experience in India. By 1880 about 14,484 km were added linking Bombay and Calcutta in 1870. But colonial trains were heavy and slow. Most Congress leaders traversed India by train. From the 1920s to the 1940s Mahatma Gandhi conducted his non-violent resistance movement against the British by train.

The train united India by carrying the newspapers and reduced famine by transferring cereals and vegetables from one region to another. Today the 19th century lumbering locomotive will become the sleek train of the 21st century. It would be great to travel from Delhi to Calcutta, Koichi to Bangalore, Mumbai to Goa, or Delhi to Chennai in just a few hours. And all this seems possible within a few decades.

The shinkansen will not only revolutionize Indian railways as Modi believes but accelerate India's entry into first world travel. The globalizing of Japanese fast train technology beginning with the Mumbai-Ahmedabad corridor will not only grow in India but could also move to the 300 km Singapore-Kuala Lumpur track, a journey that currently takes four hours but which the Japanese fast train would cover in 90 minutes. Japan has entered a new era of globalizing its engineering marvel, the shinkansen, while India is modernizing its railway system.

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