Impact of India's Mumbai – Ahmedabad Bullet Train Project: A Study

Report submitted in Partial Fulfilment of requirements for Internship

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DECLARATION

We, **Sanaa Mohammed, Mohamed Shifaz** and **Aayush Goswami** hereby declare that our work titled **Impact of India's Mumbai-Ahmedabad Bullet Train Project** is a bonafide work done by us for consideration by the Center for National Policy Research in partial fulfilment for the requirements of the internship. The work has not been submitted elsewhere for consideration.

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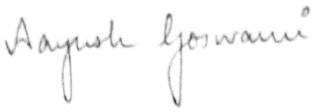

Aayush Goswami

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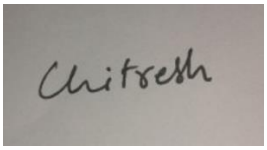
This is to certify that the work titled Impact of **India's Mumbai-Ahmedabad Bullet Train Project** is a bonafede work done by **Sanaa Mohammed, Mohamed Shifaz** and **Aayush Goswami** as part of their internship from **12 May 2021** to **12 July 2021**. Submitted to Domestic and Global Railway Policy Department, Center for National Policy Research. The work submitted is purely the work of the authors to the best of my knowledge and belief.



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List of Abbreviations

BKC	Bandra Kurla Complex
CRZ	Coastal Regulation Zone
CTRL	Channel Tunnel Rail Link
EC Directive	European Union Directive
GDP	Gross Domestic Product
GHG	Greenhouse Gases
HSR	High-Speed Railways
ICE	Intercity Express
JICA	Japan International Cooperation Agency
MOEFCC	Ministry of Energy, Forest and Climate Change
MoU	Memorandum of Understanding
NDA	National Democratic Alliance
NHSRCL	National High Speed Railway Corporation Limited
PPP	Public-Private Partnership
SIA	Social Impact Assessment
UIC	International Union of Railways

Abstract

The transportation sector of any country plays a significant role in contributing to the economy of its nation. Suitable investments in transportation allow more effortless movement of goods and services, allowing economic productivity to flourish. The Indian transportation sector has played a crucial role in uplifting the Indian economy.

The Indian Railways, being the largest railway system in the world, has been a critical enabler of development and progress in our nation. It has played an essential part in India's infrastructural development from 1850 to 1947. With an estimated population of 1.38 billion people, India might surpass China in terms of being densely populated, and the need for mobility has been rapidly expanding.

High-Speed Railways (HSR) is a distinct mode of transportation in many countries. Although possessing the most extensive railway system globally, India hasn't built a single high-speed railway corridor. A couple of railway budget speeches around 2000-2001 have made crucial statements on establishing HSR in India. One of the visions proposed by the Indian Railways Ministry in 'Indian Railways' Vision 2020' in the year 2009 also included High-Speed Railways. Pre-feasibility studies were carried out in 2007-2008 to construct HSR corridors for trains at the speed of 300-350 km/hr. Seven corridors were proposed where the Mumbai-Ahmedabad corridor is the only one currently under construction.

The Bullet Train project from Mumbai to Ahmedabad claims to be a critical enabler of development and progress for all the right reasons. It promises to uplift India's advancement in technology, social lifestyle and economy. It comes with many expectations and grandeur for its objective to improve railway technology in India, provide employment, and adhere to an eco-friendly mode of transportation. It is India’s first high-speed bullet train project, conceptualized in 2013. The project is carried out along with the technical aid of Japan, but the manufacturing will be indigenous and is expected to be completed by 2028.

However, high capital investment is required to make this project a successfully viable one. The project being quite expensive, chances are that the revenue it collects may not suffice to cover its infrastructure and operation cost for a long time. Specific challenges that would hinder the growth of HSR in India would include safety, capacity creation, quality and competition with other means of transport, especially private transportation, which is quite popular in India. In this report, we aim to discuss the initial planning carried out in the project, the current status, feasibility, key challenges and the risk of repayment of the project's loan.

Keywords. High Speed Rail, Bullet Train, Economy, Railways, Transportation

1.1 Introduction:

The International Union of Railways (UIC) and EC Directive 96/58 defines high-speed railways as:

"Systems of rolling stock and infrastructure that regularly operate at or above 250 km/hr on new tracks, or 200 km/h on existing one's tracks".

However, we cannot take this as the most precise definition. It differs with each country's parameters set on their limitations associated with social and economic points of view.

High-Speed Rail infrastructure needs to have the following set of specifications according to European Technical Specifications for Interoperability (Directive EU 2016/797 – 11 May 2016):

1. "Specially built high-speed lines equipped for speeds generally equal to, or greater than, 250km/h."

2. "Specially upgraded high-speed lines equipped for speeds of 200km/h"

3. "Specially upgraded high-speed lines which have special features as a result of topographical, relief or town-planning constraints, on which the speed must be adapted to each case. This category also includes interconnecting lines between high-speed and conventional networks, lines through stations, accesses to terminals, depots, etc. travelled at conventional speed by 'high-speed' rolling stock".

Twenty-two countries have established successful high-speed railway corridors. India will be the twenty-third country to enter the list once the construction of the Mumbai-Ahmedabad bullet train is completed. High-Speed railways offer plenty of advantages. They are efficient, safe, secured, reliable and is environmentally barely threatening. Japan built the world's first high-speed bullet train, also known as the 'Shinkansen' rail, in the year 1964. It covered 515 km at a speed of 210 km/hr. The entire journey took 2.5-3 hours. It marked the beginning of the modern HSR era [4].

However, Italy's high-speed line between Rome and Florence was the first high-speed rail to mobile at 250 km/hr. It covered a distance of 122 km. Now, China brags the maximum speed it commutes on high-speed rail. They travel at a rate of 350 km/hr, followed by Japan, France and Morocco, whose trains run at 250 km/hr - 300 km/hr. The total length of HSR lines across the globe is about 56,000 km and is expanding too. China occupies 65 per cent of this network. They have been rapidly developing their high-speed railway network, owing to the generous funding they receive from the Chinese government. High-speed rail offers many advantages. They are a comfortable means of public transportation that carries many people over long distances in a shorter time. It is suitable for travel within the city, where the transit time doesn't take beyond 3 to 4 hours. It comparatively is more energy-efficient than road or airways (EESI, 2018).

From a sustainable point of view, HSR's push for an intensive use of public transport could be a significant participant in the battle against climate change. In India, The Railway Budget

Speech in the year 2000 have statements on establishing HSR in India. India's strategy to construct HSR corridors is by meticulously partnering with countries owning HSR technology that are willing to provide bi-lateral credit.

Pre-feasibility studies were carried out in 2007-2008 to construct high-speed railway corridors for trains at the speed of 300-350 km/hr. India's Prime Minister Hon. Narendra Modi took the dream of establishing HSR corridor seriously, aiming to spread over 10,000 kilometres, and cover the nation's important points under the 'Golden Quadrilateral', by upgrading it to 'Diamond Quadrilateral' by covering the metro cities – Delhi, Kolkata, Chennai and Mumbai. India's national infrastructure pipeline proposed 7 HSR corridors, which included the following:

1. Delhi - Chandigarh - Amritsar (450 km)
2. Hyderabad - Dornakal - Vijayawada - Chennai (664 km)
3. Howrah - Haldia (135 km)
4. Chennai - Bangalore - Coimbatore - Ernakulam (850 km)
5. Delhi - Agra - Lucknow - Varanasi - Patna (991 km)
6. Ernakulam - Trivandrum (194 km)
7. Mumbai - Ahmedabad (508 km)

Out of these seven corridors, only the Mumbai-Ahmedabad corridor is under construction (NHSRCL, 2021). Initially, a 650 km-long high-speed railway corridor was proposed to run from Pune to Ahmedabad via Mumbai. The proposal also involved extending the corridor up to Bangalore. This was later dropped due to financial constraints. After much discussion, the Board decided to operate the high-speed railway from Mumbai to Ahmedabad. Japan International Cooperation Agency (JICA) agreed to fund 81 per cent of the total project cost, with an interestrate of 0.1 per cent, followed by a time period of 50 years for repayment of the 88,000-crore loan provided by Japan out of the total cost of 1,07,000 crores.

In 2012, The National High-Speed Rail Corporation Limited (NHSRCL) was established with a vision to produce indigenous, high-speed railways. In New Delhi, An MoU was signed by India and Japan to perform a joint feasibility study of the Mumbai - Ahmedabad route in September 2013. This was aimed to improve the connectivity between both the business centers and improve the networking. After this, Japan International Cooperation Agency (JICA) and the Ministry of Railways (India) signed an MoU on October 7 2013, for a joint feasibility study [9].

The Mumbai-Ahmedabad bullet train follows the 'Shinkansen' model. The Shinkansen model made the breakthrough in high-speed rail technology in Japan. They could traverse at a speed of 320-350 km/hr and has a distinct feature of a long-extended nose that prevents 'tunnel boom'. Tunnel boom occurs when train enters tunnel at a high speed and produces noise due to uneven air pressure [11].

To carry out a high-speed railway project with respect to the Indian socio-economic perspective, the Indian Railways decided to follow two approaches. The first was to raise the speed from 160km/hr to 200 km/hr. The second approach was to identify intercity routes and

build corridors for rates up to 350 km/hr through PPP mode in partnerships with the State governments.

High-Speed Rails run on electric power, so this may lead to reducing India's dependence on crude oil imports. The project will be environmentally friendly compared to travel by plane or car. The project comes with eco-friendly corridor stations, including rainwater harvesting mechanisms, natural light provisions, wastewater treatment plans and solar panels. The public much appreciated this eco-friendly initiative. It comparatively delivers a considerable reduction in energy for long term, when compared to other means of transport [9].

This project received both appreciation as well as criticism. It was welcomed for its objective to improve railway technology in India, provide employment, and also for adhering to be an eco-friendly mode of transport. It comparatively delivers a considerable reduction in energy for long term, when compared to other means of transport. The fourth largest emitter of greenhouse gases (GHG) in the world is India. From a sustainable point of view, this project reaps a lot of benefits in the long run.

Introducing HSR in India can induce competition with airways and this competition is predicted to be a very stiff one. While it may reduce the demand for air travel, it can aid in connecting airports with other suburban areas and in long distant air travel.

Although the project was appreciated for the long term benefits it environmentally brings, it was yet criticized for not being as economically viable as it was expected. The cost involved in construction and operation is quite expensive and requires capital infusion. Chances are that farebox revenues may not be sufficient to cover cost of infrastructure for a long time. The huge cost involved in the construction of the project made it seem like it was vainglorious for the majority of the population living around the Mumbai-Ahmedabad belt [8]. Some people felt it was not a good idea to invest in High-Speed Railways without upgrading the existing sub-urban rail network, or without investing in semi high-speed railways first. So, investments in high-speed railways should be reviewed to see if they reap sizeable long-term benefits.

Experts also believe that the project may lead to social conflicts and struggle for resources. Many farmers and tribal people had to give up their lands and were in a muddle about the resettlement provided by the government. They felt that sufficient compensation was not provided to them. Protests by the marginalized community also led to delays in acquisition of the land in Maharashtra.

This indigenous ambition of India is to be carried out along with the technical aid of Japan. This project is supposed to be completed by 2023. Due to the Covid-19 pandemic, the project is expected to be completed by December 2028.

Table 1.1: List of High-Speed lines with long-term planning in India (UIC,2020)

Line	Distance (Kilometers)
Delhi – Varanasi	855
Varanasi – Patna	250
Patna – Kolkata	530
Delhi – Udaipur – Ahmedabad	886
Hyderabad – Bangalore	618
Nagpur – Varanasi	855
Mumbai – Nagpur	789
Mumbai - Hyderabad	709
Patna – Guwahati	850
Delhi – Chandigarh – Amritsar	485
Amritsar – Pathankot – Jammu	190
Chennai – Bangalore – Mysuru	462

1.2 Objective of the study:

Despite being the pioneer of transportation in India, The Indian Railways have not constructed a single high-speed railway corridor. The Mumbai-Ahmedabad being the first one to be built, many complications are expected to challenge the project. This report aims to discuss some of the challenges it puts forth. The first chapter is the introduction and sets the context for the report. It also briefly looks into the history of High-Speed Railways in other countries. The second chapter discusses the planning and details of the project and is one of the highlights to look out for. It also looks into the current status of the project and its feasibility. The third chapter discusses how economically viable the project is and some of the threats it may need to address. The project raised environmental concerns, which has been covered in the fourth chapter. The fifth chapter discuss the social impact of the project and how it may affect the people settled in the area of the Bullet Train construction. We have concluded our opinions and remarks of the project in the conclusion section.

1.3 History of High-Speed Railways in other countries:

1.3.1 Japan:

The Tokaido Shinkansen, which runs between Tokyo and Shin Osaka and was first built by the Japanese National Railways in 1964, is the world's first high-speed rail network. The first route connecting Japan's two largest cities, which runs for 515 kilometres and passes through a densely populated and economically developed region, was enthusiastically appreciated. While there was a plan to use existing main railway stations for the HSR, many people were against it. Due to issues (and other factors), new (Shin) stations, such as Shin Osaka, were built to service cities [4].

When the JR Group (composed of four businesses) took over from Japan National Railways in 1987, the Shinkansen network was privatized. The specialized network is standard gauge, whereas Japan's older rail networks were narrow gauge (1067 mm).

Shinkansen has epitomized the exceptional safety levels of HSR compared to other means of transportation, with zero fatalities since 1964. In terms of air pollution, the Shinkansen emits only 16 percent of the CO2 produced directly by a passenger automobile per unit travel volume.

The Japanese HSR also maintains a high level of timeliness, which is especially critical considering the heavy-traffic network's tight schedules. Figure 1 depicts a map of Japan's HSR network. As of 2011, overall HSR traffic in Japan had surpassed 318 million passengers per year.

1.3.2 Italy:

When the 252-kilometer Rome-Florence ‘Direttissima' line opened in 1978, it was the first dedicated HSR line in Europe. With top speeds of 300 kmph, Italy's HSR services, which are run by the state-owned company Trentialia and the privately owned (Europe's first) NUV, use both tilting and non-tilting trains.

The debut of NUV's services was delayed in 2011 after RFI (the government's infrastructure manager and subsidiary) revised its "network statement" just days after NUV filed a "application for pathways." In April of 2012, the 25th NUV began operations. The two operators' "head-to-head" competition has resulted in lower fares and increased service and ridership [4].

1.3.2 France:

The LGV Sud-Est (French for South East high-speed line) was the first line of the French HSR network, opening in 1981 between Paris and Lyon over a distance of around 460 kilometres. The LGV Nord, LGV Est, LGV Atlantique, LGV Rhône-Alpes, and LGV Méditerranée, operated by SNCF Voyages, a subsidiary of the state-owned railway business, enlarged the network with more lines like the LGV Nord, LGV Est, LGV Atlantique, LGV Rhône-Alpes, and LGV Méditerrané.

TGV tracks are notable for their huge curvature radius (more than 4 km on older lines and more than 7 km on new lines), which are a significant planning feature for future speeds. This also controls the centripetal acceleration that passengers experience. To reduce the effects of air pressure variations and tunnel boom, tunnels have larger diameters than normal. Because of the articulated architecture of the trains, France has had a near-zero fatality rate in high-speed trains operating on LGV lines.

1.3.4 Germany:

On June 2, 1991, the first HSR trains in Germany ran on a regular schedule. The InterCity Express (ICE) trains are high-speed train services provided by Deutsche Bahn's DB Fernverkehr subsidiary, a private joint-stock company with 100 per cent stockholding by the Federal Republic of Germany.

ICE trainsets are divided into several classes, the most recent of which is ICE 4. ICE 3 trains have a top speed of 320 kilometers per hour. The ICE, like many other European countries, is linked to its neighbors: Denmark, the Netherlands, Belgium, France, Switzerland, and Austria.

1.3.5 United Kingdom:

The Channel Tunnel Rail Link (CTRL), currently known as High Speed 1 (HS1), was built and operated by London & Continental Railways and opened in 2003. It is the first high-speed line in the United Kingdom (UK). Section 1 (Channel Tunnel to Fawkham Junction, Kent) and Section 2 (Ebbsfleet, Kent to London St. Pancras) opened in 2003 and 2007, respectively. Eurostar operates the Channel Tunnel, which connects the United Kingdom (HS1) and France (LGV Nord). Eurostar international services travel at speeds of up to 300 kmph on the HS1 line, while Southeastern domestic passenger trains travel at speeds of up to 225 kmph. Trains in the Channel Tunnel can travel at a maximum speed of 160 kilometres per hour.

Customers travelling via the Channel Tunnel can use a variety of mobile network operators to make calls, send texts, and access data. 41 Figure 6 depicts the HS1 and HS2 networks in the United Kingdom. In June 2009, the UK government purchased LCR, which had a GBP 5.169 billion government-guaranteed financial debt.

Later in November 2010, the government awarded a GBP 2.1 billion 30-year concession to a combination of Borealis Infrastructure and Ontario Teachers' Pension Plan to run the 109 km HS1 line, although the government retained ownership of the infrastructure and land.

1.3.6 China:

The ‘China Railway Speed Up Campaign,' which began in 1997, aimed to improve train service in China. Around 6000 km of rails may run trains at speeds of up to 200 kmph by the campaign's sixth and final round. 44 China was the first country to launch a high-speed rail system. The 30 km Shanghai magnetic levitation (maglev) line was inaugurated in 2004. Rapid transit from Shanghai International Airport to the Longyang Road station of the Shanghai Metro.

Shanghai's subway system. In the midst of disputes over whether or not to use maglev trains, China used wheeled tracks and standard gauge for the remainder of the HSR. For its HSR, it will use the normal train network. Continuing from the first line that was read, the majority of the rolling stock and operations are owned by the government.

High-speed trains in China are imported and developed under technology transfer agreements with foreign train manufacturers such as Siemens, Bombardier, and Kawasaki Heavy Industries. They've been redesigned from the ground up to reach operational speeds of up to 380 kilometers per hour. In 2011, however, train speeds were reduced to 300 km/h in order to save energy and money.

1.4 Objectives considered by other countries to construct HSR:

Basic objectives of increasing capacity and speed, other factors like improved journey time reliability, economic development, political integration and environmental concerns also affect service design of the HSR projects (G Raghuram,2016)

Table 1.2: Objectives prioritised by various countries that have high-speed railways (Raghuram, 2016)

Objective	France	Japan	China	Italy	UK	Taiwan	Spain	India
Speed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Capacity	Yes	Yes	Yes	Yes	Yes	Yes		Yes
Reliability				Yes	Yes			
Economic Development			Yes		Yes	Yes		Yes
Environment					Yes			
Supply Industry	Yes	Yes	Yes				Yes	Yes
Prestige	Yes		Yes	Yes			Yes	Yes
Political Integration			Yes				Yes	Yes

HSR construction costs per route km vary, with the lowest being in France (EUR 4.7–18.1 million, 2005 prices), Spain (EUR 7.8–20 million, 2005 prices), and China (at 2010 prices, 12 lines with design speeds of 250 kmph average around EUR 8.8 million, whereas ten lines with design speeds of 350 kmph average around EUR 16.5 million). Preston cites Wu89 for China, stating that the balance between infrastructure, superstructure, and land/other expenses is normally 60:20:20, with station costs adding another 10% to 30%. On the top end of the scale, the HS1 in the United Kingdom cost EUR 31 million per kilometre in Phase I and EUR 117 million in Phase II (with about 21.5 km of tunnel length out of a total 39 route km).

At 2005 rates, the building cost of Chinese Taipei (76 percent elevated and 11 percent underground) was EUR 39.5 million per route kilometre. As a result, create operating speeds and gradients. Access to the centre area, geography, population density (land costs; grade levels), and topography and existing rights of way play a big role in construction expenses. However, with the exception of the Sud-Est, ex-post appraisals of HSR lines in France have been negative. Financial and socioeconomic internal rates of return have been found to be significantly lower than exact evaluations. In Spain, the Madrid-Seville and Madrid-Barcelona lines have not been upgraded. Neither has been executed well.

2.1 Planning and Details of the Mumbai-Ahmedabad Bullet Train Project:

To plan a HSR corridor, certain criteria have to be met. It is critical to meet the criteria to enhance the outreach of the high-speed railway network and improve the connectivity between two cities. The criteria are:

1. City Population (> 1 million)
2. Distance between start and final destination to be between 300-700 km.
3. City GDP
4. High congestion levels
5. Passenger flow between city pairs- AC rail and air trips

6. Corridors having AC passenger share of more than 50 per cent were identified.

By considering these criteria and after several meetings between JICA and Indian Railways, a proposal was initiated to design a corridor at the Bandra Kurla Complex (BKC) in Mumbai, trailing to Thane and then diverting to the Thane-Virar stretch [9]. This corridor would then transit to the western line of the Mumbai Suburban Railway and terminate at Ahmedabad just before entering Gujarat. 8 out of 12 stations proposed were to be placed in Gujarat. The 12 stations are the Bandra Kurla Complex, Thane, Virar, Boisar, Vapi, Bilimora, Surat, Bharuch, Baroda Anand, Sabarmati and Ahmedabad. Prime Minister Narendra Modi approved the project in May 2014. According to the Vision 2020 document by the Ministry of Railways 2009, it was observed that this corridor could be built as an elevated corridor, considering the habitation pattern and land constraints in India. It is expected that around 17,900 passengers will use the service every day. 35 daily train trips will be made from 6 am to midnight at intervals of 30 minutes.

The design proposal by JICA recommended that the majority of the project was constructed on an embankment slightly above the ground, followed by designs to construct on stilts, underground and bridges. 92 per cent of the track will be elevated through viaducts and bridges. 508.09 km distance, 460.3 KMs (90.5 per cent) will be viaduct, 9.22 KMs (1.8 per cent) e on bridges, 25.87 KMs tunnels (including 7 KM long undersea tunnel) and 12.9 km (2.5 per cent) will be on embankment/Cutting.

An undersea tunnel will pass through Thane Creek in Mumbai. This tunnel is expected to be the first undersea tunnel in India. The tunnel will be 7 km long. The project will operate at a speed of 320 kilometers per hour for 2.5 to 3 hours and will cover 508 kilometers. The Ministry of Railways announced that the project would follow Shinkansen technology followed by Indian manufacturing to make the entire project an indigenous one. Shinkansen system provides one of the highest safety levels in the world. Japan will supply the components, and the manufacturing will be done in India [9].

As NHSRCL brings trains from Japan, suitable modifications will have to be made to meet Indian conditions. More cooling arrangements will have to be made and the power of the trains will also have to be increased to meet the desired high speeds. It was also noted that the average weight of an Indian passenger and the amount of baggage carried is more than an average Japanese person. So, those factors will also be taken into consideration while modifying the Shinkansen models.

Table 2.1: Details of the Mumbai-Ahmedabad Bullet Train Project

Terminal	Bandra Kurla Complex - Ahmedabad
Length of Route	508 km
Number of Stations	12
Intermediate Stations	Bandra Kurla Complex – Thane – Virar – Boisar – Vapi – Bilimora – Surat – Bharuch – Baroda – Anand – Sabarmati - Ahmedabad
Approximate Speed	320-350 km/hr.

Estimated Duration	2 hours 56 minutes
Fare	Rs. 3000 – Rs. 5000
Estimated Cost	Rs. 1,10,000 Crores
Passenger Capacity	750 Passengers
Completion Date	15th August 2028

2.2 Cost and Funding:

The entire cost of the project is estimated to be 15 billion US $. JICA will be funding 81 per cent of the total project cost. This will be carried through a 50-year loan with an interest rate of 0.1 per cent with a moratorium on the repayments for 15 years [7]. Both Maharashtra and Gujarat governments will cover the other costs. However, the project poses a heavy financial risk. It is quite capital intensive and the repayment of the loan can be quite difficult.

2.3 Land Acquisition:

NHSRCL followed the State government's land acquisition process, which included an additional incentive above and beyond what was specified in the land legislation to encourage land acquisition by consent. When NHSRCL finalized the entitlement matrix, they gave people examples of how the compensation will be calculated.

When the Gujarat Amendment Act was passed, a permission provision allowed landowners to get a 25 per cent increase in compensation. The first step is to conduct a census to determine the number of impacted families and their monthly household earnings.

A Social Impact Assessment (SIA) study is required to issue a newspaper notice for a field survey. And for the notification, you'll need the names and addresses of the landowners, which you won't be able to find unless you go to the field. Gujarat passed an amendment exempting linear projects from SIA, allowing NHSRCL to notify after conducting preliminary field surveys.

Following the notification, a complete field survey is conducted, with a central line marked to obtain the specific details of the area that needs to be acquired. After the desk research in the notification stage, the accuracy level is 70 per cent, increasing to 95 per cent after the central line is identified and the details are placed onto a revenue map. A100 per cent accuracy comes only after a joint measurement survey is carried out.

Consent camps were held at the district level to disseminate information about the compensation once the details of the landowners were ready for the state of Gujarat. They were provided 80 per cent of the money within 3-4 days of signing the consent agreement to develop trust. This resulted in a cascade of consents, with more and more people stepping forward.

Maharashtra amended its Land Act in 2018, bringing it in line with Gujarat's. Direct compensation, as well as an R&R component, are included in the land payment. In Ahmedabad, Vadodara, and Vasai, there is a unique issue in R&R: the piece of land to be

acquired is owned by someone, yet someone else lives there and wants to relocate. Different challenges posed examples.

2.3.1 Navsari posing a unique challenge:

The landowners in Gujarat's Navsari Area demanded parity in compensation since they believed the compensation sum in the neighboring district was substantially larger. The Gujarat government intervened to modify the rates proactively, and land acquisition in this area eventually became the quickest in the state. Eighty per cent of the land has been bought in less than two and a half months.

2.3.2 The Palghar Challenge:

NHSRCL had a lot of problems securing land in Maharashtra's Palghar district. Local forces are opposed to new developments being built in the area, even though they are not on natural ground. Another primary concern was Gola land, which is a land that has several owners, often as many as 90 for the same piece of ground. The Palghar district contains many such Gola land holdings, making it difficult to determine who should receive compensation.

NHSRCL also had problems with Adivasi land when the landowner is not the one who uses it. There are tillers whose livelihood relies on that piece of land, and they must be rewarded. However, in the lack of reliable government records, identifying the tiller is a challenge. NHSRCL has contacted gramme panchayats to locate the tillers.

But that's not all. A problem exists with forest land. The government owns this land, although tribals occupy it. In such circumstances, the gramme panchayat agreement is essential because the tribals' livelihood is dependent on the forest - whether for food, wood, or other purposes.

Although the project was supposed to be completed by 2023, the project faced delays due to protests by Maharashtra Navnirman Sena (MNS) workers. Of the 508 km proposed, 39.66 km was to pass through district Thane, where 250 farmers initiated a protest as the farmers were not ready to give up their lands for this ambitious project of the government. The farmers requested that their compensation is on par with the Mumbai Metropolitan Region (MMR) land rates. The government then promised to deal with it by involving state government authority.

Including private, government, forest and farmlands, around 1434.4 hectares of the land was estimated to be required for the project. On January 29th 2020, the chairman of the railway board stated that 47 per cent of the total land needed for the project was acquired. In Gujarat, around 95 per cent of the land required for the project was acquired. However, the acquisition of lands in Maharashtra has been facing shortcomings due to the challenges posed by the pandemic and due to the protests by the local farmers.

2.4 Current Status:

The Ministry of Railways has confirmed that statutory approvals relating to wildlife, Coastal Regulation Zone (CRZ), and Forest clearance have been secured from the respective agencies concerned in a major development linked to the Mumbai-Ahmedabad Bullet train.

The Final Location Survey and Geotechnical investigation have also been completed. Up to June 2021, the Mumbai-Ahmedabad High-Speed Rail (MAHSR Project) has spent around Rs.13,483 crore on land purchase, utility relocation, and contractual payments.

The project has been delayed as a result of the COVID-19 pandemic's negative impact and the tardy transfer of land in Maharashtra. Mumbai-Ahmedabad. The MAHSR project is the countries only sanctioned high-speed rail (HSR) project, and it is currently being built with financial and technical aid from the Japanese government. National High-Speed Rail Corporation Limited (NHSRCL) has been constituted as a Special Purpose Vehicle (SPV) to carry out the project.

Statutory Clearances relating to wildlife, Coastal Regulation Zone (CRZ) and Forest clearance obtained.

1. Out of total land requirement of approx. 1396 ha, consent agreement signed/regular award done for approx. 1046 ha land. 1342 out of 1651 utilities shifted.

2. The total project work, including the Vadodara Training Institute, has been divided into 27 Contract Packages. Currently, seven packages have been awarded, with ten more being invited.

2.5 Feasibility:

GDP of a country during the construction of HSR plays one of the important roles in deciding the feasibility of the HSR project. In Japan, GDP per capita was $4700 in 1959 and in many European countries, it was above $14,000 in starting year of HSR. In PRC the figure was $6,200. These results can be used to arrive at a conclusion that GDP per capital of more than $5000 is suitable for HSR development, since as of 2017 Indian GDP per capita in PPP is more than $6000 [7].

Railway passenger volume plays an important role in HSR. IN 2009 the RPV between Fukuoka, Hiroshima and Osaka was 4,300 and 4,500. Seeing these results from Japan, Europe, and the Republic of Korea, 5,000 passengers per day appears to be average. Again, from the experience overseas in terms of intermodal competition with air transport, HSR is competitive against airplanes for distances less than 1,000 kilometers.

These models, when applied to the Indian setting, uncover that a large number of the proposed seven courses in India are for sure appropriate for HSR development.

3. Economic Viability:

Railways plays an Important role in connectivity and facilitating the movement of induvial and goods across the country. India has the most dense and complicated network of transport

system. Railways is the most effective mode of transport when compared to others. According to the World Bank the transport sector contributes 6.3 per cent of Indian GDP with road transport having the majority share.

According to London School of Economics and Political Science and the University of Hamburg researchers, towns connected to HSR sees a GDP rise in 2.7 per cent, compared to neighbors not on route. High speed rail has an immediate relationship with an ascent in GDP- for each 1 per cent expansion in market access, there is a 0.25 per cent ascent in GDP.

HSR is the most efficient way to travel and will aim to create considerate number of jobs and is also expected to provide affordable housing solutions to those commuting or working in high population density areas like Mumbai.

A study named 'Dedicated High Speed Rail Network in India: Issues in development' by Prof. G. Raghuram and Mr. Prashanth D. Udaya Kumar published by IIM Ahmedabad highlights the need of a High-Speed Rail Corridor as follows:

There are many positive benefits and externalities of the HSR which would be useful in India's overall aspirational development.

These externalities include technology percolation into other domains, economic development, game-changing feeling of network and connectivity, and national pride due to state-of-the-art framework cutting-edge infrastructure. In such a context, it is a good idea to begin and learn.

The Mumbai-Ahmedabad course is a good decision for the primary course, since it joins India's first and seventh most populous urban areas, with critical economic improvement in the 500 km passageway between them".

4.1 Environmental Factors:

Railways are the most environmentally friendly mode of transport where HSR produces 1/3rd of carbon emission of travel by car and a quarter of emission of an equivalent trip by air.

Carbon footprint of HSR is up to 8.32 times less carbon intensive than car travel and up to 11.48 times less than aviation travel.

As indicated by an examination by the International Union of Railways, Co2 outflow for a 600 km trip for each traveler by high velocity rail is 8.1 Kg when contrasted with 67.4 kg for vehicle travel and 93 kg for plane travel.

In a bid to minimize the impact of construction work on the environment, a well-thought-out plan has been adopted and efforts are being made to preserve the wildlife and natural habitats.

NHSRCL is ensuring that greatest number of trees at the building destinations are relocated to a close by area. It is expected that 80 per cent of these trees will survive this exercise. In

its conscious efforts for conservation of environment, tree transplantation in place of tree cutting with approx. 4457 trees transplanted at the project sites, and compensatory plantation of about 60,000 saplings, till now.

Special arrangements ensure that no harm is caused to the eco-sensitive zones of the Thane Creek Flamingo Sanctuary in order to preserve the natural habitats of the migratory birds 'Flamingos' furthermore, the connecting eco-delicate zones in the Thane stream region, a significant milestone choice to build an underground passage (up to 40m underneath the ground level).

Necessary compensations have also been laid out which includes paying Rs 10 crore (2 per cent of500 crores—the component of the project in Mumbai) for habitat improvement of the sanctuary, barricading the work site to guarantee that no scrap/debris fall outside the task.

4.2 Environmental Regulatory Requirements:

Since the railway sector is not listed in Schedule I of the notification, the MAHSR project does not require prior Environmental Clearance (EC) under the EIA Notification, 2006.

Other regulatory permissions relating to forest land diversion or approvals for forest land, mangroves and wildlife (protected) areas, tree felling in various land types, and coastal control zones will be relevant to specific sections of the alignment travelling through such regions.

During the building and operational phases, further requirements (environmental, occupational health and safety, and labor laws) based on various Central, State, and Gram Panchayat level regulations would apply.

All of these regulatory criteria were covered in the S-EIA report, and the EMP and project bid documents included responsibility allocation for compliance.

Table 4.1: The following are the project's possible negative impacts and planned mitigation measures (EIA Report NHSRCL, 2018):

Project Activities (Long Term Operation Phase)	Environmental Attributes	Potential Adverse Impacts	Proposed Mitigation Measures
Land	Topography	• Permanent change in the local topography of certain areas.	None
	Landscape	• Visual / landscape impact due to construction of viaduct from Mumbai to Ahmedabad and bridges across the intersecting water bodies.	• For the Viaduct, design comparison has been conducted in 2017, and the suitable (less impact to landscape) design was chosen. • To ensure that landscaping is effectively managed

			and minimize temporary visual impacts during construction. • To reduce as far as feasible impact and disturbance of flora. • Reduce the impact of the project and structures by additional tree planting wherever feasible to reflect the existing landscape character
		• Permanent change in the vicinity of the proposed stations.	• Landscaping at the station to improve aesthetics etc.
	Ecology	• Diversion of forest (138.3269ha. including 32.3902 ha. of Mangrove). • Removal of mangrove trees (24.3981ha.). • Loss of vegetation and tree cover (60000 trees are expected to be cut, including Forest, Government and private lands within the RoW).	• Compensatory afforestation and planting of mangroves and trees shall be carried out as per regulatory requirement. • Construction of balancing culverts shall be considered in coastal and mangrove areas, as applicable, so as to maintain tidal water exchange
Tunnel	Geology & Hydrology	• Generation of soil debris (@ 3.5 million cubic metres) from tunnelling activity. • The ground water may be affected during construction as the tunnel could intersect the aquifers in few locations.	• Tunnel shall be designed taking into account the potential seismic intensity, soil / rock structure and ground water table. • Excavated soil debris will be analysed for contamination and disposed / reused accordingly.

Stations	Climate Change Adaptation	Impact of potential sea level rise on the alignment and station structures close to coastal area at BKC.	The structure and premises of proposed Station close to Mithi River should be designed taking into consideration of sea level rise of 1 m over a period of 100 years
Operation of HSR	Energy Consumption and GHG Emissions	• Consumption of electrical energy for operation of HSR and Stations. • Associated indirect GHG emissions (this impact will also be offset to a large extent by the savings in GHG emissions due to expected modal shift from private vehicle road travel).	• The Shinkansen HSR technology is relatively more efficient as compared to the conventional railway operation presently in use in India. • Energy star rated equipment and fixtures will be used to minimize the energy consumption – e.g. energy efficient motors and pumps, use of energy efficient lighting, energy efficient luminaries, adequate and illumination levels optimized as per tasks, and energy efficient HVAC.
Site clearing and Levelling (cutting, stripping, excavation, earth movement, compaction)	Local Air Quality	• Fugitive Dust Emissions • Gaseous Emissions from construction equipment & machinery.	Use of suitable dust suppressants (e.g. water sprays). • Equipment and construction vehicles will be inspected and maintained suitably, for controlling emissions
	Water Quality	• Run-off from vegetation stripped project area. • Construction activities may cause change in the natural drainage pattern	• Plantation on the slope • Care shall be taken to avoid or mitigate any changes in the course of natural drainage.

	Soil Quality	• Loss of fertile top soil • Temporary loss of agricultural produce in farmlands.	The top soil be preserved and reclaimed back.
	Noise & Vibration	• Increase in noise levels due to running of heavy construction equipment. • Increase in ground vibration due to underground tunnelling. • Noise propagation due to running of heavy construction vehicles at the construction sites.	Where ever possible the deployed equipment shall have inbuilt noise enclosure • Noise abatement measures shall be adopted in tunneling activity. • Noise barriers of suitable specifications shall be erected in locations of sensitive receptors
	Local Climate	• Due to loss of vegetation cover (tree felling and mangrove cutting) there may be rise in the local temperatures.	• Compensatory afforestation shall be taken up. Transport, Storage and Operation of Construction Material/ Equipment Air Quality
Transport, Storage and Operation of Construction Material/ Equipment	Air Quality	• Gaseous emissions from construction vehicles. • Fugitive dust emissions due to Traffic movement especially in the Gujarat region where the alignment runs through the agricultural field. • Spillage and fugitive emissions arising out of construction materials	• All the vehicles shall have Pollution Under Control (PUC) certificate. • Regular sprinkling of water on unpaved ways / access roads. • The material shall be transported in covered condition.
	Water Quality	• Spillage of construction material and flow	• Small bunds and garland drains shall

		into streams particularly during the monsoon months. • Run-off from Storage Areas of Construction Material.	be created along the stock piles. • Proper enclosure shall be created.
	Soil Quality	• Spillage of materials, concrete slurry, fuel / oil on soil during construction	• Material stock piles shall not be stored directly on ground. • Spillages shall be avoided through management practices and controlled / disposed appropriately.
	Traffic on Public Roads	• Increased flow of traffic. • Congestion on roads.	• Alternate routes for construction vehicle shall be considered where possible to avoid congested / residential areas. • Proper road signage and traffic marshals shall be provided to regulate / divert traffic during construction activities.
	Climate Change	• Due to excessive emission from the construction vehicle, there may be increase in the concentration of CO, which will lead to climate change temporarily	• All the vehicles deployed at construction site shall have the valid Pollution Under Control (PUC) certificate.
Civil Construction Activities	Air quality	• Gaseous Emissions from Construction Machinery • Fugitive Dust Emissions due to Movement of Traffic on the unpaved way.	• All the vehicles deployed at construction site shall have the valid Pollution Under Control (PUC) certificate. • An enclosure or barricading shall be

		• Fugitive dust emission from the batching, mixing and concreting plant.	created at such locations
	Water quality	• Run-off from Construction Areas during curing and also from the storage area of the construction materials.	• Small bunds and garland drain shall be created along the stock piles. • Stock piles will not be situated directly on open ground.
	Noise Emissions	• High noise emissions from construction equipment. • Noise generated from the running of heavy vehicles deployed in the construction activities.	• Adequate enclosures shall be created around the stationary equipment. • Noise barriers of suitable specifications shall be erected in locations of sensitive receptors. • All the equipment shall be fitted with exhaust mufflers. • Appropriate personal protective equipment (PPE) shall be provided to the workers working near the high noise area.
	Vibration	• Vibration in the nearby area due to piling. • Blasting operation may lead to temporary ground borne vibration. • Running of heavy construction equipment	• Night-time pilling activity shall be avoided near residential areas. • Blasting shall be carried out in the day-time only, with advance intimation to local communities.

4.3 Environmental violations:

In a report released to the media on August 15, environmentalists Rohit Prajapati and Krishnakant Chauhan pointed out the ways in which the Indian corporation working on the project is openly violating social, environmental and human rights related norms which should be followed mandatorily made by the Japan International Cooperation Agency.

The bullet train corridor from Mumbai to Ahmedabad is planned to be an elevated 508-km high-speed railway benefitting diamond merchants, textile traders and other professionals doing business and trade between the two cities. In the process, the project will acquire land of at least 312 villages in Gujarat, Maharashtra and Dadra and Nagar Haveli accounting to take over 866 hectares of fertile farmland and cutting down of more than 80,000 trees.

Since the Japan International Cooperation Agency is a partner in the bullet train project along with the Indian government's National High Speed Rail Corporation Limited, changes have to be in accordance with not just Indian laws but also the rules of the Japanese agency. Farmers and Adivasi residents are already staging furious protests on the route of the project against the National High Speed Rail Corporation for violating land acquisition law while surveying and capturing their land in the past year. The Gujarat Khedut Samaj, a farmers' rights organisation, has filed a petition in the Gujarat High Court against the government's allegedly unlawful attempts to acquire land for the bullet train.

By emphasizing how the National High Speed Rail Corporation is also violating Japan International Cooperation Agency guidelines and rules, Prajapati and Chauhan hope the Japanese government will be initiated to require action against the Indian agency for the violations.

According to the 2015 Joint Feasibility Study report for the Mumbai-Ahmedabad high speed corridor, published by India's Ministry of Railways and the Japan International Cooperation Agency, the only environmental and social result analysis studies on which the project is based on were conducted in 2010.

"These cannot be considered valid when the land acquisition and public consultations are taking place eight years later, in 2018," said Prajapati, member of the Gujarat Paryavaran Suraksha Samiti, a non-profitable organisation for environmental protection. According to him, no fresh analysis had been done in recently.

The National High Speed Rail Corporation was able to begin the land acquisition process in Gujarat without social or environment impact assessments because of clauses in certain Indian laws just like, in 2016, Gujarat amended the Centre's Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, exempting "social infrastructure" projects from mandatory social impact assessment and getting the consent of 70% of the affected population. In the same year, the Supreme Court passed a National Green Tribunal order that made environmental clearances mandatory for railway projects.

However, Prajapati and Chauhan pointed out that Indian law should not matter if the Japanese agency's guidelines require environmental and social impact assessments for its Category A projects. The Japanese guidelines clearly state that the project must follow the standards that aim for higher levels of environmental and social considerations if a host country's laws, standards and policies differ from international standards.

Prajapati believes that environmental impact analysis is vital for the project, because it is not the only linear infrastructure project proposed in the Mumbai-Ahmedabad belt, other projects like the Delhi-Mumbai Industrial Corridor, Western Dedicated Freight Corridor and the Vadodara-Mumbai expressway are coming up in the same area. He further said, "The cumulative environmental and social impacts of all these projects have to be taken into account, and fresh assessment studies should be done accordingly."

5. Discussions:

5.1.1 Population density:

The population density of India is 366.7/km2 which is higher than Japan and most European countries. Having such a high population density makes HSR and ideal way to mass transport system Population density along the corridor also plays a major role in building of HSR.

The Mumbai Ahmedabad border has population density vs GDP per capita across the bode comparable to that of Sanyo (Japan). The below graph shows the relationship.

This concludes the Mumbai Ahmedabad corridor in 2017 makes it suitable according to its planned location.

5.1.2 Affecting the lives of Farmers & Tribals:

Throughout the route, the tribal communities and farmers have been protesting against the project. Where some do not want to give up their land, others want better compensation for giving up their land.

However, farmers in some villages of Bhiwandi and Palghar have reportedly surrendered their land for the project and the NHSRCL hopes that most of the land acquisition to be completed by the end of the year.

Also, at most of the places, the villagers have not allowed the police and the authorities to conduct a ground survey for the project. Several villagers have thrown away the red erected markings (given by authorities) or covered the red marks on stone or pillars used to mark the route of the bullet train. The villagers cleared their intension that it is both to create distraction in the work of the authorities as well as highlight their anger.

According to an article "Ready to lose life but not land for the bullet train, say Maharashtra's farmers and tribals" by Mayank Aggarwal on 7 October 2019 said:

Both the ruling party and the opposition want to avoid farmers, tribal people and their protests for their lands in these districts being usurped by the government for the National Democratic Alliance (NDA) government's dream project – the Mumbai-Ahmedabad bullet train project.

Mongabay-India stated, "Our land is our mother and our whole life depends on it. We won't give it to anyone and won't even allow the survey for the bullet train project in our villages. If our land is lost, we will lose everything. We can't help in fulfilling this government's dream of the bullet train," said by Kanchan Katkar, who was the head of the council of Mahagaon village for over 10 years.

"Elections or no elections it doesn't matter to us. No political leader has come to us so far and even if someone comes, we won't let them allow it. We have tried to promote people from amongst us to fight elections but once they join a political party, they forget the community. We are clear that we are ready to lose our lives but not our land," said Ketkar. She was

surrounded by dozens of other women who were at a break from their work while she was guiding about the expected route that will pass through their fields, local pastoral land and community land.

About 90 km away from the forest of Palghar, in Bhiwandi district, famous for its textile industries, the villages also fall under the bullet train line. Their main complain though is the lack of transparent communication and fair compensation.

Arvind Mhatre, a farmer of Dive Anjur village in Bhiwandi area told Mongabay-India, "We have no issues with this dream project of Modi ji's but our problem is that we have been kept in the dark for too long. Several people in my village are losing the land to the bullet train project and notice for surveying the land was given nearly a year ago.

Since then, there has been no communication and we have no information. Neither the bullet train authorities nor the state government has spoken to us about how land will be taken or how much will we be compensated. We are not against the project or development but we just want fair compensation and jobs. But if the government cheats us then we will have no option but to immolate ourselves."

5.1.3 Farmers complaint on the non-inclusive development in Maharashtra:

A total of 14,884 households and 37,394 trees (in forest and non-forest areas) are expected to be impacted by the project. The estimates also reveals that approximately 35 percent of the affected households fall in the vulnerable category, which includes cases where the head of the family is SC/ST, widow, separated woman, single woman, disabled, below poverty level, and persons above 65 years of age with no further family support.

The activists who have been working in Maharashtra with farmers and tribal people explained that there is a pattern to this kind of non-inclusive development.

"In Palghar, there are so many developmental projects like a seaport, expressway, coastal highway, transmission lines and now bullet train. The whole Palghar area is an area dominated by scheduled tribes but these days it seems more like a district known for its developmental projects. The tribal people have lost their land in every project and the worst part is that they have not got justice, rehabilitation and compensation in any of them," told to ***Mongabay-India*** by Shashi Sonawane of the Bhumiputra Bachav Andolan, working with tribal communities in Palghar, Maharashtra.

"The tribal people of Palghar are losing their lives and culture to this kind of development, even as they have repeatedly spoken against this development which is leaving them behind. Even during elections, issues of India's indigenous people are not of concern to anyone. Political candidates don't even visit us or speak to us about issues that are of concern to us," said Sonawane. But it is not just about the land that the farmers would be losing. According to the Ministry of Environment, Forest and Climate Change (MoEFCC) data, the project involves 131.302 hectare of forest land in Maharashtra and 5.847 hectare of forest land in Gujarat including 24.137 hectare of mangrove forest area. A total of 53,467 trees of mangrove are expected to be removed as part of the project. Till June 2019, an expenditure of about Rs 32 billion (Rs 3,226.8 crore) has been incurred on the project.

5.1.4 Requests to 'Reconsider' the Bullet Train Project:

In the report by Prajapati and Chauhan, they have urged the Japan International Cooperation Agency to examine and take prompt action against the National High Speed Rail Corporation for violating its guidelines. They also want the Japanese agency to rethink on the bullet train project and support alternative ways of improving the present railway system infrastructure between Mumbai and Ahmedabad.

In May, activists of the Paryavaran Suraksha Samiti and Gujarat Khedut Samaj wrote to the Japan International Cooperation Agency about the charged infringement of its rules. Since they did not revert back, they now plan to approach the Embassy of Japan in India. "We want international groups to respond to these violations, because JICA [Japan International Cooperation Agency] is also liable to follow international rules in the implementation of big infrastructure projects," said Prajapati.

Reports include that a point-by-point survey request has been sent to the Japan International Cooperation Agency about the charges of its rules being abused in the bullet train project. In response, the agency said, "JICA is still in the stage of discussion with the Indian side for the project formulation for the Mumbai-Ahmedabad high speed rail project, and the project is yet to be implemented."

"The concept of triple bottom line – planet, people, profit – is now almost 20 years old and it needs to be far more deeply embedded in the functioning of companies," said Rajni Bakshi, the author of the book Bazaars. "Because of this concept, many companies still file sustainability reports, but very few companies give priority to the social and environmental bottom line. That is the prime reason of why these issues keep appearing."

A worldwide agency's rules may not be the same as legally-binding laws beneath which individuals can be indicted, but Bakshi highlights that what matters is the social and environmental benchmarks that a project endeavour for. "On that, there are very mixed results across the world. Sustainability is an ongoing struggle," she said.

The Hindu stated the following, "The opposition by farmers to Prime Minister Narendra Modi's dream project — the Mumbai-Ahmedabad bullet train — has resurfaced against the backdrop of the ongoing farmers' agitation against agricultural reform laws.

Maharashtra Chief Minister Uddhav Thackeray has said that he is communicating with farmers contradicting the bullet train, and that he would not use water cannons like the Centre to prevent them from protesting.

Last year when Thackeray took charge as CM, he was very firm and clear that the bullet train project was not on the priority list of the State government. He had compared the project to a 'white elephant', saying that its future will be decided after he will be convinced that it would boost industrial development in the State.

Despite funded by a soft loan from Japan, the ₹1-trillion project having a track-length of 508.17 km, from the Bandra Kurla Complex, Mumbai, to Sabarmati in Ahmedabad, is likely to get stuck in political warfare though on the other hand, the Modi government is keen to complete the project by August 15, 2022, when India marks 75 years of Independence.

"The bullet train is the Central government's project. The State has given probably the costliest land in the Bandra-Kurla Complex for the bullet train. The project is facing opposition and I

have met farmers (opposing the project)," said Thackeray recently. He also said that farmers opposing any project must not be treated severely because it violates democratic practices.

Thackeray has brought up the farmers' position and condition on the bullet train project as the Opposition parties in the State are stirring back for a farmers' disturbance in New Delhi.

5.1.5 Environmental Risks Involved:

It has also been informed that this project has a higher risk of destroying the ecosystem, including 11 mangrove species and about 177 species of animals and migratory birds will directly be affected according to MoEFCC (MSI, MoEFCC).

This may also lead to an increase in risk of flooding, erosion of coastline, and increase of saline intrusion. Even if the necessary compensations were to be done, noise pollution from the sound of bullet trains, changes in drainage and water quality will still continue to pose as a threat for the habitats around the region.

Some of the environmentalists claim that the project cannot be a part of India's socio-economic development, if it is not sustainable. Director of 'The Nature Connect' said that it may take 15 years to recover what may be lost through this project.

Some of the mitigation measures taken are as follows:

1. Water inlets to the mangrove areas in and around the project site will not be blocked. The tidal water flow will be regulated.

2. To prevent flooding, drainage structures will be designed to ensure continuous flow.

3. Instead of the initial 53,000 trees that were to be cut, around 21,000 were saved through proper designing of the project.

While the government likes to think that this project may bride connectivity to least developed areas, develop infrastructure and reduce greenhouse gas emissions, some experts think that this increase of urbanization may lead to social conflicts and struggle for resources. Previous records of government projects have rarely shown sustainable planning or urbanization, this could lead to tensions between the public and the central government.

5.1.6 Resettlement Issues:

Many farmers and tribal people will be losing their land and are muddled about their resettlement and accused the government for not discussing about the project transparently with them. These farmers are not ready to provide their lands for the project. The people fear that they may become homeless because of the project.

The displaced people were not even provided basic amenities or sufficient compensation yet, which is a critical area of concern. Some of them also feel the compensation plans provided by the government are unfair. These groups of people belong to the frequently marginalized sector of the society. Not providing them adequate compensation can disrupt their livelihood.

There has been opposition in both states, but for different reasons. The villagers in Maharashtra claim that the project has no benefit for them. The villagers in Gujarat, although support the project and are ready to provide the land, are opposing the compensation process.

6. Conclusion:

The transportation sector plays a huge role in uplifting the economy of a country. The Mumbai-Ahmedabad Bullet Train project promises a lot of benefits. It brings a lot of honor to the nation, employment opportunities and shed a light of progress from a technological point of view. The project will aid in decongesting the route from Mumbai to Ahmedabad, reduce the travel time from 8 to 2.5 hours and promises to improve the economy by 2.7 per cent (JICA 2015).

It also consumes less energy and is environmentally friendly when compared to other modes of transportation. The HSR is expected to improve the revenue generation of the country. While the country awaits its new venture into High-Speed Railways, it should also focus on upgrading the existing rolling stock and enhance its safety features. Specific experts feel that India should have bought Bullet Train from Japan without taking a loan.

It was noticed that 100 trips a day were required to make the project financially viable, but only 35 trips were planned for now, according to a study from IIM Ahmedabad. The intensive nature of the capital invested questions how India will repay the loan it borrowed. Indian Rupee's depreciation against the Japanese Yen can threaten the loan repayment, even if the interest rate is meagre.

Since the project faced protests from farmers and tribals regarding land acquisition and has been called a ‘White Elephant’ for its cost, the project is facing major problems on the Maharashtra belt though covering only a certain distance of the route. Reports say 90 per cent of land acquisition is done in Gujarat but only 22 per cent in Maharashtra.

Some say that the Maharashtra state government are eyeing it as a personal reason of their rivalry with the BJP government though it’s still not eminent who is being a barrier towards the development of India.

India will need a stringent national policy on High-Speed railways, which will prioritize the need to plan an intense economic activity corridor. Policies regarding innovative financing and PPP can be recommended so that financial errors can be avoided. As India takes a massive leap of faith in this project, care should be taken not to risk the loan repayment.

India is a country with varying economies. Some parts of India are flourishing well, and some aren't. Not all railway corridors proposed in Vision 2020 may be worth investing in High-Speed railways. In such cases, semi high-speed railways can be constructed, which is also popular in India. They are defined as trains that run around the speed of 160-200 km/hr. They are financially less risky and highly affordable to the large Indian masses. The HSR project will provide a new dimension to the Indian Transportation System. The time has come for India to display its technological prowess in the transportation industry.

References

[1] 2020, N. H. (2020). *4th Annual Report 2019-20.* . New Delhi .

[2] Corinne Blanquart, M. K. (2017). *The local economic impacts of high-speed railways: Theoriesand Facts.*

[3] Goyal, A. (2014). High Speed Rail in India: Importance of National Policies. *Economic andPolitical Weekly*, 155-164.

[4] Hayashi, K. S. (n.d.). *Handbook on High-Speed Rail and Quality of life.* Tokyo: AsianDevelopment Bank Institute.

[5] India, G. o. (2018). *Indian Railways Year Book* .

[6] Institute, J. R. (2019). *Jaoan's Foreign Aid and 'Quality' Infrastructure Projects: The case ofthe Bullet Train in India* .

[7] JICA. (2012). *Survey on High Speed Railway Technology and Skills in India* . Ministry ofRailways, India .

[8] Khare, A. (2021). *Indigenous Solutions and Opportunities for High-Speed Rail in India.* ADBInstitute.

[9] NHSRCL. (June 2021). *India's Bullet Train Ride: The Journey So Far.*

[10] Railways, I. (2000). *Speech of Kumari Mamata Banerjee - Introducing the Railway Budget* .

[11] Railways, I. U. (2019, February 7). *Intercity and High-Speed Committee*. Retrieved fromhttps://uic.org/passenger/highspeed/

[12] Railways, I. U. (2021). *Atlas: High-Speed Rail 2021.*

[13] Railways, M. o. (2009). *Indian Railways Vision 2020.*

[14] Railways, M. o. (2020). *National Rail Plan - India* .

[15] Shrivastva, C. (2019). High-Speed Rail Corridor: The Indian Assessment. *Journal ofManagement and Public Policy*.

[16] Shrivastva, C. (2020, November 6). *Stepping Back: India's Bet for Semi High-Speed A FruitfulGamble?* Retrieved from Youth Policy Review: https://www.youthpolicyreview.com/post/semihighspeedrailway

[17] Shrivastva, C. (n.d.). *Putting Indian High-Speed Rail on the fast track: Challenges and Opportunities*. Retrieved from Global Railway Review: https://www.globalrailwayreview.com/article/118701/indian-high-speed-rail-challenges/

[18] Sunil Kumar Sharma, A. K. (2014). A Comparitive Study of Indian and World Railways . *International Journal of Mechanical Engineering and Robostice Research* .