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Riding the Tracks of Time

Indian Railways – An Unfinished Revolution

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Riding the Tracks of Time: Indian Railways – An Unfinished Revolution

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The paper has been enriched and improved based on the feedback received from Dr Rakesh Mohan, President Emeritus, CSEP and Dr Laveesh Bhandari, President, CSEP.

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Abbreviations

C&AG	Comptroller & Auditor General
CLW	Chittranjan Locomotive Works
DFC	Dedicated Freight Corridor
EIR	East India Railway
EIRC	East India Railway Company
GIPR	Great Indian Peninsular Railway
ICF	Integral Coach Factory
ICS	Indian Civil Service
IR	Indian Railways
IRCTC	Indian Railway Catering and Tourism Corporation
NER	North-Eastern Railway
NTDPC	National Transport Development Policy Committee
PPP	Public-Private Partnership
PWD	Public Works Department

Abstract

This paper examines the building of railway tracks in India prior to 1947 and, to a limited extent, the construction of railway lines in countries such as the US, Russia, Japan, the UK, and China. Prior to India's independence and, particularly in the 19th century, the laying of railway lines involved high human costs and resulted in substantial profits for British financiers, intermediaries, and Indian producers of goods and agricultural products. This led to beneficial consequences for the Indian economy, although these were limited by design. The gradual yet steady development of Indian railway networks from the mid-nineteenth century until Indian independence, almost a hundred years later, made it increasingly easier for British India to exercise greater administrative and military control over the entire Indian subcontinent. The development of India's railway networks could have contributed more to the industrialisation of pre-independent India. This did not occur, and the paper discusses a few illustrative causal reasons driven by British colonial economic imperatives. The last section of this paper moves from the post-Indian independence 1950s to the 2020s and compares the extent to which the current state of Indian Railways lags behind railway systems in developed countries and China.

Two significant reports on the functioning of the Indian Railways and recommendations for reforms were submitted by committees headed by Rakesh Mohan in 2001 and 2014. Subsequently, another central government-appointed committee headed by Bibek Debroy submitted its suggestions on reforms in 2015. It has been 22 years since the submission of the first report in 2001. Unfortunately, little forward movement has been achieved in implementing the systemic reforms which were recommended. For instance, Indian Railways could have become a corporation by now, as recommended by the aforementioned committees, and the construction of dedicated freight corridors could have progressed much further than what has been achieved. The lack of progress on several fronts is also attributed to Indian Railways not adding at least another 20,000 kilometres of broad-gauge railway tracks between 1947 and 2023. There are continuing economic and social welfare opportunity costs of not taking the required steps to get freight and passenger trains to run faster. It is also crucial to bring greater transparency and independence from government intervention in the financial statements of Indian Railways.

This paper highlights the: (a) high returns for financiers based in the UK and the administrative-control reasons for the development of Indian Railways by the British; (b) the remarkably long lengths of railway tracks laid between 1857 and 1947; (c) significant achievements post-Indian independence in building broad-gauge railway tracks, achieving high levels of electrification, and constructing dedicated freight corridors (DFCs); and (d) the unimplemented recommendations of Indian government-appointed committees.

1. Introduction

Prior to the laying of the first railway lines in colonial-era India, as in other countries, transportation of goods and people over longer distances was typically on horseback or by other animal-drawn carts over uneven dirt-roads, and by boats or steamships via waterways. To a limited extent, people and goods were transported by animal-hauled wagons on rudimentary rail tracks even before the invention of the steam engine. Travel was slow, tortuous, and dangerous. Most low-to-average income families probably lived and worked within around 50 kilometres of their places of birth. Several inland parts of the Indian subcontinent, which were remote from each other, had little to no overland connectivity between them for the movement of heavy goods.

It was in this environment that the steam engine and the laying of railway lines brought immense changes to the private and working lives of the people of the Indian subcontinent and the region's economy. The construction of railway lines began systematically by the 1850s, and the total length of railway lines, of various gauges, in British India rose to about 26,955 kilometres by 1905. At the time of Indian independence from British rule in 1947, this number for undivided India had increased to 65,217 route kilometres (Kerr, 2007). This was more than a fifty per cent increase in just over four decades, despite the two World Wars during this period.

By 1951, the number of route kilometres had decreased to 33,230 route miles or 53,168 kilometres, reflecting the partition of India (Kerr, 2007). Specifically, "…the Northwestern (region) was the worst affected, losing 5,000 of its 6,900 route miles, which included all those difficult-to-build but little-used frontier lines, while the Bengal-Assam region was more fortunate, retaining 2,600 miles (60 per cent) of its former 3,550 route miles" (Wolmar, 2017, p.227). By 2019, 72 years after independence, India had increased the total length of its railway tracks to 68,103 route kilometres, an increase of 19 per cent (Indian Railways Annual Report and Accounts 2020-2021).

An overwhelming proportion of borrowed capital for the construction of railways lines in colonial India came from private foreign, and to a limited extent, Indian sources. To attract capital, for the first four decades from around 1850 to 1890, British India provided investors with a minimum guaranteed return of about 5 per cent on capital invested in building railway lines around the country. A British House of Commons Research Paper (03/82) dated November 11, 2003, provides a time series of price levels for the UK with January 1974 at 100 (Research Paper, House of Commons, 2003). As per this research paper, the index was at 8.4 in 1850 and 8.8 in 1899. Effectively, although there was some inflation in select years, over this 50-year period there was negligible inflation in the UK. Consequently, the 5 per cent return was a real rate of return on capital for investors in railway companies which constructed railway tracks in India. Occasionally, in the second half of the 19th century, the return on capital invested in select Indian railway lines went up to 8 per cent. It was only from around 1906 that the British Indian government provided funds for investment in building railway lines or to import locomotives from Britain. A few East-West and North-South railway lines were meant to move troops to colonial India's north-west frontiers, given the British concern about Russian expansion southwards. This paper attempts to add to the considerable body of work on Indian railways along with a very short comparison with the laying of railway lines in developed countries and China, and the speeds of trains in those countries.

An oft-quoted Karl Marx remark about Indian railways was, "…the railway system will, therefore become, in India, truly the forerunner of modern industry." (Marx, 1853). Even though the British developed extensive railway networks in India, this did not lead to concomitant levels of industrialisation achieved in Europe and the US. Of course, more rapid movement of food grains was possible due to railway networks, but British India's vulnerability to the adequacy of rainfall did not change appreciably. It was logical to expect that as the reach of railways was spatially widened, this would lead to more avenues for employment and higher overall economic growth in British India. However, this did not occur, and the majority of the population remained reliant on agriculture, dependent largely on the sufficiency of monsoon rains due to the limited scope of irrigation works. According to a press release by the Government of India, a 2021 survey indicated that 60 per cent of India's population lives in rural areas, out of which 47 per cent continues to be dependent on agriculture (PIB, 2023).

An implied finding of this paper is that Indian railways should have added at least another 20,000 kilometres of track length by 2023. The funding for

this could have been accessed from private domestic and international sources if passenger fares had been rationalised on a cost-plus basis. This would have made the movement of goods via railways adequately competitive versus transportation by road. The construction of railway lines prior to the incremental takeover of all Indian railway lines in the 1930s by the British Indian government was funded mostly from private sources. This begs the question whether the same could not have been done post-Indian independence. To prevent the padding of costs, this would have required competitive passenger and freight rates with no pre-determined assured return on borrowed capital. In post-independent India, the railways have become the second-largest employer and remain wholly government-owned and managed by the Ministry of Railways. As of March 2022, there were 1,212,882 Indian Railway employees. (Indian Railways Annual Report, 2022-2023).

The paper has been divided into six sections. The following Section 2 provides the background to the early development of railway networks in India under British rule. It examines the financial, commercial, and colonial motivations which supported the introduction of railways in India. Section 3 compares the development of railways in British India and other nations between 1900 to 1947. Section 4 provides a sweeping summary of the post-independence growth of Indian Railways between 1947-2023. It also provides a few details about the electrification of Indian Railways since independence, the current speeds of Indian trains, and the experience of privately run trains. Section 5 examines the reports of central government-appointed committees which were set up to examine the state of Indian Railways and to suggest reforms. Section 6 also reports on the Comptroller and Auditor General's (CAG) comments on the finances of Indian Railways. The conclusions of the paper are in Section 6 and this section thinks aloud about the considerable distance that remains to be covered by Indian Railways. The appendices provide supplementary information and maps to support this paper.

2. Early Railway Networks in British India

Going back two centuries, the Grand Trunk Road, which was laid from Kolkata to Delhi and later extended to Peshawar, opened in 1839. Around that time, the initial push to build railways stemmed from the need to transport large and heavy granite pieces for road construction purposes. Initially, a short railway line came up from Chantries to Chennai, and this first railway line in India, built for freight, was established in 1835 (Wolmar, 2017). These early tracks, laid in what is today the state of Tamil Nadu, originated from a local initiative. Later, this railway line was used for transporting passengers. The first passenger railway line spanned 34 kilometres, constructed between Mumbai and Thane by 1851. Notably, in 1845, systematic start-off efforts were initiated by the East India Railway Company (EIRC), which established an experimental line laid from Kolkata to Raajmahal in 1851. The inaugural passenger journey from Howrah to Hooghly started in 1851. Considering the East India Company's headquarters in Kolkata, it was logical that railway construction began connecting Kolkata to other commercially and strategically important locales.

Initially, the railway carriages were too heavy for bridges, which needed to be strengthened for railway lines to be constructed over them. Local untrained labour was readily available, but the workers returned home for several months during the harvest season. At times, the British Indian government could not acquire land fast enough, and hilly or elevated regions presented difficulties for building railway lines. Blasting through rocks to build railway lines was a difficult and expensive affair. In the 1850s, the total workforce employed in building railway lines in India was approximately 100,000, surpassing the number of workers employed to build the Suez Canal around the same time (1859-1869). By the 1860s, the labour force had increased to 250,000 with only about 500 British engineers. Cholera and malaria were rampant due to scarce potable water and an abundance of mosquitoes.

Wages were low, that led to frequent worker agitations. On average, the daily wage for manual labour in India in 1910-11 was INR 0.26 (Sivasubramanian, 2000), whereas in 1850, the equivalent number in the US was approximately USD 0.97 (Lebergott, 1960). The following quote indicates the considerable wage differences between the British and Indians: *"Europeans were not only paid far more than their Indian colleagues, but, as an inducement for them to come to India, their wages were greater than they would have received for carrying out the same job in the UK—an average, in 1870, of £270 per annum for a driver (in India) compared with £115 back home. In addition, there were numerous other expenses associated with employing them that further dented the rail companies' profits."* (Wolmar, 2017).

Around the mid-19th century, there was a vigorous discussion between the proponents of building railway tracks and those who felt that the opportunity cost of not using waterways and spending on other forms of development in British India was too high. Eventually, those in favour of building railway lines won the argument, likely influenced by the vigorous construction of railways in the US, West Europe, Russia, China, and Japan.

Amid other controversies, considerable discussion revolved around the width of railway tracks. In 1850, Lord Dalhousie recommended that the railway gauge should be between 4 feet 8.5 inches and 7 feet, and it should be a uniform gauge for all railway lines in India. Ultimately, the decision was made for the metre gauge to be 3 feet 3 and 3/8 inch wide, and narrow gauge to be 2 feet. It would have been more cost-efficient if a standard gauge had become the width for all railway tracks in the plains, except for mountainous terrain, right from the start in mid-18th century.

In the 19th century, the commodities transported by Indian railway lines were predominantly cotton, hides, coal, sugar, salt, wheat, rice, and jaggery. Despite the belief held by Lord Dalhousie and Grant Duff[1] that railways would have a "civilising" impact on untouched areas of India, periodic famines in British India diminished the persuasiveness of this view. By 1870, the East India Railway (EIR) and Great Indian Peninsula Railway lines had built approximately 1200 miles of railway tracks. The EIR line connected Kolkata to Delhi via Allahabad, and the Great Indian Peninsula Railway lines connected Kolkata to Mumbai. By 1864, to connect Calcutta and Delhi, trains started running between the two cities without any bridge over the Yamuna, with rail coaches ferried on boats across the river. A bridge over the Yamuna opened at Allahabad in 1865[2]. The Mumbai to Chennai line was ready by 1871, and this line avoided Bangalore since that city was about 900 metres above sea level. Until the 1880s, there were no railway lines in Assam, even though tea had to be transported out of that state. However, by 1904, the Dibrugarh-Sadiya railway line connected the tea-growing areas of upper Assam to the port in Chittagong.

Narrow-gauge lines were first laid to the hill station of Darjeeling in 1879 and later extended to Kalka–Shimla by 1899, aimed at encouraging British and Eurasian families to settle in these areas. The Ooty line to Coonoor in the Nilgiris was laid in by 1899 for the same reason. Lord Canning provided a guarantee of GBP 100 per mile, and from 1880, the British Indian government covered the entire subsidy bill for these lines in the hills. In contrast to most of his predecessors, Lord Mayo, who was the Viceroy from 1869-1872, favoured government ownership for Indian railway lines. In the plains, the Kolkata-Delhi line attracted enough passengers to cover the cost of servicing the debt incurred for its construction, whereas most other lines required subsidies. Over time, railway lines expanded over wider swathes of territory in colonial India, and the British Indian government became increasingly involved.

2.1 Construction of Earliest Railway Lines – Financial Considerations

Finding sources of financing for the laying of railway tracks was a primary hurdle. This obstacle was addressed after 1857 when the British Indian government provided a minimum guaranteed return of approximately 5 per cent. By the mid-1880s, this rate of return was considered excessive, as construction expenditure mounted to irresponsibly high levels. For financiers, costs were not a concern, since the return on capital invested in railway line construction was assured. In comparison, the long-term fixed rates of return on the three forms of gilts (British government debt securities) prevalent at that time was about 3 per cent, varying at most up to 3.5 per cent per annum between 1845-1888 (Olesko, 2016).

In a letter to The Times of London, W.P. Andrew, Chairman of the Scinde Railway Corporation, commented that this issue of government guarantees for financing provided by private parties was a misrepresentation of facts. Andrew held this opinion even though his letter acknowledged that the minimum rate of interest was for a period of 99 years, and that land for constructing railway lines would be leased for free for the same period (Debroy, Chadha, & Krishnamurthi, 2017). At that time, it was standard for railway companies to be granted 99-year leases on the lines they built, with these companies responsible for contracting labour. The contracts between private financiers and the British Indian government were designed such that once principal and interest were repaid to the government, any surplus profits went to the shareholders of the railway lines. Additionally,

[1] Grant Duff served as the under-secretary of state for India from 1868 to 1874 then from 1881 to 1886. It appears that he was based in Bombay. Later he relocated to Madras as the Governor of Madras.

[2] https://er.indianrailways.gov.in/cris/uploads/files/1367482070268-ER_Profile_02052013.pdf

under the terms of contracts with private builders, the government had the option to take over the railway lines 25 years of operation.

According to Ian J. Kerr, "*…the interests of the Indians were incidental although, as represented in the writings of Dalhousie and many Britons, the progressive consequences for India of the railroads were a self-evident truth*" (Kerr, 2007). However, MacPherson, along with many in the British establishment, rejected the suggestion that it was economic imperialism that drove the building of railway lines in India. It is a fact, though, that Indian Civil Service (ICS) India Office officials often transitioned to the "City" in London via railway companies. Consequently, the public interest roles of ICS officials became interchangeable with those of professionals in insurance and banking activities. It seems that at a minimum, according to a quip by Lord Curzon, many officials displayed "confident incompetence," possibly alluding to the conflicting nature of the various financial and human interests involved in managing the construction of Indian railway lines in a cost-efficient manner. As for elite private financiers such as Nathanial Rothschild and Baring Brothers, who wielded considerable influence in London, showed little concern for overall development of British-India's economy. For example, Rothschild is on record as having said that Indian railway bonds or equity-linked instruments would be an easier sell in London if the sales proceeds were to be invested in the manufacturing sector in Britain (Sweeney, 2015).

The following table provides numbers on ownership and funding of British Railways around mid-19th century.

Table 1: Capitalisation of British Railways (Pound Millions)

Year	Common shares	Preference shares	Debenture bonds	Debenture stock
1850	150	34.7	55.2	—
1855	169.6	52.8	75.2	—
1860	190.8	67.9	81.9	7.6
1865	218.6	124.3	97.8	13.8
1870	229.3	158.7	90.7	51.2
1875	254.6	222.3	40.4	123.0

Source: Olesko, A. (2022). The railway mania of the 1860s and financial innovation. Available at SSRN 4006745.

Initially, the expectation in Britain was that equity funding would be the major component of financing for railways in that country. However, over subsequent decades, debt funding increasingly took precedence. It should be noted that holders of common shares in British Railways suffered serious losses (Odlyzko, 2022), which may explain the gradual shift towards debenture bonds. In the context of railways in India, which closely followed the development of railways in Britain, debt funding was often preferred. This approach meant that the shareholders of Indian railway companies faced less market risk in their investment portfolios. In this context, the following extended quote confirms that a substantial fraction of the market and credit risks associated with the building of railways lines in India was borne by the British Indian government. *"Apart from taking over the original guaranteed companies, the GOI also experimented with state-owned and -operated railways in the 1870s. But this second phase was short-lived and gave way to new second-generation railway companies in the third phase. Here, the Government of India owned most of the capital, often up to 75 per cent, with a private British company owning the rest. The company managed railway operations and split profits with the GOI in proportion to their capital share. These companies also raised capital in London using a combination of equity and debt. Unlike the original guaranteed companies, their share capital was backed by lower guarantees ranging from 3 to 4 per cent…. The public–private partnership model was common up to the 1920s when the GOI began taking over the operating companies leading to the eventual takeover of all railway operations. The changes during the 1920s reflect a new policy regime where Indians had greater control over railways."* (Bogart and Chaudhary, 2019).

Initially, several private companies, large and small, were engaged in constructing railway lines in British-controlled India. A few of these companies included the Great Indian Peninsula Railways, East Indian Railways, Madras Railways, Bombay, Baroda and Central India Railways, Sindh, Punjab and Delhi Railways, South Indian Railways, Eastern Bengal Railways, Oudh, and Rohilkhand Railways. All these companies were established between 1853 and 1871 (Kerr, 2007). The broad-gauge lines originated from ports such as Karachi, Bombay, Madras, and Calcutta, extending towards the northern and northwest frontiers. Initially, only one railway line, the East Indian Railways (EIR) stretching from Calcutta to Delhi, was commercially successful. Table 2 provides the ownership details of a few Indian railway companies as of December 31, 1869. Notably, an overwhelming proportion of registered shareholders in these companies were based in England.

Table 2: Ownership Details of a few Indian Railway Companies (1849-1864)

	Contract date	No. of owners	Shareholders %	Debenture holders	Shareholders registered in England %
East Indian	1849	17,013	83	17	81
Great Indian Peninsula	1849	13,059	87	13	85
Madras	1852	7,076	88	12	88
Bombay, Baroda & Central India	1855	6,470	85	15	83
Sind, 1862 Punjab & 1864 Delhi	1855	7601	97	3	95
Eastern Bengal	1858	2128	79	21	77
Great Southern of India	1858	1146	90	10	90
Oudh & Rohilkhand	1862	1180	94	6	91
Carnatic	1864	244	100	0	87

Source: Bogart, D., & Chaudhary, L. (2019). Extractive institutions? Investor returns to Indian railway companies in the age of high imperialism. Journal of Institutional Economics, 15(5), 751-774.

Besides the purely financial aspect, another significant factor in the construction of Indian railway lines was the commercial interest of British mercantile firms based in London. The owners of these companies felt that the building of railways in India would lower transportation costs within India, facilitate access to raw cotton, and open Indian markets to British manufactured goods (Bogart and Chaudhary, 2015). Concurrently, there was a push for the construction of railways from Indian merchants and Indian industrialists as well. One such example is a Bengali merchant named Dwarkanath Tagore[3], who offered to fund a third of the capital needed for a railway line linking Calcutta northwest to the Burdwan coalfields (Thorner, 1955). However, no significant developments materialised from any proposals by the Indian business classes. In fact, it was pressure from British merchants that persuaded the British government to build railways in India. The British Indian government at the time lacked the financial resources to build railway lines independently. This led Lord Dalhousie[4] to offer a 5 per cent guaranteed return on capital for any railway project in British India. According to Wolmar and others, this guarantee of a 5 per cent return was underwritten by the British Indian government. As per available records, there was no occasion that British India could not honour this guarantee, and to that extent, it is moot whether the British government in London had provided counter guarantees. Around this time, railway lines were also being built in France with similar guarantees for financiers (Wolmar, 2017). In these public-private partnership arrangements, the British Indian government provided land for railway lines free of cost. In mid-19th century, the prevailing mode of bulk transportation over land in India was bullock carts, which played a significant role in the construction of railway lines. For instance, thousands of bullock carts were employed to transport drinking water for workers laying rail lines in the hills and mountains of the Western ghats (Wolmar, 2017).

A sufficiently high return on capital to private financiers based in Britain and other locations overseas, plus technical parameters which resulted in higher costs, were perhaps among the many reasons for the limited spin-off contribution of railways to India's industrialisation. (Bogart et al., 2015). This is corroborated by the following quote: *"railways made a smaller contribution to income per-capita growth in India compared to the most dynamic Latin American economies between 1860 and 1912. The smaller contribution in India is related to four factors: (1) the smaller size of railway freight revenues in the Indian economy, (2) the higher elasticity of demand for freight services, (3) lower wages, and (4) higher fares."* (Bogart et al., 2015).

The British Indian government stipulated the laying of broad-gauge railway tracks of 5'6" width for Indian railway tracks, which were more expensive. In contrast, the standard widths of railway lines in Europe

[3] He was the grandfather of poet laureate Rabindranath Tagore. His firm's name was Carr, Tagore & Co. It is generally agreed that after Dwarknath's premature death, most Indian merchants played a passive role.

[4] Lord Dalhousie was a governor-general of India for 8 years from 1848-1856. His principal preoccupation while in India was consolidation of British power. His reforms included pushing construction of railway tracks, bringing telegraphy and postal services into India, and strengthening the Public Works Department to complete, for example, the Ganga canal. He also started Anglo-vernacular schools and engineering colleges.

and America at that time were 4 feet 8.5 inches and a narrower metre gauge, which was 3 feet 3.375 inches wide. It could be speculated that this width of 5'6" was chosen for railway tracks because it matched the width of bullock cart axles at that time. However, there is no readily available documentary evidence to support this hypothesis. In any case, bullock cart paths were to be replaced by railway tracks, and to that extent, those paths would no longer be used by bullock carts. Alternatively, it could be argued that broad-gauge tracks were better suited for the Indian terrain and high wind speeds during monsoon months. Again, there are no records that extensive studies were undertaken to assess wind speeds during various seasons and how these affected railway traffic over tracks of varying widths over Indian terrain. The following quote provides the reasons for the widths chosen for railway tracks: "*The initial trunk lines were constructed on the standard gauge of 5 feet 6 inches, which was wider than the standard gauge of 4 feet 8 inches employed in much of the United States and Britain. When Indian railways were constructed, the engineering community in Britain favoured the broad gauge because it was believed to lower the cost of operating high-volume railways. Opinions changed by the 1870s and engineers began advocating the metre gauge (3 feet 3¾ inches), which was cheaper to build. The GOI favoured the metre gauge for feeder lines connecting to the main trunk lines…. By 1900, the metre gauge lines comprised 41 per cent of the network compared to 56 per cent on the Indian standard gauge… The long-term economic implications of the mixed gauge network, especially the costs of inter-connection, are believed to have been significant, but more research is needed before a definitive statement can be made.*" (Bogart and Chaudhary, 2012, p. 4)

By the 1870s, the British Indian government acknowledged the difference in the width of broad-gauge lines in India and comparable lines in Europe and the US. Thereafter, the Indian government approved metre gauge lines, which complemented the more frequently used broad-gauge lines. These meter gauge lines were built in Northern, Eastern, and Western India, as well as the deep South. Such lines were also built to a limited extent in central India and the Bombay Deccan (Thorner, 1955). All things considered; it must be conceded that the broader gauge railway tracks in India possibly made it easier to haul heavy cargo over longer distances.

Merchants and manufacturers based in the UK wanted to increase their imports of raw cotton and sell more manufactured textiles in India. They were thus supportive of investments in Indian railways when presented with funding requirements by promoters. Others, such as Peninsular and Oriental Steam Navigation Company (P & O), had shipping interests and needed more coal supplies at Indian ports. Additional coal at Indian ports helped them bunker the newer steam ships that operated in the Indian Ocean. The initial goals of the expansion of the East Indian Railway (EIR) and the Great Indian Peninsular Railway (GIP) company were designed to serve the trade in coal and textiles. However, the British Indian government initially restricted EIR and GIP to building railway lines over short stretches of a few dozen miles. The government wanted these to serve as experimental lines, which is why EIR undertook a project to operate railway lines a few dozen miles north of Calcutta, and GIP established railway tracks thirty-five miles north from Mumbai (Bombay) to reach Kalyan. EIR's ambition was to eventually run a railway line from Calcutta to coal mines that were 100 miles north of Calcutta. GIP intended to run the railway line east of Bombay over the mountains of the Western Ghats to reach the rich cotton fields of the Deccan (Thorner, 1955).

By late 19th century, India had one of the largest railway networks in the world.[5] However, there were no Indians in higher management or technical positions. Effectively, the various Indian railway lines—whether owned privately, by the British Indian government, or the princely states—were managed by Britishers based in London and operating in India. Almost all the equipment used by Indian railway lines was of British origin and hence dependent on supplies and spare parts from Britain. The placing of large orders for the supply of rolling stock and engineering equipment from England helped private British houses expand their businesses.

Even by the end of the 19th century, Indian railway companies did not push to maximise passenger and freight traffic. Due to the guaranteed returns on borrowings, the underlying financial interest was apparent. Even if transportation-related revenues were low, the British Indian government would nevertheless provide an annual return of approximately 4-5 per cent. In this context, "*the initial public guarantees*

[5] Charles Hardinge was Viceroy and Governor-General of India from 1910 to 1916.

have been heavily criticized by both contemporaries and subsequent researchers (Hurd 1983, Thorner 1955, Derbyshire 2007, Sanyal 1930). According to critics, guarantees were responsible for the high construction costs of the 1860s, the poor performance of the initial lines, the related interest costs imposed on the GOI (and hence Indian tax payers)" (Bogart and Chaudhary, 2011). However, the same two authors assert in a paper titled "Extractive institutions? Investor returns to Indian railway companies in the age of high imperialism" that the average return of 3.7 percent on investments in Indian Railway lines was not too high. An extract from that paper is as follows: *"Did colonial policies in India deliver excessive returns to British investors? We answer this question using annual data on Indian securities trading on the London Stock Exchange. We present new series on market capitalization, capital gains, dividend yields, and total returns of railway securities from 1880 to 1929. When the Government of India purchased large positions in the private railway companies between 1880 and 1910, there were opportunities for profit making. However, we find no evidence of abnormal investor returns in the years leading to the purchase of railway companies. Broadly our findings call into question the extractive nature of colonial railway policy."* (Bogart and Chaudhary, 2019).

Despite this explanation, the paper does not plausibly explain why a guarantee of 5 per cent return on capital invested in Indian railways would not inevitably raise the return from 3.7 to 5 per cent if there were shortfalls. Further, why would costs not be padded or heeded if the return on invested capital is guaranteed? The British Indian government provided the land for railways free of cost, and it is unclear if this was the case in the other countries, and if so, to what extent.

Considering the relatively low cost of human resources in India compared to England, Indian railway fares were high (Thorner, 1955). However, freight charges for the transportation of long-haul bulk cargo between the ports of Bombay, Kolkata, and Madras, and the hinterland were comparatively low. These bulk cargo companies were mostly British-owned, and the haulage rate policies were designed to maximise revenues. As railway lines were laid in other countries, industrial development grew in those jurisdictions. However, the policy of buying all heavy equipment exclusively from Britain meant that India did not industrially benefit from the development of Indian railways (Wolmar, 2017). Prominent British decision-makers, including Lord Curzon, dismissed as "ridiculous" any suggestions that overall development returns from irrigation projects could surpass investments in railways, leading to a more balanced development of the Indian economy (Sweeney, 2015).

On a separate yet related note, regional railway networks such as EIR, GIPR, and Bombay-Baroda line were used to cross-subsidise such railway networks which were loss-making "white elephants" through "creative accounting" (Sweeney, 2015). At the same time, the following quote from Sweeney indicates that financial guarantees resulted in a wider railway network than would have been possible without assurances on returns for financiers.

"*Without the guarantee system, the network of India may have been much smaller than the 5,000 miles reached by 1869. The rail companies had raised capital of some £82 million, which in crises like the Mutiny would have been redirected to other purposes had railway finance come out of general government financing. In general, private sector discipline had placed curbs on the excesses complained of by sceptics, who lobbied Argyll for state control.*" Sweeney also refers to the practice of some railway companies **using 'creative accounting'** (emphasis added) "*by taking expenses to the capital account of the financial statement, rather than through the profit and loss statement, so massaging distributable profits upwards for the guaranteed shareholders*" (Sweeney, 2015, p. 17-18). Sweeney adds that the accounting flexibility lent by **"off balance sheet guarantees** (emphasis added) gave officials and their promoter/financier friends room to press specific projects…In fact, large guarantee payments were made until well into the twentieth century." (Sweeney, 2015, p. 181-182).

The insurance industry based in the City of London grew richer by insuring shipments between Britain and India. To that extent, the financial sector in London is likely to have widened and deepened as trade between Britain and India grew. For example, the Bengal-Nagpur railway was funded by the Rothschild family by issuing bonds. Several privately owned companies which were headquartered in London owned railway lines in India. There was a sharp rise in the numbers of passengers over time, and while there were 19 million passengers in 1871, this number rose to 190 million by 1900. At the same time, the priority in descending order was freight, then troops, and lastly passengers. By 1900, Indian

railways was the largest employer and largest industry in India. However, prior to Indian independence, the government-owned lines were not profitable. It needs to be noted, though, that due to gaps in information about the sources of funding and revenues generated, any direct comparison between railway lines owned by government and those owned by private parties is not likely to be accurate.

Most railways contractors were initially British till Jamsethji Dorabji, who was of Parsi descent, was permitted to break into this British monopoly of building railway lines in India. The British gradually conceded that wealthy local contractors, such as Jamsethji, had a better understanding about Indian labour markets. During late 19th and early 20th centuries, there was greater mechanisation in the construction of railway lines in the US and UK compared to India where labour was cheaper and hence more used.

All things considered, it is apparent that private British parties were granted an excessive return by the British Indian government, as it chose to provide a guaranteed return of 5 per cent when the British sovereign and the Bank of England borrowed at approximately 3 per cent per annum rate of interest. It was estimated that about GBP 50 millions of British India's annual revenues were used in providing this subsidy and it is likely that guaranteed returns resulted in overspending on Indian railway lines. After 1884, the assured rate of return on the financing of railway lines in India was reduced to 3.5 per cent.

2.2 Strategic and Opium Trade Considerations

Lord Dalhousie cited political and commercial reasons for building railways. The commercial reasons were obvious since transportation via railways was faster than the much slower movement of goods over uneven dirt roads using bullock carts. Also, goods no longer needed to be transported from Kolkata to Mumbai via the Palk Straits by ship but could be sent overland by train. On the strategic aspects, Lord Hardinge[6] pointed out that if rail transportation is readily available and sustainably affordable, large garrisons of troops would not be required at multiple points since soldiers could be transported to trouble spots relatively quickly by train. The Russian Trans-Caspian train line came up to Merv in Turkmenistan and was later extended further east. It was built by Russia as its empire extended deep into Central Asia in the 19th century. Lord Curzon commented that this Russian railway's importance went beyond local military control and threatened British interests in India. Even though there were limited commercial reasons for such a move, the British felt that they had to respond by extending Indian railway lines westwards.

Railways had already disrupted traditional Indian society starting from the 1860s, by which decade construction had literally gathered steam. By the late 19th century, a few Indian nationalists resorted to terrorism against the railways. Some criticised the railways claiming that their embankments led to floods. Furthermore, the passenger cabins for Indians were unsanitary compared to cabins meant for Britishers. In 1909, Gopal Krishna Gokhale criticised the railways for its discrimination against Indians in employment at higher levels and called for railways to be nationalised (Wolmar, 2017). As per available records, it does not seem there were white-only trains in British India or compartments. The segregation was more due to the huge difference in fares between first and third-class compartments.

At the time of the first war of independence in 1857, the total population of the entire sub-continent was about 280 million. According to Kerr, the British Indian government "*lost control of much of north and central India outside of a few tenuously held cities and major lines of communication*." At the same time, "*other areas including the great port cities and administrative centres of Bombay, Madras, and Calcutta, remained …. under British control*." This widespread revolt "*…further convinced the Government of India of the advantages railroads offered to the colonial power, and the need to push ahead rapidly with construction. The authorities had noted how the lines that were open had facilitated troop movements, and they felt that had more lines been available the 1857 mutinies and civil disturbances might have been more quickly suppressed*" (Ker, 2007, p.22).

Wolmar confirmed this understanding and wrote that "***the 1857 Rebellion had demonstrated the importance of the railways in keeping order and had led to their expansion*** *(emphasis added). They were… the mainstay of transport for the police and troops and without them it was impossible to keep hold of the country*." And some railway stations were used as for-

[6] Charles Hardinge was Viceroy and Governor-General of India from 1910 to 1916.

tresses by British forces. From then on, that is 1857 till 1947, "*[a]nlgo-Indians were disproportionately represented at higher levels in Indian railways, relative to their population, as they were deemed to be more loyal to the British India government*" (Wolmar, 2017, p. 214, 217).

"Exports of opium from British India increased from 4,000 chests per year at the beginning of the 19th century to more than 60,000 chests by the 1880s" (Bauer, 2019, p.2). The transportation of this huge increase in exports was in all likelihood, facilitated by the laying of a widespread network of railway lines by the 1880s. According to Bauer: "*…the government's opium industry was one of the largest enterprises on the subcontinent, producing a few thousand tons of the drug every year—a similar output to Afghanistan's notorious opium industry today.… However, unlike the illicit trade in Afghanistan, India's colonial opium economy was a legal business that was not only sanctioned but organised and actively promoted by the state…**Opium was, for the largest part of the nineteenth century, the second most important source of revenue for the colonial state and it was only outmatched by the taxes that the government collected on land** (emphasis added). Although opium has had a long history in the region as both a medicinal and recreational drug, it was only under British rule that it became a major item of trade.*" The revenues from opium trade were only outmatched by extortionary land taxes (Bauer, 2019, p. 2).

To sum up, for richer Indians who were based in Mumbai or Kolkata, opium trading was hugely profitable. In the colonial era, the commercial production of opium was a significant source of revenue for British India. What made it disastrous for peasant farmers was that the cost for manure, irrigation, etc., was higher than income generated from the sale of raw opium. Concurrently, opium production resulted in widespread addiction, particularly among those who were close to centres of opium cultivation. Further, this trade with countries to the East and West earned India a bad reputation, which persists even today in China.

On a related note, there are the starvation risks faced by average Indians. Widespread famines occurred every few decades in the 19th and 20th centuries after the British took full control of the country. For example, in the 1874 famine in Tirhut (Bihar) and Chennai famine in 1877-78, about 2 million people starved to death. There was another famine in Western and Central India in 1899-1900, and the last major famine while the British ruled India was in 1942-1943 in Bengal. Ignoring the causal reasons for famines, including inadequate expenditure on irrigation as compared to railways, railway lines were useful in transporting grain to the affected regions at such times.

As for overall administrative control over British India, so-called "political agents" were stationed in the capitals of princely states to keep an eye on development which may have an impact on overall British control over the Indian sub-continent. This is evident from the following quote from Fisher (1984): *"The British Empire established itself and expanded largely through its incorporation of existing indigenous political structures. A single British Resident or Political Agent, controlling a regional state through "**advice**" (emphasis added) given to the local ruler, became the norm for much of the Empire. India's princely states, where from the mid-eighteenth century the British first employed and developed this system of indirect rule, stood as the conscious model for later imperial administrators and politicians who wished to extend the Empire without the economic and political costs of direct annexation*" (Fisher, 1984, p. 393).

2.3 Gandhi's Criticism of Indian Railways

Mahatma Gandhi was critical about the unintended consequences of railway traffic in India, and he voiced his opposition in *Hind Swaraj*. According to Gandhi: *"…railways, lawyers, and doctors have impoverished the country, so much so that, if we do not wake up in time, we shall be ruined…It must be manifest to you that, but for the railways, the English could not have such a hold on India as they have*" (Gandhi, Hind Swaraj, 1909 p.47). Gandhi wrote that famines are more frequent in the country due to railways since businesses moved food grains from one place to another, destroying the self-sufficiency of Indian villages and towns.

Gandhi's negative experiences while travelling by train are encapsulated in a short write-up titled "Third Class in Indian Railways" (Ranchi, September 1917). The following was a comment about the difference between travelling 1st class as compared to 3rd class: *"it is a known fact that the third-class traffic pays for the ever-increasing luxuries of first and second-class travelling… (third-class passengers) squat on dirty floors and eat dirty food.*" Yet, trains were useful for Gandhi to explore and meet with weaker economic sections through the length and breadth of India.

3. Financing of Railways in Europe, the US, and China

In India, by 1870, approximately GPB 70 millions were spent in building railway networks across the country (O'Brien, 1983). In comparison, in the year 1850, the capital expenditure on railways in Britain was GBP 8.68 millions, and for 1870, the expenditure was GBP 6.54 millions (Kenwood, 1965). The amounts invested in German and French railways in the second half of the 19th century are listed in the following table.

Table 3: Investment in German & French Railways

Year	Germany (million marks annual average)	France (million francs annual average)
1855-1859	134	355
1860-1864	142	322
1900-1913	489	386

Source: O'Brien, Patrick, ed. *Railways and the economic development of Western Europe, 1830-1914*. New York: St. Martin's Press, 1983, p. 32, 124

European government bonds carried interest rates of approximately 3 per cent, and in the 1880s, interest rates were approximately 6-8 per cent for railway loans in the US. The four large investors in US railway lines were of British, Dutch, German, and French origin. British firms such as Baring Brothers, N.M. Rothschild and Sons, and J Brown and Company were at the forefront of investing in US railway networks (Roth and Dinhobl, 2017). The higher rates of interest and lower costs of bond issuance promoted such investments in the US.

Later in the first half of the 20th century, and particularly during the Nazi era, German railway networks were popularised as a symbol of national pride. A robust volume (*Hundert Jahre deutsche Eisenbahnen - One Hundred Years of German Railways*) was published celebrating the achievements of German railways. This book records that the first German railway line was from Nuremburg to Furth and the locomotive was sourced from England (Roth and Dinhobl, 2017). German railway networks were projected as a symbol of national entrepreneurship and technological advancement, side-stepping the fact that development of railway networks in Europe was supported by innovation around the continent, and capital was accessed from wherever it was available (Roth and Dinhobl, 2017). Investments across borders supported railway development all over continental Europe and, wherever technically and geographically feasible, around the world. For instance, important private cross-border railway investors were the Rothschild family in London and Pereires in France and the Duke of Galleria who invested in France, Austria, Italy, Spain, and Russia. Another key private investor was the Bartholony group. By the 1860s, the Duke of Galleria came to hold important positions on the boards of numerous railway companies in different nations. Separately, Bethel Henry Strousberg was a private investor in Prussian-German railways around 1855-75. These private efforts were not always financially successful. Post 1870, Strousberg's investments failed due to the disturbed political situation in Europe, including the Franco-Prussian war and his own miscalculations. (Roth and Dinhobl, 2017). A company called the Spanish Society of Secondary Railways was established to build a railway system in Spain. The administration of this company was headquartered in Paris, and much of the investment capital came from outside Spain. However, the reach of Secondary Railways remained confined to the northern provinces of Spain. The development of railways in Italy was dependent on financial guarantees plus the government-provided grants based on per kilometre of completed track.

Invariably, capital looking for higher returns found its way across European countries. For example, a Rome-based banker was a large shareholder in railway lines in Germany, France, and England. Similarly, there was French investment in Portugal, although these investors faced difficulties due to Portugal's economic problems, which also gave them an opportunity to dabble in local politics (Roth and Dinhobl, 2017). On a related note, Dutch investors were involved in financing the building of railways in Russia, Austria, and the US. Curiously, however, Dutch banks, stockbrokers and investors played a limited role in building railways at home or in the railways of Dutch East India. The principal reason was that the returns were much higher in investing abroad, even though such investments were risky. According to Veenenedal's investigations, Dutch investors were the second-largest investor group in US railways.

In overall terms, European investment was significant in the building of railways in the US. Numerous US states gave exemptions from taxation or provided free federal land along the lines of the British Indian government's concessions to railway companies in India. About one-third of all railways-related securities issued by US states were held by

foreigners. The largest investor was Britain, followed by investments from Netherlands, France, and Germany. Railway construction was started in the Ottoman empire by numerous investor groups from France, Germany, and the UK. Minor investments came from Belgium and Austria. There was an environment of open competition, illicit rivalry, and corruption in the building of railways in the Ottoman empire (Roth and Dinhobl, 2017).

The construction of railway lines started in Britain, and Britishers also invested overseas, as in India. Interestingly, by 1914, a cumulative total of about 40 per cent of British investment in railways went to the US. Around that time, French investment went into railway construction in northern China, and this was China's first major laying of railway lines. For example, "*…the Beijing-Hankou Railway was supported by the French and Belgian governments and the Chinese Eastern Railway across Manchuria, and the Kaifeng-Taiyuen Railway was backed by a Franco-Russian institution*" (Roth and Dinhobl, 2017). As for the Rothschild investments in Brazil a "*system of interest rate guarantees attracted foreign capital but resulted in an increase of Brazilian external debt during the second half of the nineteenth century; that (in turn) brought serious problems of potential insolvency which finally led the government to contract a back-stop loan in 1898 with the Rothschilds' British bank*" (Roth and Dinhobl, 2017).

The building of railways in continental Europe was across the borders of several countries and was funded by networks of large-scale investors. These large-ticket investors operated internationally with contributions from several smaller investors. From the inception of railways at the beginning of the 19th century to the 1880s, Europe remained a focal point for rising sophistication in railway technology, building of locomotive machinery, including tracks. From the 1880s onward, many countries around the world received financing from domestic and international sources for building railways as a mode of transporting goods and people. The US remained the largest recipient of funds for railways while India, China and Latin America received somewhat lower foreign investments.

It is likely that British-India's national income related numbers were error-prone and approximate at the end of the 19th century. Nevertheless, it was estimated in 1900 that the national debt of British India amounted to GBP 224 million. This was, by today's standards, a conservative 18.5 per cent of national income which amounted to GBP 1.21 billion (Sweeney, 2015). All Indian railway lines operated by a variety of private and government owners were consolidated into one central government owned entity post 1947. In this overall context, the British Indian government's capital expenditures on railways and irrigation in select years between 1896-97 and 1905-06 are provided in the following tables.

Table 4: Expenditure on Railways and Irrigation (2019 Rupees[7])

Years	Railways (Rs million)	Irrigation (Rs million)
1901-1902	6484	1867
1913-1914	17864	3750

Data Source: Bagchi, Amiya Kumar. Private investment in India, 1900-1939. Vol. 5. Taylor & Francis, 2000, p. 41

Table 5: Expenditure on Railways and Irrigation

Year	Railways (£ millions)	Irrigation (£ millions)
1896/97	2.730	0.595
1900/01	1.435	0.590
1905/6	9.410	0.556

Source: Sweeney, Stuart. Financing India's Imperial Railways, 1875–1914. Routledge, 2015, p.189

The expenditure on railways was significantly higher than on irrigation. During the British colonial years in India, there were periodic famines resulting in the deaths of many. To that extent, the British Indian government neglected the welfare of the poorest in comparison with the interests of those who financed the construction of railway lines or were passengers and traders moving goods.

3.1 Railways in British India and other nations between 1900-1947

Around early 20th century a British railways gazette writer described Indian railways as positively surprising. This reporter commented that he was "awe-struck" to see the clean white uniforms worn by guards and station masters. He also found the gar-

[7] Methodology for conversion of expenditure amounts in 1901-1902 and other years to 2019 rupees: Annual inflation rates starting 1901 used.

dens at railways stations "enticing" (Wolmar, 2017). To him it all seemed rather like back home or even better. This reporter, writing for a subsequent edition of the gazette, had one complaint: there were too many food choices!

Inevitably development of Indian Railways was given less importance in India and in Britain during the First World War years of 1914-1918. There was no routine maintenance during these years and equipment on less-used railway lines were requisitioned to East Africa and Iraq for military purposes. Consequently, Indian Railway companies found it difficult to handle the usual number of passengers and there were delays, cancellations, reduction in speed due to the wearing out of tracks. These developments further antagonised Indian nationalists such as Gopal Krishna Gokhale who felt that Indian railways was not for Indians, and it was only meant to serve the needs of the British mercantile and military classes. Gokhale demanded that more employment be given to Indians in the railway sector as had happened in the Public Works Department (PWD) and this was in addition to the demand of Indian leaders for nationalisation of Indian Railways (Wolmar,2017). After the war years of 1914-18, Indian railways could no longer handle the earlier numbers of passengers or goods. Ian Kerr commenting on the year 1916-17 observed that 50 million fewer passengers were carried that year and the total was 400 million in that year. This was a 13 per cent drop from the previous year. As for freight trains of that era, these moved very slowly at an average speed of approximately 4 miles per hour. It is likely that speeds of passenger and freight trains in other countries such as the US were higher. For example, in 1876 the Transcontinental Express Train took 36 hours to cover the distance between New York and San Francisco at an average speed of about 36 miles per hour.

The following quotes from Wolmar (2017) and Ian Kerr, 2007 provide a summary description of Indian Railways in the second half of the 19th century and at Indian independence in 1947. "*By 1870, there were already around 70,000 permanent railway workers, and in 1905, after a strong growth spurt in the early years of the twentieth century, 437,500 were employed directly by the railways, of which 6,300 were European and 8,600 Eurasian…*" (Wolmar, 2017, p. 126-127). Around 1920, the British Indian government owned 27,000 route miles, 440 miles were owned by princely states and 5750 miles were in private hands (Wolmar, 2017). "*The results of decades of inconstant policies was an Indian railroad system in April 1905 with a small 5,570 miles owned and operated by the state railroad system (13,231 miles were state-owned but privately operated) out of the total mileage of 26,955 miles. By about 1945, however, the situation had changed completely: almost all the railroads in India were state-owned and state operated*" (Ian Kerr, 2007, p. 120). In the first half of the 20th century the: "*route miles and numbers of permanent employees, two measures of success, increased considerably: 35,129 miles in 1919–1920 and 39,678 in 1929–1930 for an increase of 4,549 miles; 692,544 employees in 1919–1920 and 789,903 in 1929–1930 for an increase of 97,359. The employment total in 1929–1930 was not surpassed until 1942–1943*." India's railway networks were estimated to be the 5th longest in the world by 1920. (Kerr, 2017, P.124).

Post the second World War the acquisition of privately owned railway lines by the British Indian government proceeded in a steady and systematic manner. The British Indian Government gradually terminated the contracts with the railway companies and took over the management of these railway lines on the dates mentioned below.

Table 6: Name of Major Railway Lines and the Date of Taking Over by the Government

Name of Railway	Date of taking over by the government
The East Indian Railway	1st January ,1925
The Great Indian Peninsula Railway	1st July, 1925
The Bombay Baroda and Central India Railway	1st January, 1942
The Assam Bengal Railway	1st January, 1942
Oudh and Tirhut Railway	1st January, 1943
The Madras and Southern Maharashtra Railway	1st April, 1944
The South Indian Railway	1st April, 1944
The Bengal Nagpur Railway	1st October, 1944

Data Source: Evolution of Indian Railways—Historical Background, Indian Railways. URL https://indianrailways.gov.in/railwayboard/uploads/codesmanual/ADMIN_FINANCE/AdminFinanceCh1_Data.htm

The US, Germany, and the Union of Soviet Socialist Republic (USSR) had the longest railway tracks around the beginning of World War I. By 1937, India had 26 miles of railway lines per 1000 square miles of area, whereas the US had more at 80 miles and for Germany this number was more than three times

that for the US and was at 253 miles for the same land area. In terms of population, in 1937, India had 0.11 track miles per person, whereas the same number for the US was much higher at 1.4 (Thorner, 1955).

Table 7: Railway Lines per 1000 Square Miles of Area in 1937

Countries	Per thousand square miles
India	26
US	80
Germany	253

Source: Thorner, D. (1955). The pattern of railway development in India. The Journal of Asian Studies, 14(2), 201-216.

Around the start of the second World War in 1939, American railroads hauled 2977 ton-miles of freight per capita. The Russian railroads hauled 1134, the German 795, the British 424, the Japanese 138, the Indian 60, and the Chinese only 17 (Thorner, 1955). In 1942, the railway mileage per 100,000 square miles and 1,000,000 population respectively were as follows: United States, 7,970 and 1,940; United Kingdom, 21,360 and 436; Germany, 20,150 and 550; Japan, 9,120 and 190 and for China, the estimate in 1942 was, 12,036 miles of railway lines, including those in Manchuria and occupied areas; the ratio was then 274 miles of railroads per 100,000 square miles, and 27 miles per 1,000,000 population (Sun, 1953). In India, the total length of operational railway tracks of all widths totalled 41,052 miles in 1941 (Kerr, 2007). Daniel Thorner has pointed out that in 1947 in terms of track length per square mile of land mass the Indian railway system was not that dense, and many urban areas were left out.

Table 8: The Railway Mileage per 100,000 Square Miles and 1,000,000 Population in 1942

Countries	Railway mileage per 100,000 square miles	Railway mileage per 1,000,000 population
US	7,970	1,940
UK	21,360	436
Germany	20,150	550
Japan	9,120	190
China	274	27

Source: Sun, E-tu Zen. "The Pattern of Railway Development in China." The Journal of Asian Studies 14, no. 2 (1955): 179-199; Chang, Li. "Railway Construction in China." Far Eastern Survey 22, no. 4 (1953): 37-42.

Table 9: Length of Railway Tracks in 1911-1914

Country	Length (miles)
Britain (1914)	23,000
US (1914)	252,105
USSSR (1913)	36,000
India (1911)	31,310
Germany (1913)	35,000

Sources:

Britain – Network Rail, https://www.networkrail.co.uk/stories/wwi-and-the-railway/

US - Series K 28-42.-Railroads-Mileage, Equipment, And Passenger Service; Operating Steam Railways; 1890 To 1945, Historical Statistics of the United States, 1789 – 1945, Census Bureau

USSR - Whitworth, C. E. (1943). The Russian Railways. The ANNALS of the American Academy of Political and Social Science, 230(1), 150-158.

India - Kerr, Ian J. Engines of change: the railroads that made India. Greenwood, 2007

Germany - Kuczynski, R. R. "German Railways and German Public Finances." Journal of Political Economy 32, no. 2 (1924): 137-163.

Table 10 provides the manufacturing and construction as percentages of Indian GDP in 1947 compared to the same proportions in the US and China.

Table 10: Percentage Composition of GDP (1947)

Countries	Manufacturing	Construction
India	8.9	—
USA	25.6	3.7
China (1933)	—	0.01

Sources: Yuskavage, Robert E., and Mahnaz Fahim-Nader. "Gross Domestic Product by Industry for 1947-86." Survey of Current Business, December (2005): 70-84; Sivasubramonian, S. The National Income of India in the Twentieth Century, Oxford University Press, 2000. Groningen Growth and Development Centre, Historical National Accounts Database, March 2009, http://www.ggdc.net/

A part explanation of the relative smaller share of manufacturing in India as compared to the US was perhaps because railway engines and hardware was mostly imported from Great Britain. Almost all steel, machinery and engines came from Britain despite the high transportation costs. At no stage did the British set up production facilities for railway equipment in India. It is conceivable that if the British had allowed domestic industry to cater to the needs of Indian railway companies prior to independence this may have led to greater capital accumulation and industrialisation of India by 1947.

3.2 William Acworth Committee – Government Takeover and Financial Statements of Indian Railways

In 1903, the finances of Indian railways were separated from those of the Government of India. To provide a common approach, a Railway Board with oversight responsibility and control was set up in 1905. However, technical standards were different in the various segments of Indian railways because of varying ownership structures. The importance of the railway sector for the overall economy of British India was evident from the fact that, by 1920, about 50 per cent of British India's revenues came from railways. It is in this setting that the British Indian government set up the Sir William Acworth committee in the same year to examine the working of Indian Railways. The Acworth committee's report on Indian Railways was made public in 1921. This report's recommendations resulted in systemic changes in the working of Indian Railways with consequences that have lasted till now. Acworth was considered an outstanding British railway economist of that era and his report worked in favour of those who were seeking "Indianisation" of railways. This committee considered the dissatisfaction of Indians with the working of the several railway lines and investigated the finances of Indian Railways. It was well understood by then that it was Indian taxpayers' who were bearing the losses, if any, and British investors invariably received a healthy rate of return on their investments. Acworth did not accept the suggestion that the finances of Indian railways were negatively impacted by the shortage of resources during the First World War. He was of the view that a long period of under-investment and neglect had resulted in what was then considered the poor state of Indian railways.

Although William Acworth was known to favour private management of railways, he recommended government ownership and management of Indian railways (Thorner, 1955). Individual railway companies, which were partly or fully-owned by individual Britishers, Indians/Princely States or privately owned companies, were gradually taken over by the British Indian government. This was to be expected given the large number of employees, importance of the railway system in the economy and to further centralise British control over India. Around 1924, the Indian government placed the EIR under full government ownership and management. In a step-by-step manner, other significant railway lines were gradually brought under state ownership and control. By the mid-1920s, most Indian railway lines had become government owned and managed (Bogart and Chaudhary, 2015). However, all private railway lines were not taken over by government and a few relatively shorter railway lines continued to be owned by princely states till 1947.

Around that time, in several other countries around the world the respective governments acquired local railway companies. For example, in "*Germany, Japan and Russia, railways had come fully under government control, while France was considering legislation for nationalisation and soon afterwards created the government owned Société Nationale des Chemins de Fer Français. Similarly, in other parts of the British Empire, such as Australia and Canada, railways were run by the state*" (Wolmar, 2017).

The revenues of Indian Railway lines were estimated at 2.6, 3.2, and 4.9 per cent of gross national income in 1901, 1919, and 1939, respectively (Bogart and Chaudhary, 2015). Among the several other recommendations made by the Acworth committee, there was a pointed suggestion for greater clarity about the finances of Indian Railways. The committee argued that the accounts of Railways should be separate from that of the government. After a separation of the railway budget from the finances of the government in 1921, this budget was again merged with the union budget in 2017. It is ironic that a complete separation from government accounts and transparency in the accounting of all operations of Indian Railways has not happened even as of end 2023.

Around 1921 Indian Railways transported 560 million passengers annually. The population of undivided India was about 389 million in 1941 and by 1951 it was 437 million.[8] Post the first World War, the profitability of Indian railway lines declined as trade unions became more powerful. It is also likely that trucks came to be used increasingly for transporting cargo, reducing the tonnage moved by rail. In the 1930s, the government decided that a merging of lines was required because separate owners meant disparate interests and the economic depression in the US and Europe had caused a negative impact on

[8] A census was conducted in a "synchronous and complete manner every ten years since 1881" The data available is for 1941 and 1951, since it was conducted every ten years. (The National Income of India in Twentieth century, S Sivasubromonian).

the finances of Indian railways. To an extent, innovations such as bazaars on trains proved to be profitable and things turned around financially for Indian Railways by the mid-1930s. The capital of British India shifted formally from Calcutta to Delhi in 1931. After Indian independence in 1947, the Indian central government came to own all Indian railway lines.

4. Indian Railways From 1947-2023

Partition of India Railways

The Annual Reports of the Indian government's Ministry of Railways are readily available. The reports of the Indian central government appointed committees too are in the public domain. A 1988 book titled the "History of Indian Railways" by G.S. Khosla records improvements and developments between independence and the mid-1980s. This book was published by the Ministry of Railways and to that extent is not an independent study. An extensive search for writings on Indian Railways post 1947 yielded almost no results of papers or books by independent railway experts, historians, or generalist authors. By contrast, there are so many publications, books, and research papers, about the building and performance of Indian Railways prior to 1947.

At its pre-independence peak Indian railways had a million workers, of whom about 12,300 were Eurasians and Anglo-Indians (Wolmar, 2017). After Indian independence in 1947, almost all British railway and management professionals employed at senior management and technical levels left India. Consequently, there was a sense of foreboding that Indian railways would collapse with the departure of the British much as perhaps Winston Churchill had suggested that British India would break-up into multiple countries. The following quote provides a sense of the difficulties in managing the complex transition between British India and independent India post-partition.

"*The immediate issue arising out of Partition was to sort out the sections of railway that had lost huge chunks of their mileage to Pakistan. Two major systems, the Bengal Assam Railway in the east and the North-western in the west, were split, and a few other minor companies also saw sections of their routes cut off by the new border. The North Western was the worst affected, losing 5,000 of its 6,900 route miles, which included all those difficult-to-build but little-used frontier lines, while the Bengal - Assam region was more fortunate, retaining 2,600 miles (60 per cent) of its former 3,550 route miles*" (Wolmar, 2017, p.227).

The doomsday predictions for Indian Railways proved to be incorrect. India managed the transition efficiently and expanded railway networks across the country despite the losses in trained enginemen and workers around 1947. As East Pakistan stood between mainland India and the north-east, independent India had to build railway connectivity with Assam post-haste. Assam was reconnected to the rest of India via a 229 km stretch of a meter gauge line which was built through West Bengal. This link was opened to passengers on Republic Day, 1950 and the work was completed within two years. For this link "the Kishanganj branch of the Darjeeling Himalayan Railway was taken over and converted to metre gauge and connected to the North-Eastern Railway (NER) network at Barsoi. The Teesta Valley Line was taken over till Sivok, but the rest of it was devastated by floods and closed. The link spanned the Teesta, Torsha, and Sankosh rivers. The Assam Rail Link project also saw the first use of pre-stressed reinforced concrete in railway construction in India" (Indian Railways Fan Club). After 1947, the Indian government set up 6 separate zones for Indian railways and was able to continue running trains on these networks. In 1941, the operating route miles of Indian Railways was 41,052. By 1951 this number had come down to 33,230 route miles or 53,168 route kilometres reflecting the partition of India (Kerr, 2007).

4.1 Electrification & Domestic Production of Locomotives and Coaches[9]

Although the electrification of Indian Railways started around 1925 by 1947, a mere 388 kilometres of railway tracks were electrified. Thereafter, the progress was steady but slow and by 2011 about 19,600 kilometres of tracks were electrified. Over the next ten years by 2021 a total of about 44,804 kilometres had been electrified. Out of a total route length, broad, metre and narrow-gauge tracks combined of 68,103 kilometres this amounted to about 66 per cent electrification. If this rate of progress is maintained, it is possible that all Indian railway tracks would be electrified by 2030. Clearly, this would be a positive

[9] https://indianrailways.gov.in/railwayboard/view_section.jsp?lang=0&id=0,1,304,366,532,565

change for the efficiency with which trains would run since there would be no delays due to bottlenecks in the supply of diesel. Further, the severely harmful effects of inhaling carbon dust and/or smoke that coal-fired and diesel-powered locomotives emit would be reduced. Appendix 3 provides the time-line in the electrification of Indian Railways from 1925 to 2021.

Prior to Indian independence almost all the hardware for Indian Railways was produced in the UK and no significant heavy engineering works for manufacturing railway hardware were set up locally. In 1950 the Chittranjan Locomotive Works (CLW) started production of steam locomotives. CLW is located about 32 kilometres from Asansol and 237 kilometres from Kolkata. This location was chosen as it was envisaged that power would be available from the Damodar Valley Corporation's hydroelectric and thermal power stations. CLW also set up a steel foundry, with technical support from the UK, to produce steel castings for railway tracks. This CLW facility produced coal and diesel-powered engines, and the first electricity powered engine was manufactured in 1961.The well-known Integral Coach Factory (ICF) was set up in Chennai in 1955 and it is owned and operated by Indian Railways. ICF produces railway coaches and electricity powered locomotive engines are soon to be manufactured at this facility. By contrast to CLW and ICF, which were set up after Indian independence, the Jamalpur (Bihar) locomotive workshop was set up as far back as 1862. This workshop was established by the East India Railway Company (EIRC) to make imported rolling stock functional and carry out repairs. Indian Railways' mechanical and electrical engineers have been trained in Jamalpur.

This paper does not include the development of metro-railway networks in several large cities in India including Delhi, Kolkata, Mumbai, Bengaluru, Jaipur, Hyderabad, Chennai, Lucknow and so on. Another 15 cities have metro projects which are under construction are at various stages of completion. Several metros such as Delhi were built under collaboration with foreign parties, and the Delhi and Mumbai metros are jointly owned by the central government and the respective state governments. These metro networks have a cleaner look and are providing a cleaner and more efficient service than Indian Railways. This could be due to the standards set by foreign collaborators or because part ownership of state governments has resulted in a sense of local accountability. This short reference to metros in major Indian cities is a reminder that such services are proving to be relatively efficient.

4.2 Passenger Trains & Car/Air Travel

Vande Bharat passenger trains is an indigenous Indian effort, and these trains are manufactured at Integral Coach Factory, Chennai. Currently, Vande Bharat trains run at a maximum speed of 160 kilometres per hour and the Rajdhani and Duronto trains run at about the same top speed. This highly commendable effort has been entirely the work of India based engineers. At the same time, it needs to be noted that a Vande Bharat train takes about 4 hours and 50 minutes to cover the 240 kilometres from Delhi to Dehradun. This train has 7 stops in between the start and finish points which are way too many for a fast train. Subtracting an average of 5 minutes for each stop out of the total time taken of 4 hours and 50 minutes, this Vande Bharat train runs at an average speed of 57 km per hour.[10] Given the improvements in highways in recent years it now takes about 4 hours of non-stop driving by car to cover the distance between Delhi and Dehradun. For Vande Bharat trains to be competitive vis-à-vis cars, it has to cover this distance at most in 2 hours with just 2 stops in between.

Table 11: Claimed Speeds of Vande Bharat Trains

Vande Bharat Trains	Claimed Speed (kilometres per hour)
Gandhinagar - Mumbai	90
New Delhi - Shri Mata Vaishno Devi Katra (J&K)	81
New Delhi - Varanasi	105
New Delhi - Amb Andaura in Himachal Pradesh	78
Chennai - Mysuru	74
Nagpur - Bilaspur	71
Howrah - New Jalpaiguri	83
Secunderabad-Visakhapatnam	73
Mumbai-Solapur	62
Mumbai- Shirdi	46

Data Source: IRCTC – Schedules

[10] As of 10 July, 2023.

The distance from New Delhi to Chennai is almost 2180 kilometres. The MAS[11] Duronto Express covers this distance between Hazrat Nizamuddin station and the Chennai central railway station at an average speed of 75 kilometres per hour. This is the fastest train between Delhi and Chennai, and it takes about 29 hours to reach the capital of Tamil Nadu from the national capital. The average train takes around 34 hours to cover the same distance and according to the IRCTC the slowest train takes around 44 hours.

The fastest train for travel between the national capital Delhi and information capital Bangalore is the 22692 K.S.R. Bengaluru Rajdhani Express. This train takes 33.5 hours to travel the distance of 2,176 kilometres between Delhi and Bangalore at an average speed of 66 kilometres per hour. Ordinary passenger trains are slower as they must make way for faster trains such as Vande Bharat, Rajdhani and Shatabdi trains.

The average speeds of trains in various countries reflect the relative technical sophistication of the countries concerned. Table 12 lists the speeds of a few of the world's fastest trains.

Table 12: Passenger Train Speeds

Country	Train	Maximum Speed km/h
China	Shanghai Maglev	460
China	CR 400 Fuxing	350
Germany	Inter City Express 3 (ICE 3)	330
France	Train a Grand Vitesse (TGV)	320
Japan	Japan Railway East 5 (JR East 5)	300
Morocco	Al Boraq	320
Spain	AVES – 103 (Alta Velocidad Espana)	310
South Korea	KTX	305
Italy	Trenitalia ETR1000	300
Saudi Arabia	Haramain High Speed Railway	300

Source: Flying without wings - The world's fastest trains by Ben Jones,(Dec 11, 2021) https://edition.cnn.com/travel/article/worlds-fastest-trains-cmd/index.html CNN

China's fastest passenger trains, called Shanghai Maglev, run at 460 kilometres per hour, at maximum speed and use magnetic levitation technology. They can complete a 30-kilometre journey from Shanghai's Pudong airport to Longyang Road station in the city centre in 7 minutes. Another passenger train, CR400 Fuxing, runs at a maximum speed of 350 kph (CNN, 2022). China boasts the longest high-speed railway tracks, with a distance of about 2397 kilometres from Beijing to Hongkong. Chinese bullet trains, such as G79, take around 8.5 hours to cover this distance, while slower overnight trains, like the Z97, take around 24 hours, and a commercial flight takes 3.5 hours.

Standardisation of design and procedures has kept costs down and this is reported to be a major factor contributing to China's success. The cost of construction for China's high-speed rail network was around USD 17-21 million per km, which is about two-thirds the cost in developed countries (Press Release, World Bank, 2019). It is counter-intuitive but high-speed rail not only saves time but also reduces overall operating costs, accidents, and highway congestion. It is also considered to be better for the environment due to lower greenhouse gas emissions. In 2011, China had an estimated total of 66,239 train track kilometres, and by 2021, this number had increased to 109,767 (World Bank).

Japan is renowned for the high speeds and punctuality of its trains and its fastest trains run at speeds of 300 kilometres per hour. The spotless stations and lack of crowding make train journeys a pleasant experience in Japan. Eurostar and the French TGV trains are among the fastest trains in Europe which run at maximum speeds of 330 kilometres per hour between Brussels-Paris/London and within France.[12] Moscow and St. Petersburg, two of the largest cities in Russia are about 635 kilometres apart and the fastest train on this route takes around 3.5 hours at an average speed of about 181 kilometres per hour (as stated on Russian ticket booking portals).

In the United States, the distance from New York to Chicago is 1262 kms and train speeds are relatively very slow. On average it takes 24 hours to cover this distance by regular Amtrack trains and Amtrak Shore which is the fastest US train that takes around 19 hours. Trains from Boston to Washington DC

[11] M.G. Ramachandran Central Railway Station, commonly known as Chennai Central (station code: MAS), is the main railway terminus in the city of Chennai, Tamil Nadu, India

[12] Eurostar connects the international high-speed routes between London and Amsterdam/ Brussels. It has become a favoured mode of transport between London and Paris. Within the UK it connects London to Kent.

which are 710 kilometres apart take around 8 hours. The Acela Express owned by Amtrack runs at top speeds of 100 kmph between these two cities. Pete Buttigieg's, the US Transportation Secretary in the current President Biden administration, plaintive comment about US trains was: *"I just do not know why people in other countries ought to have better train service and more investment in high-speed train service than Americans do."*

Over the past two decades airports in major Indian cities have been improved considerably with private sector participation. The central government has emphasised the need to build or expand airports in second or even third-tier cities with investment contributions from the private sector. Further details are available in the following study https://www.ibef.org/research/case-study/rise-of-the-indian-aviation-market.

Effectively, Indian Railways is facing competition for passengers not just from cars and buses but also from lower cost airlines. Currently, even budget travellers prefer air travel for longer distances. Gradually this preference may also extend to travel around 500 kilometres or even shorter distances. In addition to raising train speeds, Indian railway stations need to provide cleaner facilities and hygienic food alternatives if Indian Railways is to increase its share of passenger traffic. A mitigating factor to this trend away from rail travel is the gradual rise in the numbers of Indians who are travelling as tourists. With competitive pricing of rail fares and better ancillary facilities rail travel may hold its own against car and air travel and Indian Railways may possibly even raise its overall revenues.

4.3 Private Passenger Trains

Indian Railway Catering and Tourism Corporation (IRCTC) started privately operated trains named Tejas in 2019. These Tejas trains were initiated on the recommendations of the 2014 Bibek Debroy Committee. However, as of now "*…the physical infrastructure of the train— locomotives, coaches, loco pilots, guards, and security personnel—will remain in the Indian Railways' hands, while the services provided, including ticketing and refunds, parcels, catering, and housekeeping, will be contracted to private players through the railways' subsidiary company IRCTC under the public-private partnership (PPP) model. The IRCTC has signed concession agreements with private service providers, according to which operators will share their profits with the IRCTC, which in turn will pay haulage charges to the railways.*"[13]

The Tejas trains are private sector run trains but are not privately owned. Currently Tejas sleeper trains run from Delhi to Mumbai, Patna, and Agartala. Tejas chair-car trains run on shorter distance routes such as New Delhi - Lucknow, Chennai - Madurai, Ahmedabad – Mumbai, and Mumbai - Goa. As in the case of Vande Bharat trains, Tejas trains too are not significantly fast. For instance, a Tejas train runs from Delhi to Lucknow and vice versa and takes 6 hours and 15 minutes, i.e., at an average speed of 88.8 kmph, to cover this distance, and other express trains take 6 hours and 40 minutes to cover the same distance.

Separately, Indian Railways has catered to wealthy passengers by providing tours of well-known tourist destinations within India using trains called "Palace on Wheels." The tickets for that train were expensive by Indian standards and meant mainly for tourists from developed countries. Concessions for senior citizens and others are not admissible for private trains. The so-called "Bharat Gaurav" trains were launched in 2022. These are theme-based tourist circuit trains. These circuits include places of cultural and historical interest and pilgrimage destinations. The trains do 8-to-10-day tours somewhat on the lines of the Palace on Wheels trains. There are ten Bharat Gurav trains currently, and their tours include places such as Mysore, Hampi, Shirdi, Nashik and, Goa. "During FY 2021- 22, Indian Railways through IRCTC operated 42 trips of Bharat Darshan Tourist Trains carrying 30,714 passengers. All (such) tourist trains are being operated under Bharat Gaurav Train Policy." (Indian Railways Annual Report and Accounts, 2021-2022). As of 2023, it appears that the private trains are priced at levels that are unaffordable for most Indians and are unlikely to attract adequate numbers of passengers to make them commercially viable on a sustainable basis.

[13] https://theprint.in/india/whats-new-in-first-private-train-tejas-hostesses-refunds-for-delays-no-concessions/301938/#:~:text=The%20Tejas%20Express%2C%20in%20fact,Bibek%20Debroy%20in%20September%202014.

4.4 Freight Trains & Dedicated Freight Corridors (DFCs)[14]

Government websites have claimed that Indian freight trains, with the introduction of dedicated freight corridors (DFC), have achieved average speeds of about 99 kilometres per hour. Specifically, 137 freight trains are claimed to have attained average speeds of more than 90 kmph. Nevertheless, "…the share of railways in freight transportation in India has been declining since 1951. In 2020, it stood at merely 18 per cent as compared to the share of 71 per cent for road transportation" (Fast Tracking Freight in India, 2021). This is mostly because average speeds of Indian freight trains are low, as shown in Table 13.

Table 13: Average Speeds of Freight Trains

Speeds of Freight Trains (kms per hour)

Year	BG (All tractions)
1950-1951	17.4
2019-2020	23.6

Data Source: Indian Railways Yearbook 2020-2021

Freight trains are required to make way for passenger trains by moving to siding tracks. This back and forth between the regular tracks to sidings to give right of way to passenger trains lowers the speeds of Indian freight trains. This reduction in the speeds of freight trains due to making way for passenger trains was starkly evident during the COVID-19 epidemic in the years 2020 and 2021. During the COVID-19 years, when the movements of passengers and hence passenger trains were negligible, the average speed of freight trains doubled from about 23 km per hour to 46 km per hour.

According to numbers sourced from the Ministry of Road Transport and Highway, about 60 per cent of India's freight traffic movement is by road. A Ministry of Railways press release dated December 14, 2022[15] states that 27 per cent of freight is hauled by railways. Even in the US, which has 8-lane highways, 46 per cent of freight moves by trucks, 27 per cent by railroads, and the rest via rivers and other waterways (Bureau of Transportation Statistics special tabulations, US). Indian Railways have a National Rail Plan till 2030 which aims to increase the share of railways in the movement of freight to a relatively modest 45 per cent. It also intends to increase the average speed of freight trains to 50 kmph (National Rail Plan Vision, PIB, 2022). An average speed of 50 kilometres an hour is not a sufficiently ambitious target.

It has been glaringly apparent for some time that separate railway tracks are required for goods trains in India. This is to achieve higher speeds over longer distances and for the freight charges to be competitive versus transportation by road. As far back as October 2009, an agreement was reached between the Indian and Japanese governments for collaboration to build two exclusive rail corridors between Delhi-Mumbai and Delhi-Kolkata. These are to be called the Western and Eastern corridors, respectively. Table 14 provides details of various freight corridors, their lengths, start and termination points, as well as their current stages of implementation.

Table 14: Dedicated Freight Corridors

Corridor	Length	Status	Start Point	Termination Point
Western	1,504 km (935 mi)	Partly Operational	Dadri	JNPT, Nava Sheva
Eastern	1,873 km (1,164 mi)	Partly Operational	Ludhiana	Dankuni
East-West	2,000 km (1,200 mi)	Announced in Budget 2021–22	Dankuni	Bhusawal
North-South	975 km (606 mi)	Announced in Budget 2021–22	Vijayawada	Itarsi
East Coast	1,115 km (693 mi)	Announced in Budget 2021–22	Kharagpur	Vijayawada
Southern	892 km (554 mi)	Proposed	Madgaon	Chennai
Total	8,359 km (5,194 mi)	2/6		

Source: Dedicated Freight Corridor Corporation of India Limited (DFCCIL) website

[14] https://economictimes.indiatimes.com/prime/economy-and-policy/dedicated-freight-corridors-put-goods-trains-on-the-fast-track-but-will-transportation-costs-drop/primearticleshow/104865051.cms?utm_source=newsletter&utm_medium=email&utm_campaign=prime_dailynews-letter_unpaid&utm_content=heading_1&ncode=1400fa3ce69eda04ef689f539583fc95e1ce5f5e3d890048fee52f9a23ce5c4cdc1adac677a4ea8325b-faf19e6e8e6fbc1f2e206fee16a802bc3799eeb8e4d7b7775436e91dde642f7dceb74ef5cb3fc

[15] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1883514

As of August 2023, the Eastern and Western corridors were deemed to be partially operational. The other lines are either proposed or have been announced as part of central government Budget statements. The Eastern, Southern, North-South and East-West DFCs are shown in Appendix 2. The following is a comment about how Railways has gradually lost its share of freight traffic. "*Over the years, Railways (has) lost the share in freight traffic from 88 per cent in 1950-51 to 26 per cent in 2021-22. Not only this, but the National highways along these corridors also comprising 0.5 per cent of the road network carried almost 40 per cent of the road freight.*"[16]

As of 2018-2019, Indian Railways earned 1.65 rupees for every ton of freight it moved per kilometre. By contrast, it earned about 44 paise in moving a passenger over the same distance (Indian Railway Yearbook, 2020). The difference between those two numbers has narrowed in recent years. In 2014, this number for freight was 1.44 rupees, and for passengers it was 35 paise. The average rate per passenger kilometre was 66 paise in 2020-21. The average freight rate per tonne-kilometre was 160 paise (Indian Railways Annual Reports and Accounts, 2021).[17]

Table 15: Average Rate per Passenger km and Average Freight Rate per Tonne km

Year	Average rate per passenger km (in paise)	Average freight rate per tonne km (in paise)
1950-1951	1.48	3.16
1960-1961	1.71	3.87
1970-1971	2.5	5.43
1980-1981	3.97	10.5
1990-1991	10.64	35
2000-2001	22.94	73.78
2010-2011	26.3	96.99
2020-2021	65.97	161

Source: Indian Railways Annual Reports and Accounts, 2021

The numbers in Table 15 do not indicate any further reduction of passenger per kilometre fares as compared to freight rates per tonne-kilometre. However, the following quote provides a measure of the extent to which passenger fares are subsidised vis-a-vis freight rates in India as compared to other countries.

"*In 2018, The fare-freight ratio (the ratio of the average passenger fare to average freight rates) of the Indian Railways was 0.3, compared to 1.4 in South Korea, 1.3 in France, 1.2 in China, 0.9 in Malaysia and Indonesia, and 0.7 in Thailand*" (Financial Express, 2018).

India's passenger rail fares compared to freight charges are well below the same sets of numbers in developed countries and even communist China and lower per capita income countries in the ASEAN grouping such as Indonesia and Thailand. However, it is not just higher freight charges that inhibits its growth in rail freight traffic. The relative lack of timely and reliable availability of railway wagons for freight traffic is also a factor inhibiting haulage of goods by Indian Railways.

5. Government Committees

Since Indian independence, several committees headed by subject experts and economists have examined the working of Indian Railways (IR). The recommendations of these committees were aimed at improving the efficiency with which passengers and goods can be transported and to make Indian Railways financially self-sufficient. Committees led by Wanchoo (1968), Kunzru (1978), and Sarin (1981-85) made specific recommendations to improve operational performance. More recently, committees headed by Nanjudappa (1993), Prakash Tandon (1994), Rakesh Mohan (2001), Sam Pitroda (2012), Rakesh Mohan again in 2014, and Bibek Debroy (2015) made wide ranging recommendations. Indian Railways has made useful improvements in ticketing for passengers and the air conditioning of railway coaches. However, it has resisted professional third-party auditing of its accounts.

The committees mentioned above have studied the working, mobilisation of resources, and restructuring of Indian Railways, including the Railway Ministry and the Railway Board. Unfortunately, these committees have not shed light on the reasons and remedies for the relatively low level of technological excellence in Indian Railways. In comparative terms, central government-managed bodies such as the Indian Space Research Organisation (ISRO) or the Department of Atomic Energy (DAE) have built up much better capabilities for research and innovation than Indian railways.

[16] https://dfccil.com/Home/DynemicPages?MenuId=3
[17] Cross-subsidy also known as fare-freight ratio which is the ratio of the average passenger fare to average freight rates.

Three decades ago, the 1993 Nanjudappa Committee had observed that high freight rates to subsidise passenger traffic was financially unsustainable. In this context, subsequent Committees have commented that the central government should not bear all losses incurred by Indian Railways since this dependency on the central government is an unfair burden on taxpayers. This line of thinking was glaringly evident in the recommendations of all subsequent committees, including those of the 1994 Tandon and 2001 Dr Rakesh Mohan committees. Another report prepared by the World Bank and titled "India's Transport Sector: The Challenges Ahead" (World Bank Report, 2002) included railway reforms.

The terms of reference of the 2001 Rakesh Mohan Committee included reorganisation and restructuring of the Railway Board and Railways Ministry, investigation of the finances of Indian Railways, and reforms including sustainable raising of financial resources. An overriding comment of the Rakesh Mohan Committee was that Indian Railways was facing difficulties because of "…*under-investment, mis-allocation of scarce resources, increasing indebtedness and poor customer service*." The recommendations of this committee were submitted to the then Railways Minister Nitish Kumar, and a few specific suggestions were that: (i) Indian Railways should be corporatized and called the Indian Railways Corporation (IRC); (ii) Government should pass legislation to set up an Indian Rail Regulatory Authority (IRRA) as distancing IR and the Indian government was imperative and in order to do that, such an IRRA was required; (iii) IRC should be exempt from taxation for a period of 5-7 years; (iv) the Railway Board needed to be reconstituted; (v) private participation in the working of Indian Railways was recommended; (vi) and a safety net was needed for surplus labour. It is likely that due to turf reasons, the Ministry of Railways did not take up any of these reforms. The following table summarises the recommendations of this Rakesh Mohan Committee.

Rakesh Mohan Committee Recommendations (2002)
Indian Railways should be corporatized and called the Indian Railways Corporation (IRC);
Government should pass legislation to set up an Indian Rail Regulatory Authority (IRRA) as distancing IR and the Indian government was imperative and in order to do that, such an IRRA was required;
IRC should be exempt from taxation for a period of 5-7 years;
The Railway Board needed to be reconstituted;
Private participation in the working of Indian Railways was deemed necessary

A crucially important 2002 Rakesh Mohan committee recommendation was that Indian Railways needs to be corporatised. In commentaries about this report, this suggestion was mistaken to be a call to privatise Indian Railways. In fact, this report stated explicitly that Indian Railways should not be privatised. Several large Indian corporations, some listed and others not, continue to be majority government-owned. Among such entities, which are more than 50 per cent owned by government and are listed, are the Coal Authority of India, Oil & Natural Gas Corporation, and State Bank of India. Of course, Indian Railways has a much larger number of employees than any of the public sector companies mentioned above, and their interests would need to be considered as and when Indian Railways becomes a corporate entity. If Indian Railways were to become a corporation, it would have a separate balance sheet, and accounting statements would need to be independently scrutinised by internal and external auditors. Such a requirement for external auditors to go over the accounts of Indian Railways would strip away the veil of inadequate transparency in the financial statements of Indian Railways.

An obvious yet important observation in the World Bank report dated May 2002 on India's transportation sector, including railways, was that "uneconomic functions will prove unsustainable." Eight years later, a Forbes magazine article dated August 2010 commenting about Indian Railways said "*the main problem is a severe capacity constraint that does not allow the Railways to carry more freight even when there is demand…Railways sources say that the ministry spends close to 10 per cent of its expenditure on non-core activities such as manufacturing units, schools, and hospitals for its employees*."[18] A decade later in 2012, an Expert Group for Modernisation of Indian Railways was headed by Sam Pitroda, and in the same year, a High-Level Safety Review Committee was chaired by Dr Anil Kakodkar, former Chairman of the Atomic Energy Commission (Press Information Bureau, 2012). It does not appear that Indian Railways has made sufficient progress towards catching up with countries such as China or Japan in terms of modernisation or safety.

Given the lack of sufficient forward movement on reforming the transport sector, including Indian Railways, in the 8 years between 2002 and 2010, the central government set up a National Transport Development Policy Committee (NTDPC) headed by Rakesh Mohan. The NTDPC submitted its report at the end of February 2014. An important recommendation of this Committee was that there should be just one unified transport ministry rather than one for roads and shipping and another for railways. Another suggestion was for the establishment of an Office of Transport Strategy. Again, no significant steps were taken by the central government on these recommendations. On an extremely important note, the NTDPC requested a professional private sector accounting firm to examine the accounts of Indian Railways and provide an assessment. This was done as a one-time piecemeal exercise, and the accounting norms used by this firm were not, as per publicly available information, adopted subsequently by Indian Railways.

After the new NDA government came to power in May 2014, yet another group called the "*Committee for Mobilization of Resources for Major Railway Projects and Restructuring of Railways Ministry and Railway Board*" was set up in 2015. This Bibek Debroy Committee, which had members with private sector experience, submitted its suggestions more than 8 years back in June 2015. The following table summarises the recommendations of this Committee.

Bibek Debroy Committee Recommendations (2015)
Indian Railways is too centralised in its decision making and engages in too many activities which are not core to its functioning, namely running schools and hospitals.
Over the next 5 years (by June 2020 since the report was submitted in June 2015), the Railway Protection Force should not be needed since law and order is a state subject and protection of trains, freight, and passengers should be the responsibility of state governments.
Indian Railways accounting practices need to be reformed such that there is "responsive and transparent accounting and costs system" for a commercially viable railway system. The same recommendation was made by the Rakesh Mohan committee 13 years earlier in 2002 when corporatisation of IR was also recommended.
8 Railways services need to be merged and their responsibilities rationalised and made more efficient (the central government has accepted and implemented this recommendation by 2020).
To accept the Anil Kakodkar Committee (2012) recommendations on safety.
Indian Railways needs an independent regulator. Again, the same suggestion was made by the Rakesh Mohan committee in 2002 and in addition to a railways specific regulator the financial sector and other regulators too would oversee the functioning of Indian Railways if it is converted into a public sector corporation.
The "social costs" issue would need to be considered if there is an increase in passenger fares and reduction in freight rates to better reflect actual costs.

The Indian railway system is very large with 8500 stations, 21,000 trains, 23 million passengers, and 3 million tonnes of freight transported per day.[19] The recommendations on reforming Indian railways are way too familiar from reports of earlier committees. To recapitulate, these were: (i) Indian Railways faces unfair competition from road transportation given

[18] https://www.forbesindia.com/article/briefing/reviving-indian-railways/16332/1
[19] https://www.livemint.com/opinion/columns/opinion-it-s-time-for-indian-railways-to-take-the-reform-track-1561392340103.html

the "artificially" high freight rates and low passenger fares, particularly on long distance routes; (ii) Indian Railways is too centralised in its decision-making and engages in too many activities which are not core to its functioning, namely running schools and hospitals; (iii) over the next 5 years (by June 2020 since the report was submitted in June 2015), the Railway Protection Force should not be needed since law and order is a state subject and protection of trains, freight, and passengers should be the responsibility of state governments; (iv) Indian Railways accounting practices need to be reformed such that there is "*responsive and transparent accounting and costs system*" for a commercially viable railway system, and commercial accounting needs to be introduced within 2 years—that is by June 2017.

The Rakesh Mohan committee offered precisely the same recommendation about accounting practices in 2002 when corporatisation of IR was also recommended. There has been no forward movement on this recommendation as of September 2023. All governments have social and several other responsibilities. However, these need to be budgeted separately so that the obvious and pressing need to meet social objectives does not obscure the functional efficiency and financial viability of Indian Railways.

A few other recommendations of the Debroy Committee are: (vi) 8 Railways services need to be merged and their responsibilities rationalised and made more efficient (the central government has accepted and implemented this recommendation in 2020); (vii) to accept the Anil Kakodkar Committee (2012) recommendations on safety; (viii) Indian Railways needs an independent regulator. Again, the same suggestion was made by the Rakesh Mohan committee in 2002 and in addition to a railways specific regulator the financial sector and other regulators too would necessarily oversee the functioning of Indian Railways if it is converted into a public sector corporation; (ix) if there is an increase in passenger fares and reduction in freight rates to better reflect actual costs the "social costs" issue would need to be addressed.

On the recommendation at (iv) above, the Railways Protection Force has not been disbanded. Instead, it became the Indian Railway Protection Force Service in 2020. The Ministry of Railways has given this service a Group A status and it is under the central government's administrative jurisdiction. The Debroy Committee's sweeping recommendation to disband the Railway Protection Force since law and order is a state government responsibility flies wildly in the face of ground realities in India. The violence during the 2023 Panchayat elections in Bengal and the evidence of horrific crimes against women and others in May-June 2023 in Manipur indicate that state governments are often unable to provide basic safety to citizens let alone manage security in moving trains. Therefore, the decision of the central government to create a special Railway Protection Service is logical.

In December 2022, the Indian parliament's Standing Committee on Railways made several suggestions to stem the continuing losses incurred by Indian Railways since 2020 (Standing committee on Railways, 2023). Of course, it was understandable that Indian Railways experienced a sharp decrease in revenues during the COVID-19 pandemic years of 2020 and 2021. Despite the many committees which have studied the working of Indian Railways, these groups have focused on overall management and financial issues. Relatively little attention seems to have been paid to improving engineering and related technical standards in the working of Indian Railways. For example, what steps are needed to catch up in technological terms in the production of rolling stock, coaches, and locomotives with countries such as France, Japan, or China? Although India produces locomotive engines that can power trains to speeds of 180 kilometres per hour, that speed is half or less than that of the top speeds of trains in France, Japan, or China.

5.1 Railways Budget Merged With the Union Budget

The Indian Railways budget was merged with Union budget in 2017. This change was implemented reportedly after the NITI Aayog made this recommendation in a white paper which was accepted by then Finance Minister Arun Jaitley. The NITI Aayog Paper is not in the public domain and is said to have observed that railway ministers tend to announce new trains and tracks for their constituencies, particularly during periods of coalition governments in Delhi. A separate comment was that railway budgets tend to reflect the political priorities of incumbent governments rather than operational necessities. It was also mentioned in this paper that in the colonial era, total railway revenue was about the same as that of the Government of India, and on occasion, surplus earnings of Indian Railways supplemented the government's revenues. This NITI Aayog paper and the Bibek Debroy committee have said that railway bud-

gets had become an annual ritual, and considering the usual revenue deficits of Indian Railways, such a merger would allow the transfer of deficit burdens to the Finance Ministry. Further, it would be easier to raise passenger fare prices, and thus reduce the fiscal burden of losses incurred by Indian Railways. The budgetary support provided by the central government has outweighed dividends paid by Indian Railways into the Consolidated Fund of India, as listed in Table 16.

Table 16: Budgetary Support, Dividend and Interest Paid

Year	Budgetary Support (Rs crores)	Dividend and interest paid (Rs crores)
2011-12	20,013	5,784
2012-13	24,131	5,467
2013-14	27,072	8,009
2014-15	30,121	9,174
2015-16 (Prov.)	35,008	8,723

Data Source: Press Information Bureau, Government of India. (16 November 2016)

5.2 Comptroller & Auditor (C&AG) Comments

The C&AG continues to audit the accounts of Indian Railways, as it did when Indian Railways budget statements were presented separately to the parliament prior to 2017. The following are sample observations in the C&AG's report on Indian Railways for the financial year which ended on March 31, 2019. The year April 1, 2018 to March 31, 2019 has been chosen since it was prior to the COVID-19 pandemic.. Illustrative, self-explanatory, and worrisome sample observations of the C&AG are as follows:

- **The total expenditure of Indian Railway sre-mained about the same between 2018-19 and 2019-20:** This expenditure grew from Rs 3.2 lakh crore to Rs 3.21 lakh crore, which amounted to a very small increase of 0.33 per cent. Even while total receipts decreased by 8.3 percent in 2019–20 compared to a 6.5 percent increase in 2018–19, revenue expenditure decreased by 7.3 percent this year and capital expenditure increased by a robust 11%. The primary reason for the lower revenue receipts in 2019–20 was a decrease in freight earnings by 10.94% and so-called "sundry" profits by 16.20% in comparison to 2018–19. The revenues of Indian Railways were too dependent on transporting coal, which made up 48.8 per cent of Freight Earnings. It appears that if there is any increase/decrease in the volumes of commodities that are transported by Indian Railways, this results in a large change in freight earnings.
- **Indian Railways had higher costs than revenues in 2019-2020 despite showing a surplus:** There was a net surplus in revenues over costs of Rs 1,590 crore in 2019-20. However, there would have been a negative balance of Rs 26,328 crore instead of a surplus, if the full amount spent on pensions, which was Rs 48,626 crore, had been shown against the pension head instead of Rs 20,708 crore. This is an obvious example of why Indian Railways should be converted into a corporation, namely, transparent accounting which takes pensions and other liabilities fully into account to provide an accurate picture of the financial health of Indian Railways.
- **Operating Ratio (OR):** The OR of the Railways would have been 114.4 per cent instead of 98.4 per cent if pension payments were to be correctly accounted. The C&AG's conclusion was that an OR of 98.4 per cent, as reported by Indian Railways, is not a "true" picture of its financial performance.
- **Indian Railways freight earnings compensate for its net losses in carrying passengers:** In financial year 2019-20, IR's losses on passenger and related services had risen to Rs 63,364 crore from Rs 36,286 crore in 2015-16. Although profits from freight traffic were used to compensate the loss on transporting passengers and related services, a loss of Rs 34,618 crore in passenger operations remained uncovered during 2019-20. Pension payments are mounting and eating into the overall net revenues, and appropriation to the Indian Railways Pension Fund has been inadequate.

6. Conclusions and the Long Distance Left to Cover

The construction of India's railway lines began earnestly post-1857 in British India and the princely states. In the 90 years until Indian independence in 1947, in undivided India, railway tracks totalled 42,524 route miles or 65,217 route kms (Kerr, 2007). With the separation of West and East Pakistan from India, the length of railway tracks in newly independent India reduced to 54,693 kilometres. By 2019-20, that is, in 73 years after independence, the total length

of India's railway tracks reached 68,103 kilometres. Effectively, in 74 years from 1947 to 2021, India has added just 13,410 kilometres of railway tracks. However, to its credit, Indian Railways has converted most metre gauge and narrow-gauge lines to broad gauge.

Table 17: Route Length of Indian Railways by Gauge

Year	BG	MG	NG	Total km
1947	25,170	24,153	5,370	54,693
2020-2021	64,403	2,112	1,588	68,103

BG: Broad Gauge; MG: Metre Gauge; NG: Narrow Gauge

Source: Ministry of Railways response to a question in parliament as stated in the Indian Railways Annual Report 2021

Given the significant improvements in technology, including the invention of sophisticated heavy earth moving and other electrical and engineering equipment, this increase in the laying of additional railway tracks post-independence is a relatively modest achievement. This increase in railway track length is substantially lower than what was achieved in the 90 years from 1857 to 1947, despite using lower levels of technology and presumably much less heavy machinery. Although there are several studies about Indian Railway lines and their construction, financing, and operation during the British India era, there are relatively few independent studies about the achievements and failures of Indian Railways post-1947 and particularly between 2000 to 2020.

Ms Mamata Banerjee was the Minister for Railways in the UPA coalition government from May 2009 to May 2011. The following is an extract from paragraph 13 of her budget speech on February 24, 2010. "*I would like to bring the attention of the august House to the information that the route-kilometres of the Railways amounted to 53,596 kms in 1950. After a span of 58 years, we have now reached only 64,015 kms, adding just 10,419 kms, an annual average of only 180 kms.*" Over the next eleven years since Mamata Banerjee's speech in 2010, the total railways track length (distance between any two points, irrespective of the number of lines connecting them, whether single line or double line) as of 2020-21 totalled 68,103 kilometres (Indian Railways Annual Report, 2021).

Post-independence, Indian Railways has been engaged in converting metre and narrow-gauge lines to broad gauge. This should have led to greater load-bearing capacity for freight trains. However, even in 2023, more freight by weight is hauled over roads than by rail due to a variety of reasons, including ease in booking of trucks as compared to wagons on freight trains, fewer unanticipated delays, lower costs, and easier door-to-door delivery. Higher volumes of truck traffic have a negative climate change impact. Over the past decades, Indian trains are increasingly electricity-powered. As more coastal/remote locations of electricity generation are established in India, it is logical to push for the haulage of freight by trains rather than trucks. If Indian Railways had added an additional 30,000 kilometres of railway tracks by now, goods trains would not need to move to sidings to make way for passenger trains. To that extent, both goods and passengers would reach their destinations faster.

In 1947, the Indian Railway's total earnings from passenger fares was about the same as that from hauling freight. By contrast, in 2019-20, passenger earnings had contracted to approximately 45 per cent of freight revenues (Appendix 5). It is obvious that the relative pricing between passenger fares and freight charges has swung considerably in favour of passengers. It could be argued that the British Indian government was less concerned about the welfare of passengers and kept their fares relatively high. This paper does not study the causal reasons—including whether it is low load-bearing capacity of tracks, freight costs, and delays caused, for example, by shortage of wagons—which has resulted in Indian railways not being used more than roadways for transportation of goods. However, cross-subsidising passenger fares by raising freight rates inordinately is likely to have contributed to the cost balance in favour of goods transportation by road. Of course, lower passenger fares make travel by rail viable for those who have limited incomes. However, combining the objective of social welfare with running a financially self-sufficient railways makes it difficult to assess whether this important segment of the Indian economy is being run efficiently or not.

On February 25, 2011, in the annual Ministry of Railways budget speech, Mamata Banerjee said that "… our dream is to bring about social revolution through rail connectivity." On February 12, 2014, Mallikarjun Kharge presenting the last budget for the UPA government before the May 2014 elections mentioned that "Indian Railways is primarily a commercial organisation with social responsibility, and it must operate in a financially self-sustaining manner." It is difficult to assess the financial health or efficiency

with which any public utility is run if social objectives are included or even acknowledged among its accountabilities. For purposes of transparency in financial reporting, social-human development objectives and associated costs need to be budgeted and provided for separately.

The single most important recommendation from several committees that have examined the working of Indian Railways is its conversion into a corporation. However, there has been no mention in the speeches of Railway Ministers from various political parties regarding the Indian government not implementing this repeated recommendation to convert Indian Railways into a public sector corporation. It is evident that Indian Railways should not function as a giant, self-governing central government-owned entity with its finances clouded by accounting practices that do not meet basic standards of transparency. Indian Railways needs to be corporatized as a majority government-owned company. It is likely that the potentially negative political consequences for the party in power in Delhi are hindering the implementation of converting Indian Railways into a corporation, which would be a transparent and cost-efficient way forward. The financial and administrative performance of the insurance giant Life Insurance Corporation is better understood now that it is listed on Indian stock exchanges. Indian Railways could first become a company and then get listed over the next 10 years.

Between 2008 and 2019, China's railways built 25,000 km of high-speed rail lines, surpassing the total high-speed rail lines operating worldwide. This is mentioned in a World Bank study[20] that summarises some key takeaways from China's success in high-speed railways for developing countries. The fare for high-speed rail service is competitive with air and bus for distances up to 1200 km, which has helped rail service gain 1.7 billion passengers a year. This study mentions that "…*countries with smaller populations will need to choose routes carefully and balance the wider economic and social benefits of improved connectivity against financial viability concerns.*"

Indians took over as British senior technical staff and engineers left post-1947. All pluses and minuses considered, in 2023, Indian Railways represents India's ability to manage a large, complex, and unwieldy organisation that has served the country well in the 75 years post-independence. The credit for the initiative should go to British India for having started the construction of railway lines, even though it was intended to serve British colonial interests.

Indian Railways employs close to 1.5 million people, making it one of the largest employers in India. Yet, the potential benefits of railways on India's economy, passenger travel, and society remain to be fully realised by many in the country. India needs to literally move much faster down the tracks to improve safety features and increase the coverage of cost-efficient and efficient railway networks for passengers and freight around the country.

[20] https://documents.worldbank.org/en/publication/documents-reports/documentdetail/933411559841476316/chinas-high-speed-rail-development

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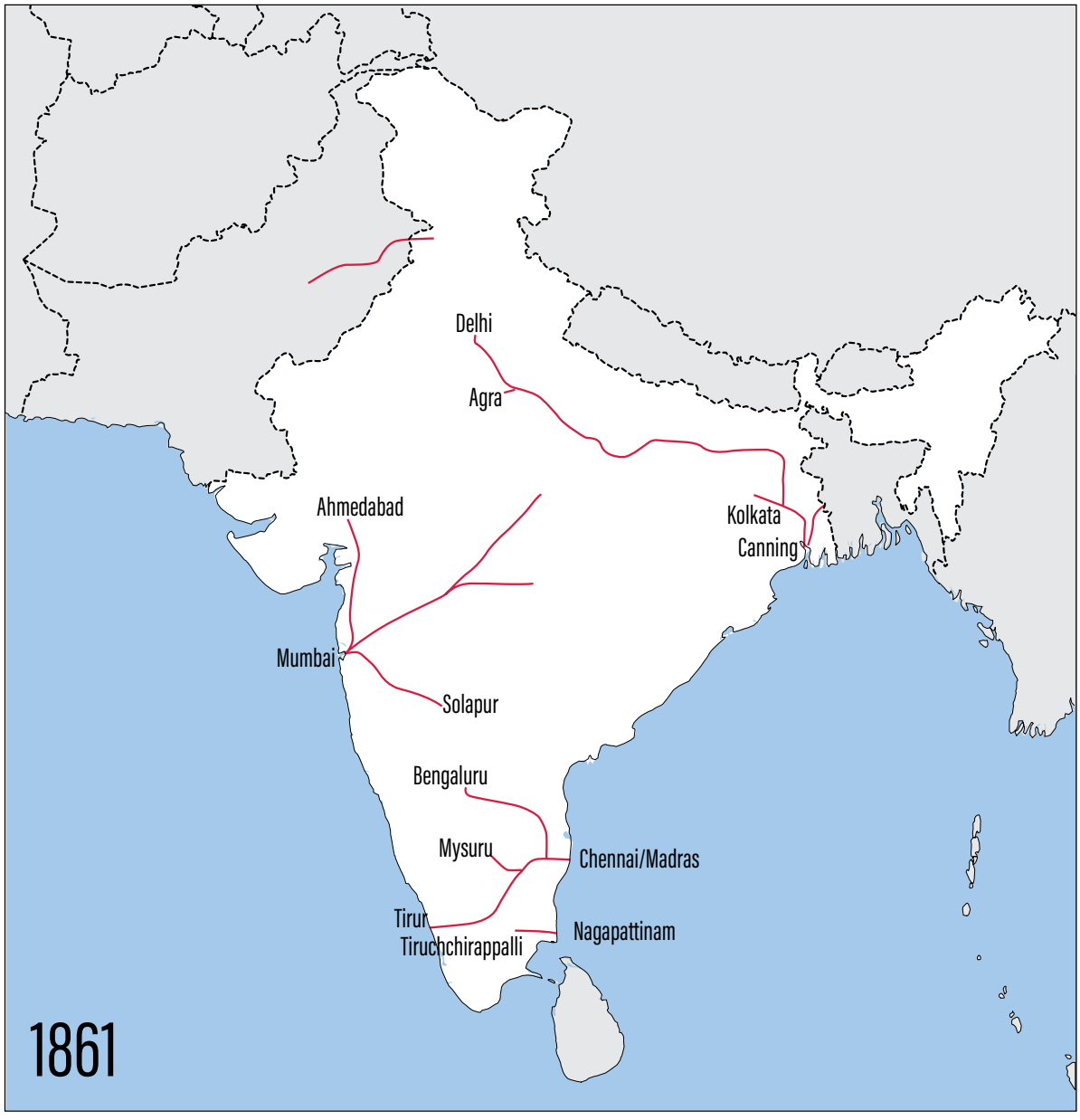
Appendices

APPENDIX 1

India's Railway Lines From 1861-2022

The following three maps show the railway lines that were ready to be used by 1861, 1905, and 1931. It can be seen, the British India progressed rapidly in connecting most of the country by broad or metre gauge tracks. The ownership of most of these lines in 1861 and even in 1905 was with private British companies or princely states. By 1931, Indian Railways had been consolidated, and almost all lines were owned by the British Indian government. The number of lines and points in India that were connected by the end of March 2022 was obviously many more. Despite the apparent density of lines depicted in the 2022 map, the total length of railway tracks has increased by only 28 percent between 1947 and 2023, disregarding the post-independence conversion from meter to broad gauge.

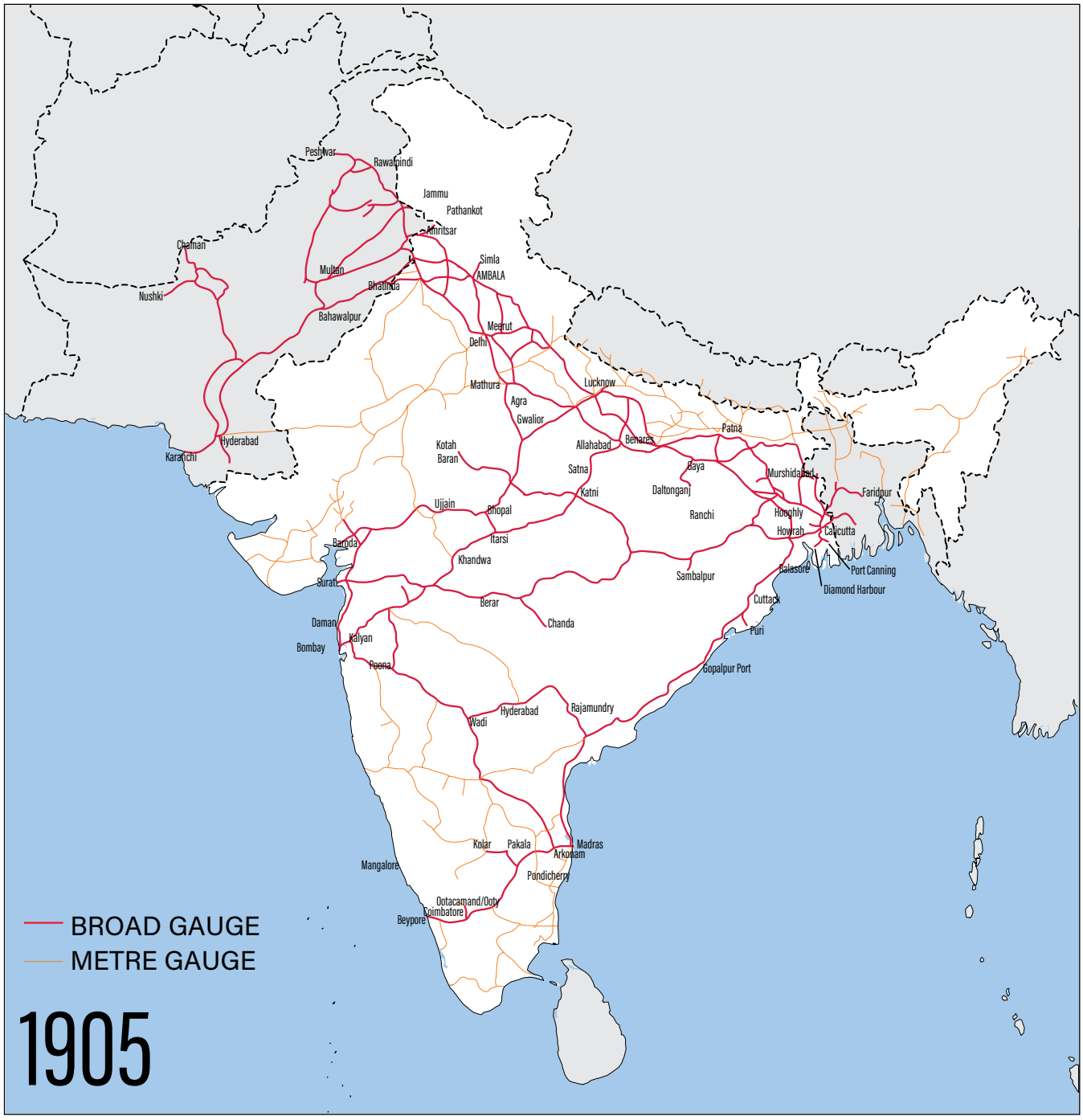
Map 1: Railway Lines in 1861



It is apparent that the railway lines were initially laid to cater to the movement of goods and passengers to and from major Indian ports.

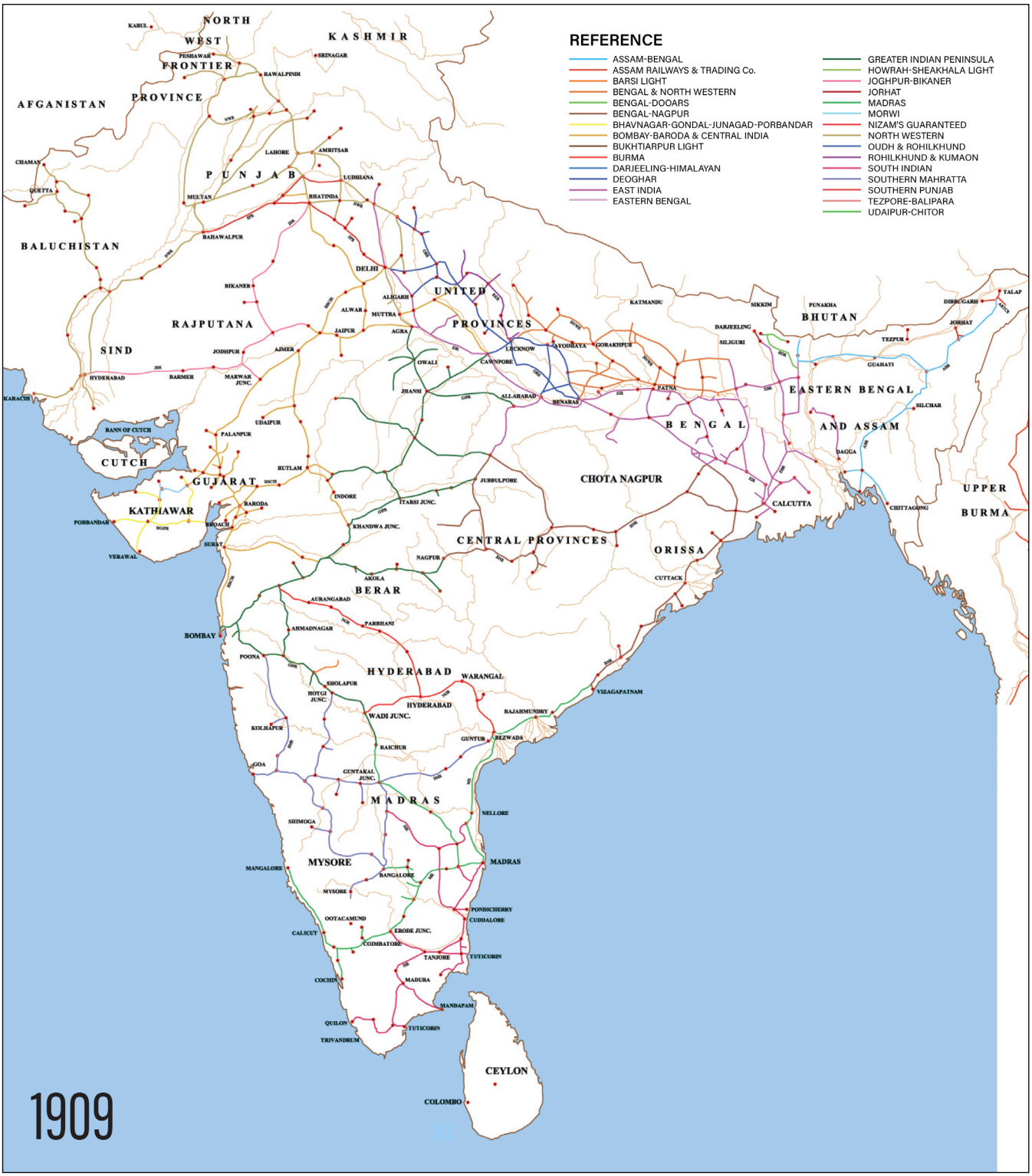
The map has been drawn based on images in the *Engines of change: The railroads that made India* by Ian Kerr.

Map 2: Railway Lines in 1905 Showing Broad Gauge in Red and Metre Gauge in Orange



Drawn based on images from *Engines of change: The railroads that made India* by Ian Kerr.

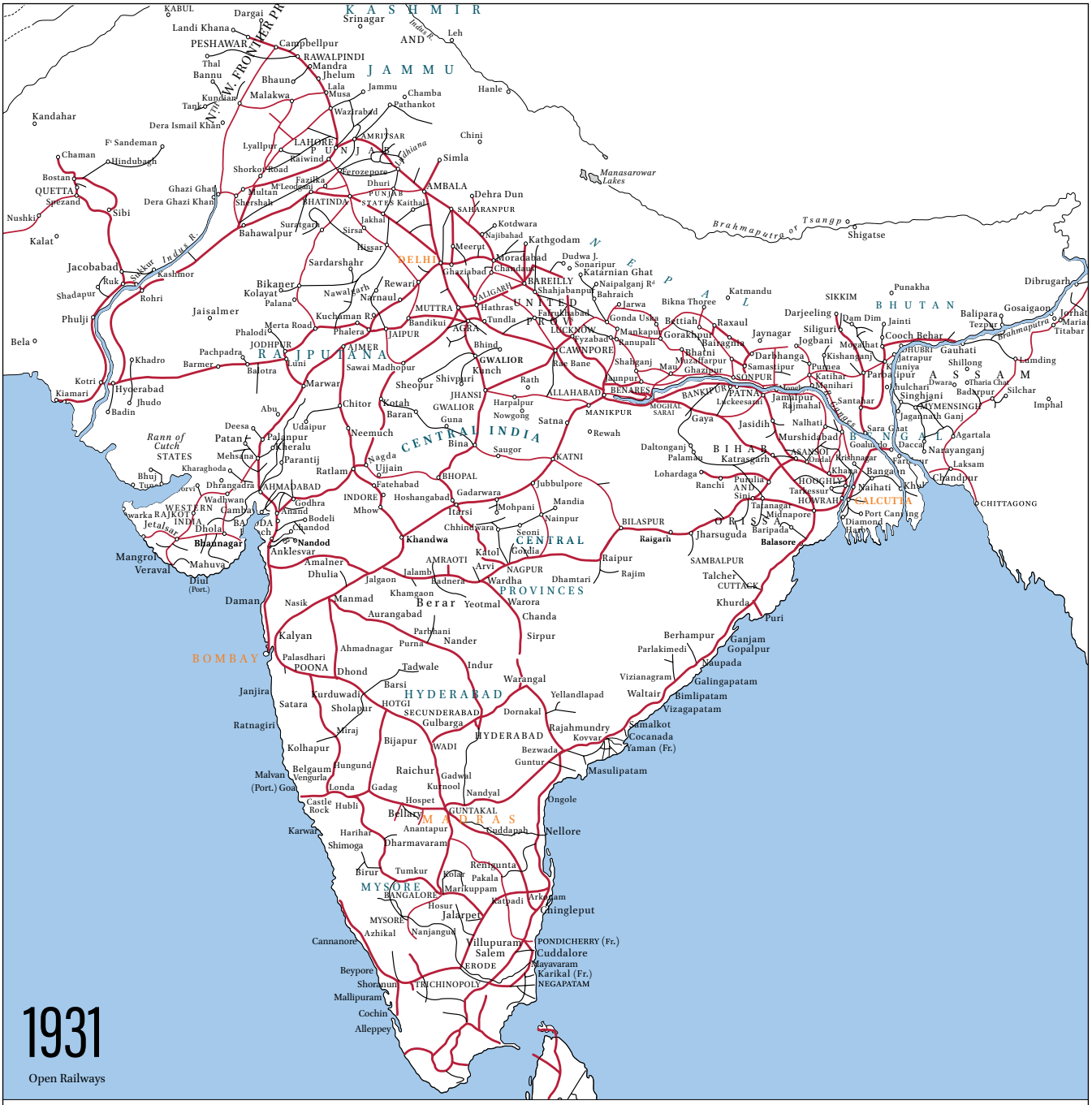
Map 3: Railway Lines in India in 1909, Showing the Names of Private Companies Which Owned Those Lines in Operation at That Time



Source: Bogart, D., Chaudhary, L., & Herranz-Loncán, A. (2015). The growth contribution of colonial Indian railways in comparative perspective. Available at SSRN 2576892.

Prior to 1947, Indian Railways did not have neatly organised and identified zonal railways under one unified command structure called "Indian Railways." It was fragmented, scattered, and owned by dozens of British and Indian businesses, as well as royal houses. The various ownerships can be seen at the top right-hand corner of this map dated 1909.

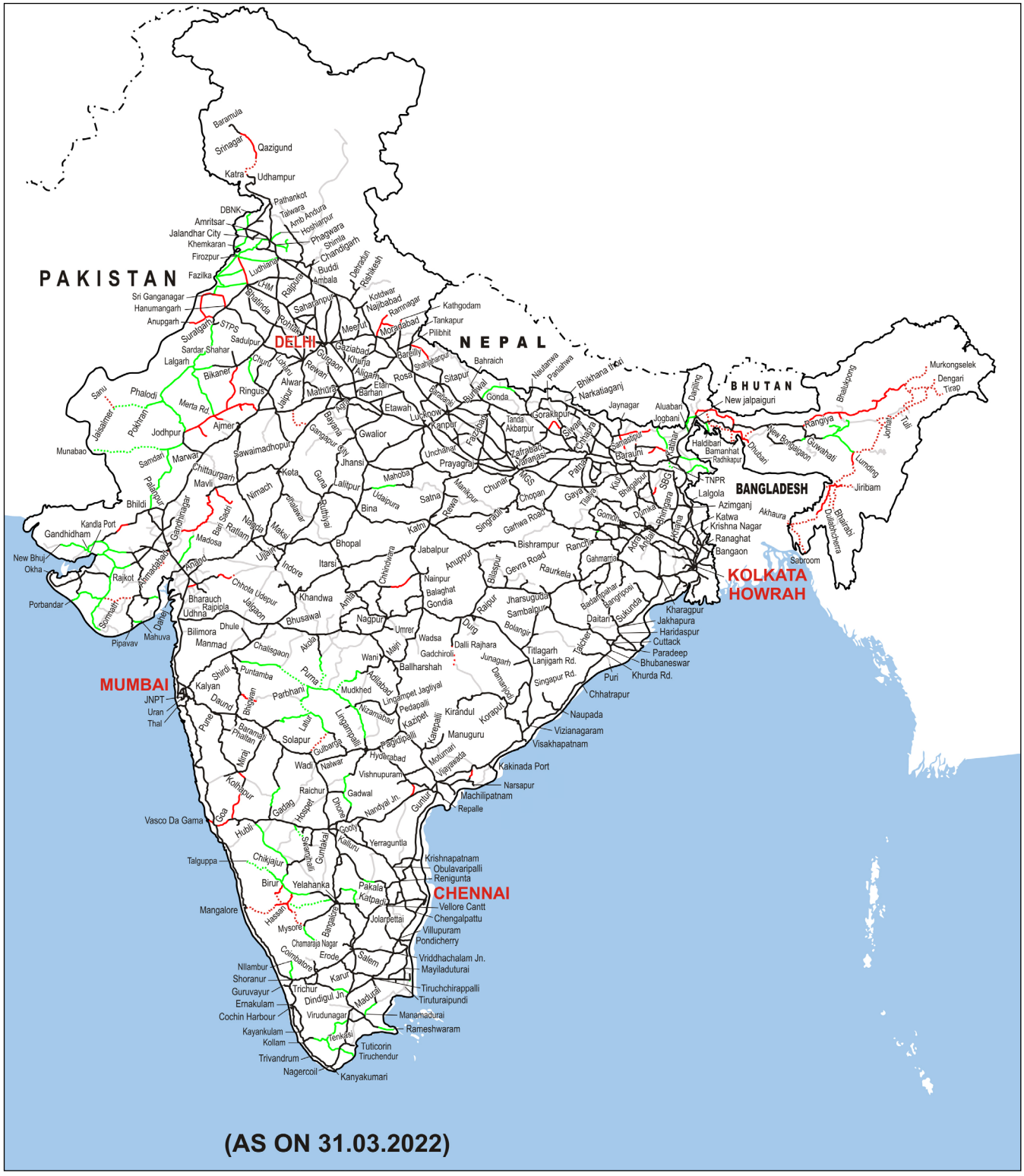
Map 4: Railway Lines in Undivided India as of 1931



Railway routes are not distinguished by gauge.

Map has been drawn based on images from *Engines of change: The railroads that made India* by Ian Kerr.

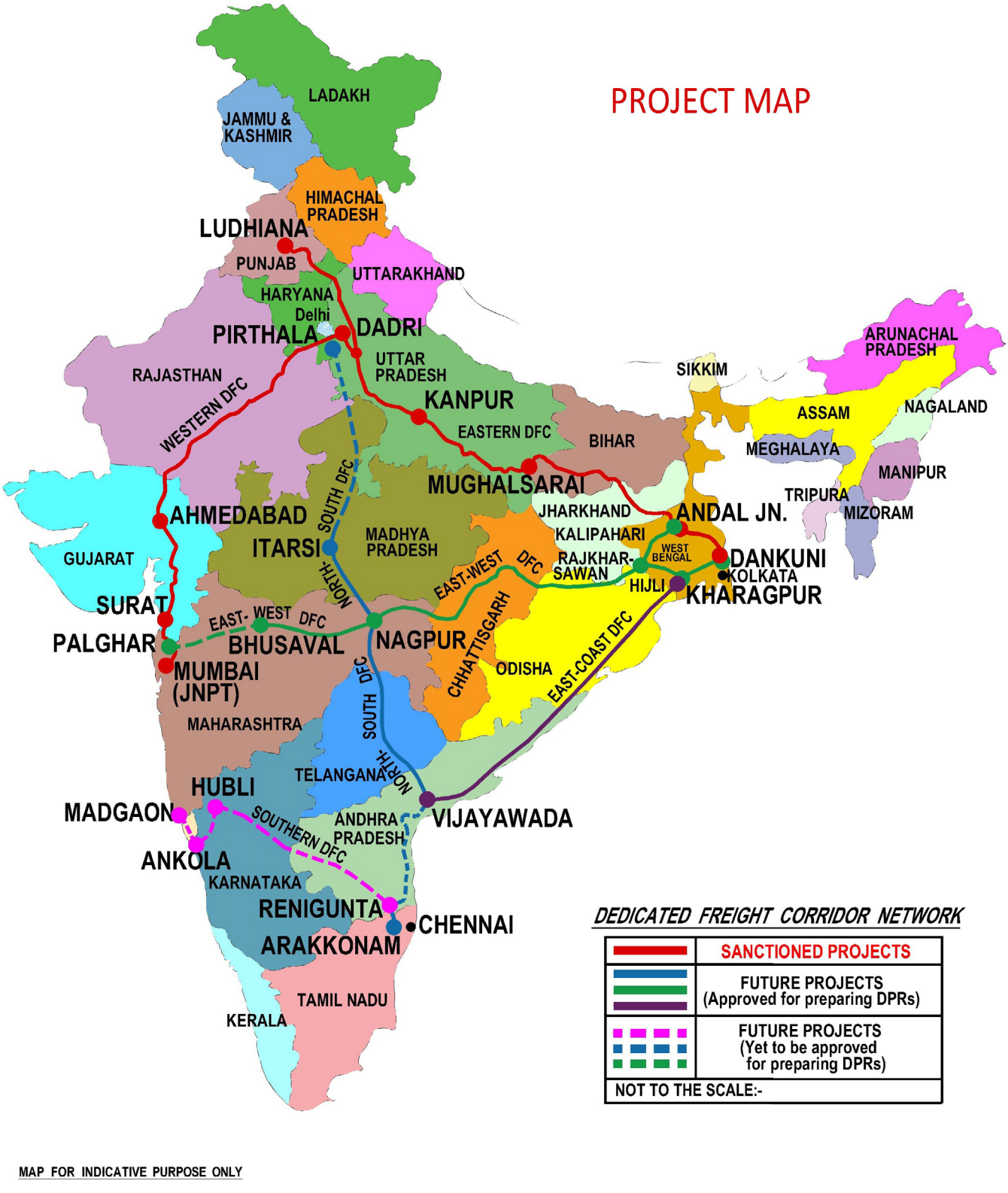
Map 5: Railway Lines in India in 2022



Source: Central Organization for Railway Electrification, Allahabad

APPENDIX 2

Map 6: Dedicated Freight Corridors



Source: DFC website. URL https://dfccil.com/home/corridor

APPENDIX 3

Railway Electrification

The progress of railway electrification in India since independence:

Year	Cumulative Electrified (RKM)
1951	388
1961	748
1971	3,706
1981	5,345
1991	9,968
2001	14,856
2011	19,607
2021	44,804

Data Source: Indian Railways Annual Report & Accounts English 2018-19

State Wise Electrified Network (As On 31.03.2023)

SN	STATE	Total BG RKM	Electrified BG RKM as on 31.03.2023	% Electrified
1	Chandigarh	16	16	100.00%
2	Chhattisgarh	1,199	1,199	100.00%
3	Delhi	183	183	100.00%
4	Haryana	1,701	1,701	100.00%
5	Himachal Pradesh	67	67	100.00%
6	J&K	298	298	100.00%
7	Jharkhand	2,558	2,558	100.00%
8	Madhya Pradesh	4,822	4,822	100.00%
9	Meghalaya	9	9	100.00%
10	Odisha	2,822	2,822	100.00%
11	Puducherry	21	21	100.00%
12	Telangana	1,858	1,858	100.00%
13	Uttar Pradesh	8,482	8,482	100.00%
14	Uttarakhand	347	347	100.00%
15	Andhra Pradesh	3,965	3,841	96.9%
16	Bihar	3,686	3,554	96.4%
17	Tamil Nadu	3,854	3,659	94.9%
18	Maharashtra	5,734	5,415	94.4%
19	West Bengal	4,047	3,682	91%
20	Kerala	1,047	947	91%
21	Gujarat	3,862	3,421	89%
22	Punjab	2,253	1,872	83%
23	Goa	189	147	77.8%
24	Rajasthan	5,623	4,348	77.3%
25	Karnataka	3,836	2,820	73.5%
26	Assam	2,518	723	28.7%
27	Arunachal Pradesh	12	0	0.00%
28	Manipur	13	0	0.00%
29	Mizoram	2	0	0.00%
30	Nagaland	11	0	0.00%
31	Sikkim	0	0	0.00%
32	Tripura	265	0	0.00%

Source: Ministry of Railways. Retrieved from https://indianrailways.gov.in/railwayboard/uploads/directorate/ele_engg/2023/Railway%20Electrification%20as%20on%2001_04_23.pdf

APPENDIX 4

Operating Route Miles,1861-2001

Year	Operating Route Miles
1861	1,587
1871	5,074
1881	9,723
1891	16,690
1901	24,185
1911	31,310
1921	35,406
1931	40,224
1941	41,052
1951	33,230 (reflects the political division of 1947)
1961	34,873
1971	37,070
1981	37,969
1991	38,668
2001	39,077

Source: Kerr, Ian J. Engines of change: the railroads that made India. Greenwood, 2007, p.10

Length of Indian Railways in 1951 and Now

Year	BG	MG	NG	Total route km
1951	—	—	—	53,596
2020-2021	64,403	2,112	1,588	68,103

Data Source: Indian Railways Annual Report Accounts, 2020-2021

**The number for 1951 reflects the post-independence route km.*

Indian Railways- Route length, Running Track kms, and Total Track kms

Year	Route Length	Running Track kms	Total track kms
1950-1951	53,596	59,315	77,609
2019-2020	67,956	99,235	1,26,366

Data Source: Yearbook 2020-2021

Route Kilometre: The distance between two points on the railway, irrespective of the number of lines connecting them, whether single line, double line, etc.

Running Track Kilometre: The length of all running tracks, excluding tracks in sidings, yards, and crossings.

Track Kilometre: The length of all running tracks, including tracks in sidings, yards, and crossings.

Total Route kms for Large Railway Networks (2021)

The US, China, Russia, and India have, respectively, the four top largest railway networks in the world by route length.

Countries	Total Route Kms
India	68,103
US	148,553
UK	16,179
France	27,716
Germany	33,401
China	109,767
Canada	47,150
Russia	85,544

Source: https://data.worldbank.org/indicator/IS.RRS.TOTL.KM

APPENDIX 5

The numbers in Appendix 5 & 6 and corresponding notes sourced from Government of India websites do not provide an adequate understanding of the finances of Indian Railways.

Indian Railways Passenger and Freight Earnings (at 2019 prices)

Year	Passenger earnings (Rs Crores)	Freight earnings (Rs Crores)
1947-1948 (2019 prices)	4570	5629
2019-2020	50,669	1,11,472

For 2019-2020 freight earnings excludes demurrage.

Source: Report on Indian Railways 1949-1950, Vol -I, Railway Yearbook 2020-2021; Indian Railways Annual Report (Accounts): 2020-2021

Earnings and Net Traffic Receipts

Year	Passenger earnings (Rs crores)	Freight earnings (Rs crores)
1947-1948	66	82
2019-2020	50,669	1,11,472

For 2019-2020 freight earnings excludes demurrage.

Source: Report on Indian Railways 1949-1950, Vol -I, Railway Yearbook 2020-2021

After Adjusting for Inflation (at 2019 Prices)

Year	Passenger earnings (in crores of Rs)	Goods earnings (in crores of Rs)
1947-1948	4570	5629
2019-2020	50,669	1,11,472

These are approximate figures as the financial year data may not align precisely with the available inflation numbers, which are typically reported for calendar years.

Capital-at-charge - Indian Railways

Year	Capital-at-charge (Actuals), in Rs crore
2019-2020	3,74,922
2010-2011	1,43,221
2000-2001	43,052
1980-1981	6,096.3
1950-1951	827

Source: Indian Railways Annual Reports, Report of the Comptroller and Auditor General of India, Railway Budgets

Capital-at-charge: This represents the book value of the capital assets of railways. Alternatively, it can be viewed as the total amount of capital advances provided by the central government in the form of non-repayable grants from the time of Indian independence to the present. Dividends on this capital-at-charge are paid to the General Revenues head at a rate recommended by the Railway Convention Committee, considering exemptions and various concessions allowed on dividend payments. The current annual rate of dividend is 6.5 per cent.

Capital-at-charge

Year	Capital-at-charge (Rupees crore)
1947-1948	605
2019-2020	3,74,922

The figures for 1947-1948 excludes EP, Assam, and Indian government portions of the NS and narrow gauge of EI Railway.

Source: Report on Indian Railways 1949-1950, Vol -I, Railway Yearbook 2020-2021

Total Investment (Rs crore)

Year	Total investment (Rupees crores)
1950-1951	855
2019-2020	6,40,408

Source: Railways Yearbook 2020-2021

Capital Investment

Year	Capital Investment Rs (in crores)
1947-1948	—
2019-2020	3,74,592

Data Source: Railway Yearbook 2020-2021

Capital Investment: Book value of the Indian Railways' capital assets

Total Number of Staff in Railway (1905, 1947)

Year	Total number of staff
1905	437,535
1947	1,046,843

Source: Kerr, Ian J. Engines of change: the railroads that made India. Greenwood, 2007, p. 75

Number of Staff and Expenditure on Staff (in 2019 prices)

Year	Total Number of staff (in thousands)	Expenditure on staff (in Rupees crores)
1950-51	914	7865
2019-20	1,254	1,56,243

The total number of staff includes Groups A & B, Group C, and Group D. It also includes number of Railway Protection Special Force (RPSF) personnel and expenditure on them from 1980-81.

Source: Yearbook 2020-2021

APPENDIX 6

Summary of Receipts and Expenditure During 2018-19 and 2019-20 (Rupees Crores)

Summary of capital and revenue expenditure

S. No	Details	Actual (2018-19)	Actual (2019-20)
1.	Capital Expenditure	1,33,377	1,48,064
2.	Revenue Expenditure	1,86,734	1,73,105
Summary of Revenue Receipts and Revenue Expenditure			
1.	Passenger Earnings	51,067	50,669
2.	Other Coaching Earnings	4,475	4,641
3.	Freight Earnings	1,27,433	1,13,488
4.	Sundry Earnings	6,996	5,863
5.	**Total Traffic Earnings**	**1,89,970**	**1,74,661**
6.	Clearance from Traffic Outside (Suspense)	(-) 64	(-) 304
7.	**Gross Traffic Receipts (Item No. 5+6)**	**1,89,906.58**	**1,74,357**
8.	Miscellaneous Receipts	601	338
9.	Total Receipts (Item No. 7+8)	1,90,507	1,74,695
10.	Net Ordinary Working Expenses	1,40,200	1,50,211
11.	Appropriation to		
	Pension Fund	44,280	20,708
	Depreciation Reserve Fund	300	400
12.	**Total Working Expenses (Item No. 10+11)**	**1,84,780**	**1,71,319**
13.	Miscellaneous Expenditure	1,953	1,785
14.	Total Expenditure (Item No. 12+13)	1,86,733	1,73,105
15.	Net Surplus (Item No. 9 (-) 14)	3,78	1,590
16.	Surplus available for appropriation to		
	Development Fund (DF)	750	1,388
	Capital Fund	0	0
	Rashtriya Rail Sanraksha Kosh	3,023	200

Source: Railway Budgets for 2018-19 and 2019-20

APPENDIX 7

Total Road Length in India (in kilometres)

Year	Road Length (in kilometres)
1950-51	3,99,942
1980-81	14,85,421
2000-01	33,73,520
2018-19	63,31,757

Note: Total Road length includes national highways, state highways, district roads, rural roads, urban roads, project roads.

Source: Basic Road Statistics of India, (2018-2019)

Length of National Highways in India (in kilometres)

1950-1951	19811
1960-1961	23798
1970-1971	23838
1980-1981	31671
1990-1991	33650
2000-2001	57737
2010-2011	70934
2016-2017	114158

Source: Basic Road Statistics of India (2016-2017), Ministry of Road transport and Highways, Transport Research Wing

Note: Total Road length includes national highways, state highways, district roads, rural roads, urban roads, and project roads.

APPENDIX 8

GDP Per Capita, India

This data is adjusted for differences in the cost of living between countries, and for inflation. It is measured in constant 2011 international USD.

1900	955$
1947	985$
1990	2087$
2018	6806$

Sources: https://ourworldindata.org/grapher/gdp-per-capita-maddison-2020?country=~IND

India's GDP and Per Capita in Current USD. In USD (2019 prices)

Year	GDP (Current USD)	Per Capita (Current USD)
1960	$325 bn	$719
2000	$713 bn	$674
2019	$2830 bn	$2072

Source: CPI inflation calculator, Bureau of Labour Statistics- https://www.bls.gov/data/inflation_calculator.htm

India's GDP and Per Capita in Indian Rupees (2019)

Year	GDP (current trillion Rupees)	Per capita (current thousand Rupees)
1960	22	50.7
2000	50.2	47.5
2019	199.3	145.9

Note: Converted from USD into INR by 2019 average nominal exchange rate as available from the World Bank.

Famines in India (1900-2020)

Year	Country	Excess Mortality midpoint	Excess Mortality lower	Excess Mortality upper	Source
1907-08	India	2,683,782	2,148,788	3,218,776	Maharatna (1992)
1943	India (Bengal)	2,550,000	2,100,000	3,000,000	Devereux (2000); WPF
1972-73	India (Maharashtra)	130,000	130,000	130,000	Devereux (2000)

Source: https://ourworldindata.org/famines#data-sources

World Peace Foundation, Famine Trends Dataset

Devereaux, Stephen. "Famine in the 20th century." IDS Working Paper105 (2000).

Maharatna, Arup. The demography of Indian famines: A historical perspective. University of London, London School of Economics (United Kingdom), 1992.

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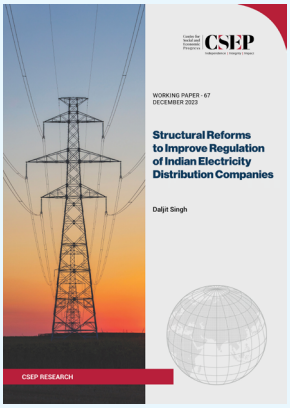
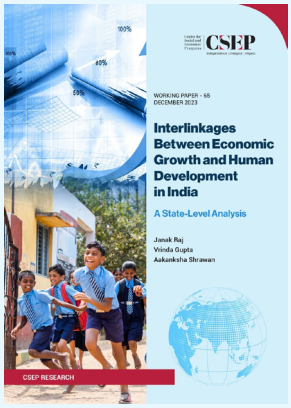
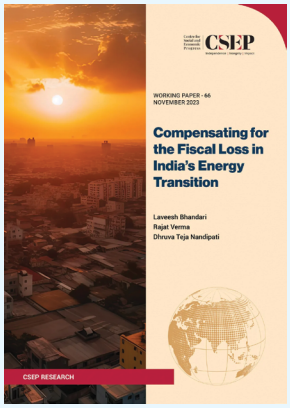
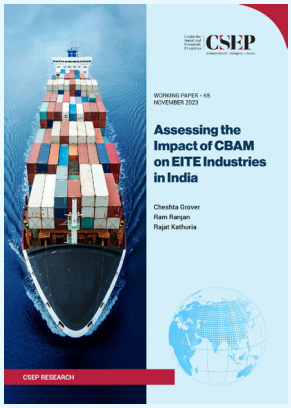
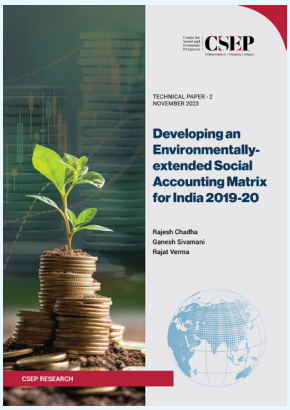
Other publications

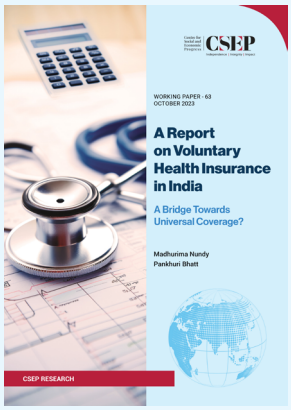


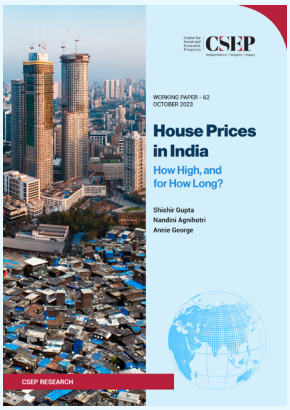


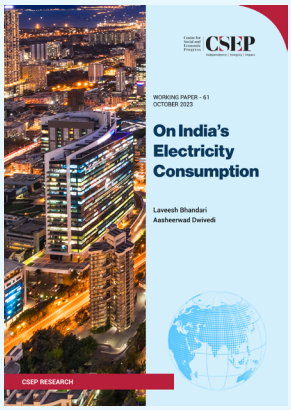


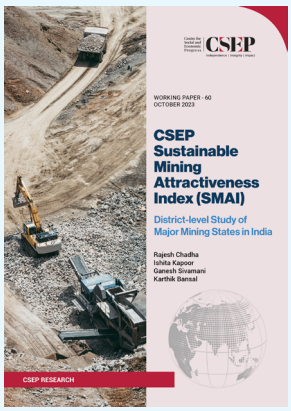


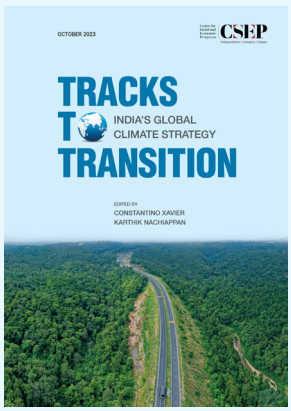


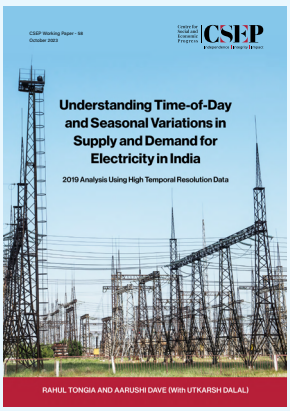


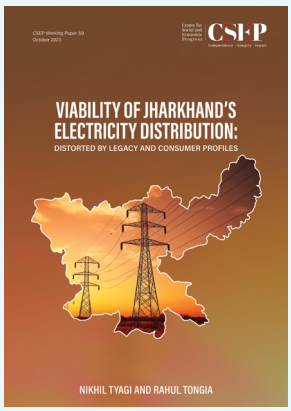


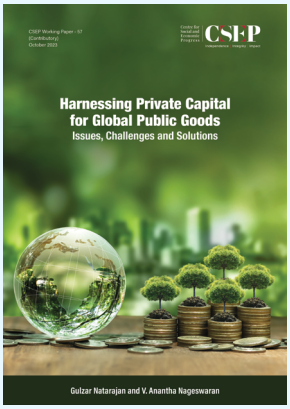


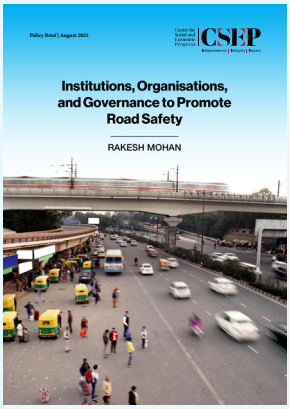


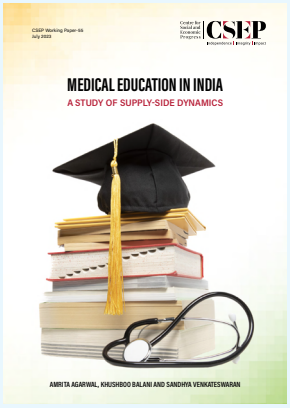












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