Chapter 2

COMPARATIVE OPERATIONAL HISTORY OF MAJOR WORLD RAILWAYS

2.1 The Railway Impact on Development

Reviewing the advent of railways and their impact on economic development in Western Europe, Patrick O'Brien[1] identifies three broad aspects of the process that were found in common among all countries which adopted railways as their principal mode of transportation. The first among these were *forward* linkages which influenced resource allocation, labour migration, rates of capital formation and differential regional growth by altering the ratios of relative prices and by widening and laterally integrating regional and national markets. The next were *backward* linkages which led directly to the rapid expansion of iron & steel, construction and engineering industries in many of these countries over a short span of time. The third were *social* savings resulting from the lowering of inventory needs that followed railway development, which were influenced also by the relative endowment of these countries with alternative transport modes, and by the speed and frequency of the new railway services. It is mainly on the third count, which reflects upon the state of pre-industrial development in roads, canals and other waterways following the growth of the early towns, that noticeable differences may be discerned between different European countries.

Not all scholars however have concurred readily on the occurrence of such events, a marked divide separating the views of the transport historians from those of statistical scholars. Econometric studies of the railway impact on economic growth that gained momentum during the second postwar decade following the work of Fogel[2] and Fishlow[3] on the US railroads, and of Hawke[4] on railways in Britain during the initial phase of development between 1840-1870, have generally agreed that the social savings directly created by the railways through the expansion of passenger and freight transportation were relatively small at around 10 percent of national income.[5] Although the true impact of expanded transportation may well have been understated by social savings concepts, econometric measurements of the external technological economies arising from railway development - such as the inducement for industry to adopt technological innovations and to concentrate investments in certain agglomerated geographical regions - also show paradoxically low scales of impact. The historical approach on the other hand has taken more cognisance of the prolonged influence of railway development on downstream development of industries, entrepreneurship and capital markets, apart from the immediate quickening achieved in freight transits,[6] and will be the method adhered to in the present discussion.

Despite such variations in the scholarly standpoint, comparative railway history studies from an Indian perspective can broaden insights into the role of infrastructural investments and into why the downstream benefits from railways accruing to India had differed for a considerable period of time from those derived on other world railway systems. Although India figures quite prominently among the countries which made early ventures into railway development, the transportation linkages that have been outlined above did not gain much ground during the early phase of railway development because of the lack of parallel growth of towns and manufacturing activity. Instead, the veneer of industrial transformation that may be attributed to the railways was restricted to the vicinity of the few major mercantile centres, and was circumscribed by a dearth in domestic entrepreneurship which would otherwise have spread it outwards. Thus the patterns of transportation linkage commonly observed in Europe only become relevant to the study of the railway impact on India after commencement of the planning era, although their antecedents might well be traced back to the history of colonial enterprise.

The institution of planning in India, which swiftly followed the achievement of Independence, articulated a national commitment to draw level with the rest of the world through the selective application of economic policy and will. As part of their structural objectives, the Five-Year Plans [FYPs] have since then sought to maintain parity of growth between the transportation sector and other producing sectors of the economy, in order to achieve integration between infrastructure and manufacturing capacity. Although forward and backward linkages are evident in the reciprocal relationship between industrial growth and transportation

volumes, these remain statistically unspecified because of the difficulty of decomposing the mutual interaction of the two into economic *cause* and *effect*. On the other hand, it cannot be overlooked that the basic prerequisite for establishment of large industrial enterprises is the creation of a large unified market, which is substantially accelerated when efficient transportation brings spatially-dispersed market centres into a common web of exchange.

2.1.1 Comparative Railway Development

Viewing the course of Indian economic history, the impact of railways might conceivably have differed from that observed in other countries because of dissipation of the 19th century boom in railway construction much before it could produce coincident downstream expansions of manufacturing in India. It was not until the consolidation of infrastructural investments in the economy during the planning era that a railway boom recurred on a smaller scale. Nevertheless, comparative study of railway development across select countries brings out features of common experience which would go unnoticed were study to be made of India alone, while also building conceptual appreciation of the role of railways as a component in infrastructure. As the preeminent mode of transportation for well over a century, India's railways have provided essential support to all economic transactions that have required spatial barriers to be dismantled in order to ensure mobility of resources and efficient distribution. Till the commencement of planning, the cumulative indirect or social linkages of railway development have greatly outweighed the direct upstream and downstream linkages of railways in India and the comparison between selected world railway systems should be made in this light.

Comparison may commence from a review of contemporary operating positions on IR versus those on British Rail plc, SNCF [*Société Nationale de Chemin de Fer*] or the French National Railways, AMTRAK or the Class I intercity passenger railroads of the US, the US Class I freight railroads comprising some 28 individual freight lines, Japan Railways and the China Railways. Comparisons between these are made in the table below. Selection of this cross-section of world railways has been guided by the historical or geographical affinities between them which render crosscomparison meaningful. British Rail and the Indian Railways, for instance, have common antecedents in the mix of state policies and investor speculations that marked the commencement of the Railway Age in Britain, and both systems became state enterprises at around the same time. Despite nearly parallel origins, SNCF was directly promoted by the agency of state and was accordingly nationalised much earlier. Like IR, it has since remained wholly under state control till the present time. Though respective booms in US railroads and Japanese railways both occurred during the second phase of railway development, finances for the former were drawn from private external capital borrowing, while the latter was funded by domestic surpluses that had been mobilised by the state. Thus while throughout their history the US railroads never came under direct state operation and were merely subject to state regulation, Japan Railways were among the first nationalised transportation systems and remained under direct control of the state till privatisation occurred during the 1980s, a period during which British Rail underwent a similar experience. After a relatively belated start and slow development, the China Railways were consolidated by huge public investments made during and after the 1950s and thus partially share their experience of planned consolidation with the development of IR under the Five-Year Plans, both systems serving the needs of *developing* rather than *developed* nations. The world railway systems selected for comparison thus represent a mix of state railways, recently denationalised railways and entirely private railways, each supported at different times by both state and private infrastructural capital. Thus the table enables meaningful assessments to be made of differences in performance and overall efficiency levels between systems with apparently shared or similar histories and heterogeneous operating characteristics. The remainder of the chapter is given to exploring their individual infrastructural histories.

Comparison yardsticks are set up on the one hand by the gigantic network of nearly 200 thousand track-km operated by the US Class I railroads with over 600 thousand freight wagon units and nearly 19 thousand traction units, and on the other by the trim network of under 10 thousand track-km operated by the AMTRAK intercity services in the US with just 318 traction units and under 2 thousand passenger coaching units. Against these entirely compartmentalised networks, every other railway system presents an amalgam of varying intensity between freight and passenger services, with plant, equipment and personnel needs being defined accordingly. While comparison is made in terms of these principal efficiency parameters, it needs to be remembered that spatial dispersal or concentration in railway services becomes an important determinant of railway operational performances as well as equipment needs, and should be factored into the assessments.

Table 2.1: Railway Infrastructure & Operations on Selected National Railway Systems

Country	Network [km]	Rail-Track Locomotive Units	Traction Wagon Units	Freight Coaching Units	Passenger Personnel Workforce	Railway Operations [million]	Freight Tonne-km Operations [million]	Passenger-km Operations [Ratio]	Freight Intensity of Railway
British Rail	*UK*	16584	2227	39313	3100	135321	15986	33191	0.482
SNCF	*France*	34070	5542	148100	11640	202081	49677	63761	0.779
AMTRAK	*USA*	9540	318	-	1983	24000	-	10095	-
US Class I	*USA*	193158	18835	604672	-	216424	1530742.8	-	151.634 *
JR	*Japan*	20254	1659	30170	21587	193763	26803	237551	0.113
China Railways	*China*	53378	13592	364966	27261	3381000	1060100	263530	4.023
Indian Railways	*India*	62367	8417	346103	31843	1651100	229601	295644	0.777

*Note: *for combined US Class I Railroads & Amtrak*

Source: Recompiled from *World Railways*, 'Statistics on Railway Scale and Traffic Characteristics',
cf. RFFC [1993]: *Railway Fare and Freight Committee Report*, 1(4):91-92, Annexure 4J

The comparison reveals apparently close resemblances between IR and China Railways in terms of network-size and freighting capacity, but striking distinctions between them in traction equipment, passenger coaching fleets and workforce - China Railways in fact being the only major railway system that has carried steam traction into the current century. Comparison of a relatively close order also relates JR to British Rail, both systems having high passenger intensities of operations since they serve island nations which require the provision of high-density commuter railway services over relatively small spatial areas. With overall freight-intensity in operations being expressed as the ratio of freight-km to passenger-km, extremely high commuter density is indicated for JR which runs upwards of 26 thousand trains a day. Despite operating a track network just over half the size of IR, railway density on SNCF is observed to considerably exceed that on IR, both in terms of traction equipment as well as personnel deployment. Overall freight intensity on SNCF is also much higher than on IR. The operations of the China Railways indicate strikingly high specialisation in freight, with over 4 freight tonne-km being hauled for every 1 passenger-km carried. But despite a smaller coaching fleet, aggregate realisations of passenger-km on China Railways do not lag far behind that of IR, testifying to high overall utilisation of railway services in China and to the consequent need for larger staffing and traction fleets. The IR network being older and the China Railways network being of more recent vintage, much of this growth of traffic and freight intensity on the latter has occurred relatively recently.

Table 2.2: Railway Productivity & Efficiency on Selected National Railway Systems

	RAILWAY PRODUCTIVITY INDICES				*RAILWAY EFFICIENCY INDICES*					
Railway	Traffic Units achieved per Route-km ['000]	Traffic Units achieved per Traction unit [million]	Tonne-km operated per Wagon unit ['000]	Passenger-km operated per Coaching Unit ['000]	Traffic Units achieved per Employee ['000]	% Wage-costs per Revenue unit [%]	% Passenger-km per Traffic unit [%]	Unit Passenger Fares to Freight Rates [Ratio]	Average Passenger Traffic Lead [km]	Average Freight Lead [km]
British Rail	2965	18.6	407	5169	363	78	67	122.3	44	116
SNCF	3330	19.7	335	5478	561	90	56	119.3	76	359
AMTRAK	255	31.4	-	5091	421	n.a.	100	604.7	455	-
US Class I	7925	81.3	2532	-	7073	28	-	-	-	1184
JR	13052	64.9	888	11004	1364	70	90	173.4	29	452
China Railways	24997	97.4	2905	9667	391	26	20	163.8	278	n.a.
Indian Railways	8422	59.6	663	9284	318	45	56	29.6	77	741

Source: Recompiled from *World Railways*, 'Statistics on Railway Performance',
cf. RFFC [1993]: *Railway Fare and Freight Committee Report*, 1(4):93-96, Annexure 4K

Comparisons of the scales and intensities of operations indicate extremely high freight intensity and relatively insignificant passenger intensity of railway operations in the US. The other railway systems all carry much higher passenger-traffic volumes. By inference, the relative intensities of freight operations achieved by each system relate directly to the spatial span of the concerned rail network, while those of passenger operations appear to relate inversely. Although hidden from the present analysis, the presence or absence of comparable transportation alternatives would also appear to play a determining role. The substantial existence of motor

freeways, and the high incidence of automobile ownership and high frequency of domestic intercity air services are all important factors in reducing passenger dependence on AMTRAK services in the US. In comparative terms, passengers in less developed countries such as India and China depend much more on railway services, although much less freight is transported on IR than on the China Railways. Since technology levels and capital vintages inducted by each railway system into its traction, coaching and freight equipment remain imponderables within the comparison, summary assessment of railway performance on the basis of track and equipment inventories alone would probably be inappropriate. Even so, both China Railways and SNCF present pictures of more rounded utilisation of railway services, while either freight and passenger services disproportionately dominate the other systems because of their spatial or technical circumstances.

For better comparative assessment of current railway performances across the selected systems, analysis may therefore be made of the productivity and efficiency ratios that are included in the subsequent table. With cumulative traffic units being defined by the sum of passenger-km and tonne-km levels achieved on each national railway system, it becomes readily evident that the highest intensity of railway utilisation occurs on the China Railways, followed by JR. The main distinction between the two railway systems is that traffic units for the China Railways have a larger and therefore heavier freight-tonnage element, while the JR traffic units are highly commuter-intensive. The freight-intensive China Railways and US Class 1 Railroads both put relatively large traction fleets to efficient use, realising a greater number of traffic units per traction vehicle, even though the traction technologies differ considerably between the two systems. Freight-capacity utilisation on the US Class 1 Railroads and China Railways is again remarkably high because of higher freight-intensity, with the latter railway system again occupying top slot. Traffic realisation per traction unit is also relatively high on JR but is much more commuter-intensive, compared to which the corresponding traffic realisations of SNCF and British Rail are low. Nevertheless JR, with a relatively small wagon inventory, achieves efficient per unit freight traffic realisations to accompany its highest per unit realisation of passenger traffic. While US Class I and JR traffic realisations are achieved at lower labour intensity, railway services provided by the other systems appear to be more personalised, particularly on AMTRAK which caters exclusively to intercity passengers. It would bear noting however that other factors such as average commuting distances and passenger-comfort levels, as reflected in class of travel, also affect passenger traffic realisation by each railway system, some indication of which can be gleaned by crossreference to the associated average passenger-traffic leads and to the ratios of passenger earnings to freight fares. British Rail and JR for instance show the typically short passenger leads associated with commuter traffic, while AMTRAK, with its reliance on intercity passengers, and China Railways show more evidence of long-lead passenger traffic, albeit at widely diverging levels of passenger-comfort as implied in the associated fare realisations.

The peculiarities of IR's current operating situation become readily apparent from the comparison. In terms of traffic realisation, IR occupies a relatively favourable position even though IR traffic is relatively less freight-intensive than the China Railways. Passenger traffic realisation on IR is also fairly creditable, although achieved over relatively short average commuting leads, and at very low fare and comfort levels. It may be inferred therefore that the high realisation of short-haul passenger traffic on IR is in fact an impediment to better freight realisation, with existing routes and traction units being heavily precommitted to the operation of passenger services. Despite a relatively large workforce, the average wage-cost per revenue unit on IR is not unduly high when compared to railway systems other than the freight-intensive US Class 1 Railroads and China Railways. Low per unit wage-costs on the latter systems are not immediately attributable to low labour deployment or high capital intensity of operations, but - particularly in the case of China Railways - are the consequence of higher freight traffic realisation as well as relatively high fare realisations from passenger services. On no other railway system in fact is relative passenger fare realisation as low as it is on IR, pointing to several simultaneous anomalies in IR's operational situation. The combination of short-lead dominated passenger traffic, highly subsidised passenger fares, and the probably high incidence of ticketless travel prevents correction of traffic imbalances, perpetuating high freight rates and cross-subsidisation, lower freight realisation and a surfeit of uneconomically-operated commuter services, which eventually tell on the financial health and resource-mobilising capacity of IR. As the ultimate consequence and in marked contrast to the China Railways, IR infrastructure remains weak and its traction and freight equipment inventories too meagre and of too old a vintage to permit the provision of freight services on the scale warranted either by India's development needs or IR's large track network.

As a prelude to more contemporary evaluation of the IR freight-infrastructure and recent operational trends, an exploration of the economic history and infrastructural impact of selected world railway systems becomes necessary and is made below.

A. The First Foundations: The European Railways

2.2 Railways in Britain

The beginnings of railway enterprise represent an innovative response to the increased transportation needs created by the growth of towns and mercantile activity in Europe, following the dismantling of feudal institutions and the freeing of artisans and serfs. Although these developments occupied the greater part of the 17th and 18th centuries, the earliest infrastructural responses reflected the adaptation of existing transportation technology methods extending the use of animal and wind power onto commercial turnpike roads and existing riverine channels, rather than the immediate inculcation of new technology. It took a long time for commercial needs to build up to the point where transportation along these traditional channels became clogged and so slow as to warrant the investment of time and money on evolving new transportation technology. Retracing the technological events of that time, the growing focus evident in inventions such as Thomas Newcomen's steam-driven mining pump [1712], James Watt's improved steam engine [1769] for mining and other applications, or Nicolas Cugnot's self-propelled steamcar [1769] built for military haulage of cannon, was on the need to accomplish work volumes lying beyond the physical competence of human or animal power, implying also the need to harness new energy resources such as coal to the fulfilment of new economic needs. Technology provided the singular means of achieving this, and each technologically-superior invention found ready commercial application.

It is interesting to reflect on the long preceding chain of infrastructural innovation that led eventually to the industrialisation of Europe and made the railways its prime movers. European products in the precapitalist era mainly comprised light town-based manufactures produced under local artisanship which obviated the need for developing bulk transportation. Although natural coal was already known and was being mined as a metallurgical resource, the preferred fuels for manufacturing processes continued to be either wood or charcoal. It was only when wood supplies had dwindled by the early 17th century because of the deforestation which followed the mass shift from agriculture to manufacturing in Western Europe,[7] that the mining industry and its need for economic bulk transport became inviting targets for technological innovation. Both the waterways and railways were early outcomes of an innovative engineering process which sought to enhance the bulk haulage capacity of horse-drawn transportation by applying physical principles of lessening resistance, smoothing momentum and maintaining the velocity of transit along a *permanent way* that could be kept free of all other traffic obstacles. The mechanical advantages of transporting heavy loads upon rails had been known and applied at the waggonways in the mines of Europe since the 16th century. Paired wooden rails nailed onto crossties were used there to offer a hardwearing and evenly-spaced wheel bed on which horse-drawn wagons could haul much heavier payloads. By the end of the 18th century, considerable innovation had gone into the replacement of wooden rails by metal and into improvements of rail geometry and wagon-wheel design, leading to introduction of flanged wagon-wheels that did away with the frequent inconvenience caused by derailments of the heavy mining wagons. In all these innovations, a technological lead was consistently maintained by Britain.

2.2.1 Dawning of the Railway Age

Economic and technological transitions in Britain over the 18th century had brought increasing focus to bear on the mining and metallurgical industries. The strong consequent demand for the transportation of bulk materials such as coal and iron spurred the construction of a system of inland canals and waterways which considerably lowered the costs of towed transportation relative to those on roadways. The close association that developed between railways and the new mining and metallurgical industries was much more than coincidental. Coal found principal use in the smelting of metals. Besides directly transporting coal and ore materials from mining pitheads to the nearest river-ports, the iron railways also became the principal consumers of metallurgical products, for wheels and rails, and also for carriage and bridge work. Accordingly, the growth of the iron foundries was also stimulated by backward linkages from the construction of iron railways,

and considerable technological innovations were incorporated by the improved rail designs. While the initial competition between the bargees and road operators in bulk transportation had principally been a market contest where the point of entry for railway transportation was its ability to offer a combination of better transit speeds and bulk economies similar to those of waterways at sunk costs relatively lower than those incurred in canal construction, railway construction was also favoured by strong investor support from the mining and metallurgical industries. Entering the contest, railway transportation was able to transfer the *permanent way* principles of canal transportation to transportation overland, thus mounting a much stronger challenge than roadways transportation had ever encountered before when the Surrey Iron Railway built by William Jessop from Croydon to Wandsworth near London in 1803, took these innovative advantages far afield of the mines by providing the world's first railway service for the carriage of public goods.[8] The haulage efficiency of railways in general surface transportation was established beyond dispute when horses drew trains weighing upto 55T [55 metric tonnes] along this railway, and fuelled further commercial interest in railway development. Several other horse-drawn railways came into operation during the first quarter of the 19th century.

After establishing their viability in terms of haulage capacity, the railways also needed to prove their competitiveness in terms of speed. The steam engine, which had attracted a flood of late-18th century innovator interest as a potential source of horseless motive power, had till then developed around Watt's low-pressure design which suited it mainly to static applications such as the dewatering of mines. The first adaptation of the steam engine for use in commercial freight transportation occurred across the Atlantic in the USA, where the need was primarily for bulk river transportation to and from ports, along broad estuarine waterways to which both tow-barges and deep-keeled sailing craft were inherently unsuitable. After John Fitch had invented the powered paddlewheel steamboat in 1787, its commercial viability for ferries and freight services was established in 1807 by Robert Fulton's *Clermont*, built around an engine supplied by Watt. By 1809, steam engines on Watt's design were being regularly used for oceangoing shipping and the first steamboat crossing of the Atlantic was accomplished in 1819.[9]

However the limitations which till then had hindered the application of steam power for railway transportation - namely the relatively heavy mass of Watt's steam engine and the great weight of the fuel it consumed - continued to remain the focus for further technological innovation in Britain, where the need was primarily for rapid overland transportation. Further improvements in the steam engine design had to await advances in precision engineering and machining techniques that allowed an increase in engine-power ratio relative to engine and fuel mass. Hence the earliest prototypes of powered railways were based on the principle of cable railways towed over fixed distances by a static engine. Nevertheless, by 1804, Richard Trevithick had already demonstrated the feasibility of running a high-pressure locomotive engine at the Newcastle coal mines without requiring special rack-and-pinion arrangements on the track. Fundamental innovations on the locomotive design made by George Stephenson reduced its power-to-weight ratio considerably. Stephenson was therefore commissioned by the new Stockton & Darlington Railway in 1821 to further improve his locomotive design for regular coal haulage. The trial run of his new locomotive in 1825 with a mixed train of 36 freight and passenger wagons was an unprecedented success. Railway development in Britain began in earnest after this event, with approval being given to the Liverpool & Manchester Railway Bill by Parliament in 1826 and commissioning of the railway in 1830.[10] Foreseeing the market potential of steam locomotives, Stephenson along with his son and their principal railway promoters, had already shown considerable foresight in forming an engineering company for their commercial manufacture. Reaching speeds nearing 40kmph on the new railway, Stephenson's 'Rocket' locomotives completely revolutionised the haulage of both passenger and freight traffic and heralded Railway Mania, quickly precipitating the demise of commercial horse-drawn railways in Britain.[11]

The transportation revolution which occurred after the mid-18th century, culminating in the advent of railways, may thus be viewed as the product of a continuous stream of innovation in which Britain was a noticeable technological leader. Purely *physical* innovations such as the building of turnpike roads, canal construction and the deepening and widening of natural waterways, and construction of horse-drawn railways augmented freight volumes, creating the infrastructure for industrialisation of the British economy. The high pace of infrastructural innovation, supported by rising mercantile profits and consequent interest in the commercial development of the transportation sector, was generated by the competition between different transportation modes, as they sought to contest the temporary monopolies that were created by each infrastructural innovation.

After the escalation in freight volumes had triggered the growth of mining and metallurgical industries which depended extensively on the movement of bulk materials, the focus of the freight contestants turned to *engineering* innovation in order to improve transportation efficiency and running speeds. Technological attention inevitably gravitated towards coal and steam which had already revolutionised factory manufacture, and at the summit of this innovatory wave, the *mobile* steam engine or *locomotive* was born. Although the commercial history of this innovative process has remained largely unrecorded, the exclusive returns to patented inventions from their commercial application worldwide spurred the development of new transportation concepts and their application to newer fields. While the roadways also sought to reenter the freight contest in Britain through early 19th-century innovations such as the macadamisation of road surfaces, without backward linkages their freight interest remained confined to the relatively uncontested piece-goods segment, and was quickly demolished when animal power was supplanted by steam. With time, railway engineering principles even entered the realm of urban transportation through the development of horse-drawn, and later, powered tramways.

2.2.2 Railway Enterprise & Operations

Close association was also observed between railway engineering and railway enterprise in Britain. Soon after the success of steam railways had established them as a technologically superior alternative to the roadways for intercity transportation, a number of important lines were constructed by railway entrepreneurs to link contiguous cities. The concept of a *trunk* railway was born after the first flush of railway construction was over, when the Grand Junction Railway was built in 1837 to link the Liverpool & Manchester Railway to Birmingham. By 1838 the trunk line had already been extended to link with the London-Southampton Railway. The technological importance of the trunk line concept lay in the rapid standardisation it brought to railway gauges and equipment in Britain. The first British railway lines had been laid by private companies over numerous small routes. Initally, their choice of gauge tended to be arbitrary - the 1.435m (4'8½") choice of gauge on the Stockton & Darlington Railway, which had been based on the width of the local colliery waggonway, being adopted as standard gauge by several other railways. Citing the advantages of better locomotive stability and speed, greater train safety, and higher haulage capacity, the eminent 19th-century engineer Isambard Kingdom Brunel however chose the broadest-ever railway gauge of 2.2m (7') for the Great Western Railway which was built between 1833 and 1841 to connect London to Bristol. A Royal Commission was therefore appointed to investigate gauge standardisation on the British railways, paving the way to enactment of the Gauge Act in 1846, under which the 1.435m gauge was declared the standard railway gauge all over Britain. To allow standard gauge trains of the other railway companies to pass through the London-Bristol trunk section, the Great Western Railway was consequently compelled to add a third rail on its tracks, and maintained this until 1892 after which it wrote off its old inventories and converted completely to standard gauge.

During the Railway Mania years between 1830 and 1850 the stance of the British government remained regulatory in nature, since private railway capital could only be raised from the money markets by the companies against individual railway schemes that had been approved by Parliament. By 1850, railway trunk routes in Britain already extended over a network of more than 9600km from Scotland to Southampton. As the trunk lines were completed and the pace of railway construction within Britain began to slacken, entrepreneurial interest shifted to mergers and acquisition of smaller railway companies, as their larger neighbours settled into the business of running railway services profitably. By 1844, the 'Railway King' George Hudson had already amalgamated the Midland Counties Railway, North Midland Railway and Birmingham & Derby Railway into the *Midland Railway*, later also acquiring the Birmingham & Gloucester Railway and Bristol & Gloucester Railway to build a zonal railway empire spanning 1600 track-km. Amalgamation of the London & Birmingham Railway, the Grand Junction Railway and the Manchester & Birmingham Railway into the *London & North Western Railway* occurred in 1846. The need for prior parliamentary sanction thus also enabled the British government to regulate the sequencing of railway construction and amalgamation. Consequently the *Great Northern Railway* which was proposed in 1827 to link the northern mining and industrial regions in Yorkshire to London did not secure parliamentary approval till 1846, after the Midland and London & Northwestern railway networks had already been put in place, and was only completed in 1860. Similarly, the *North Eastern Railway* was only formed in 1854 after the amalgamation of the York & North Midland Railway, Leeds Northern Railway and the York, Newcastle &

Berwick Railway, and eventually absorbed the South Durham & Lancashire Railway, Stockton & Darlington Railway and West Hartlepool Railway between 1863 and 1865. Railways in the northern territories relied heavily on the transportation of coal and other raw material freight, and were allowed to come into being only after appropriate economies of scale had been created by the rest of the network. Railway consolidation in Britain occurred through the building of zonal monopolies for the amalgamated railway networks, which secured their profitability and operational position. Meanwhile, the railway construction and finance companies had begun to carry their expertise overseas, accompanying massive exports of British capital, iron rails, locomotives and other railway materials. Despite railways in Britain being built and operated entirely by private companies, the role of the government in railway development is thus seen to have been proactive, ensuring a continuous flow of infrastructural benefits to the economy from backward and forward linkages.

The cyclic sequence of drawn-out market booms deemed collectively as Railway Mania, followed by noticeable slacks in 19th-century British capital markets has been the subsequent subject of much economic and policy analysis.[12] During boom conditions, individual railway investors felt their investment risks were indemnified in the mass response attracted by railway equity issues. Railway capitalisation hence rose appreciably during the phases of 'low risk' perception which accompanied railway construction, enabling the companies to build an equity base strong enough to tide them over through succeeding periods of financial stringency. During the latter, when railway companies made greater resort to financial instruments such as loans and debentures, the accumulations of paid-up capital acquired earlier provided the collateral to offset lender-risks. In this sense, the market process served to iron away ebbs and eddies in railway capital flows, underwriting the railway companies against sudden money market failures.

After domestic railway construction in Britain had been largely completed, the British railway companies were thus enabled by their accumulated stores of capital, engineering expertise and investor confidence to participate aggressively in global railway construction through the remainder of the 19th century. Periodic accusations of overcapitalisation by railway companies nevertheless arose within Britain, which were scrutinised by several parliamentary committees between the 1840s and 1850s.[13] A subsequent debate among British railway historians has thus arisen on whether these high levels of capital accumulation represented the phenomenon of adverse selection, *i.e.* the inability of capital markets to distinguish correctly between true market potential and speculation. Tracing Railway Mania through the successive transfers of railway construction activity to other countries, one position within the debate deems that the market allocations were generally efficient and ensured capital flow into the most viable railway projects at hand. The competing argument however relates sharp divergences in constructional and operational costs of railways in Britain vis-a-vis other countries to waste of resources encouraged by overcapitalisation, inevitably leading to low rates of return on railway capital. The high institutional costs of land surveys and acquisition in Britain which raised railway construction costs to £5000 per mile, or nearly twice the construction costs incurred by the French railways and eight times more than construction costs on the US railroads, were invariably cited by the railway companies before parliamentary investigations as the main reason underlying the high railway capitalisation needs of Britain.

It can still be surmised that promoter competition and the piecemeal mode of railway development adopted in Britain were at least partly responsible for the high construction costs of British railways. Unlike sparsely-settled countries on the Continent or the US where land was granted to the railways as a state prerogative, land in the British Isles already commanded a high premium, which escalated further as open contests emerged between rival railway promoters while government procedures sought to secure landed citizens against arbitrary land dispossession. Railway development in Britain was therefore constrained by competitive inefficiencies arising from promoter competition and inappropriate company network sizes that proved too small in practice to yield adequate economies of scale. Quite clearly, these guided the consolidation of natural railway monopolies through company amalgamation and buyouts in the subsequent period.

From the early 1880s, operating performance on the British railways steadily deteriorated as their *operating ratios*, or percentage of working expenditure to gross receipts, rose substantially and annual net rates of return on railway capital declined from the peak of around 4.5 percent achieved in 1870.[14] Sharp accompanying declines in the growth of railway productivity also provided evidence of diminishing returns to railway investment. However the deterioration in operating ratios did not reflect declining operational efficiency *per se*, since it was partially attributable also to rapid escalation of working expenses relative to the growth of gross railway earnings, following the rising labour and input cost trends of late 19th-century Britain.[15]

Following the 1870s, railway extension in Britain largely comprised the construction of branch and suburban lines and provision of special passenger services and amenities, each of which required disproportionately high cost outlays at higher average unit operating costs, because of their lower traffic density. Returns on suburban traffic, which was composed mainly of workmen commuting to and from cities on concessional fares, were also low since the clustered peak-hour density of suburban services necessitated high deployment of personnel and railway rolling stock, even when traffic capacity remained underutilised for the remainder of the day. In several instances, peak traffic even interfered with the flows of more profitable mainline traffic. Commercial adaptation to the presence of railways was also noticed among British retail traders and distributors who began to lower inventories in order to reduce stock expenses and market risks, relying on the quickened freight transit offered by railways to meet business orders. Needless to say, this reduced consignment-sizes while increasing shipping frequency, turning hitherto large freight consignments into traffic smalls. Although the standard tariff-setting principles being followed set low rates for cheaper freight commodities and high rates for those with higher unit-values, the proportion of underrated traffic carried at low profit margins increased substantially. Thus by 1914, nearly a third of all freight transits on the British railways comprised low-rated coal traffic. Meanwhile, the capture and consolidation of passenger traffic required induction of expensive coaching and rolling stock and the provision of additional station amenities, on which the costs of maintenance were also commensurately high.[16]

Regulation of railway rates through extended government control rendered it difficult for the British railways to pass on these increased costs to freight shippers and the travelling public, since the justifications to be submitted while proposing upward tariff revisions to the government required the segregation of freighting costs from the costs of passenger carriage, which proved difficult to accomplish in practice because of the joint-cost character of railway operations. On the other hand, railway rates were less sticky downwards since special preferential rates were regularly negotiated between the companies and the major freight shippers. Thus during their early phase, the British railways were sandwiched between rising unit-costs and falling average revenues and charges, as rising proportions of freight and passenger traffic entered the cross-subsidised traffic categories. In fact, it was not until the advent of serious roadways competition much later that these patterns of cross-subsidisation were called to question, because they tended to encourage selective transport competition in the highly-rated traffic segments.

2.2.3 Railway Technology & Institutions

In the face of their inability to pass on increased costs in the form of higher charges, the logical alternative for the railways would have been to raise productivity and reduce working expenses through fresh inductions of technology, especially in view of growing traffic volumes and density. No such mitigatory course was seen to have been adopted in Britain, causing the economist George Paish to point out at the turn of the century that substantial reduction in unit-costs had been achieved by the American railways by inducting improved technology into railway freight handling methods and carriage.[17] These had in fact allowed the running of heavier trains, justified by the longer haulage-distances and larger consignments transported on the American system. Delayed inductions of railway technology were particularly noticeable in British freight operations. Apart from the lack of improvement in railway marshalling and handling, a significantly large part of freight inefficiency on the British railways arose from inadequate wagon design. Improvements in wagon capacity were thus wholly neglected, and the 8.13T and 10.16T (ton-equivalents=8 and 10 British tons) 'toy truck' design remained the standard British railway wagon till 1914, sacrificing economies of size. Even in the 1930s, wagons of the improved 20.32T (20 ton) design constituted only 3 percent of the British wagonfleet, although it was well recognised that substantial operating cost reductions had materialised from their use because of the highly favourable ratio of additional earnings to additional capital costs, reductions in maintenance and marshalling costs, and the increase in tractive handling power of locomotives consequent upon their higher payload-to-tare ratios.[18]

Thus while acknowledging that the distinct character of railway freight traffic in Britain had to some extent determined the type and technology of services provided, the Beeching Report on structural reforms for the nationalised British Rail [19] commented later that glaring innovatory failures were also involved in the evolution of a traffic pattern under which freight continued to be moved at slow speeds in very small loads to a multiplicity of stations, and where much of the traffic originated and terminated in single wagonloads. Consequent upon this practice, the railway wagon had become the primary unit of movement passing through

British marshalling yards, with through working of trains being neglected till the point where variable and cumulative delays in the marshalling process had made the overall freight service slow and unreliable. The obligation of the British Railways to fulfil the role of a mover of freight smalls over a vast network of branch lines despite their being technically unsuited to traffic in this category, was observed to have led to sacrifice of the speed, reliability and low operational costs of trainload services even along mainline trunk routes. Other innovatory failures are also deemed to have arisen from the unwillingness of British Railway to introduce modern braking technology on wagons which would have contributed to their operational efficiency and economical running, and from the lack of standardised designs incorporating uniform axle boxes and suspensions which would have lowered both the costs and complexity of railway maintenance. The low cost of British coal was similarly noted to have led to the neglect of railway technology improvements, which could have increased tractive efficiency through modifications of traction design and the phased introduction of diesel and electric traction.[20]

The outbreak of World War I brought a salutary improvement to railway performance, providing evidence also that considerable slack existed on the British system, since with less rolling stock and depleted manpower, more traffic was moved between 1914-1918 than had ever been moved previously. Much of this improvement was achieved by transport coordination and was attributable to unified working of the entire freight infrastructure and the various railway companies under exigencies which allowed government to invoke the provisions for wartime railway control included in the Railway Act of 1871. The measures adopted for coordination eliminated the light loading of wagons, and consolidated freight, particularly that with military character, into full trainloads through point-to-point allocations of traffic. Secondly, they reduced congestion at railway sidings and terminals by confining maximal traffic flows to the handling capacity of sectional networks on which they were being transported. Substantial freighting efficiency was gained by pooling the limited wagonfleets owned by individual railway companies, thereby ensuring the reloading of wagons close to their points of discharge and the reduction of wagon turnarounds.[21] Such traffic and efficiency gains, no matter how substantial, resulted from the wartime scenario rather than commercial reorganisation and thus tended to evaporate when the railway companies reverted to individual operations at the conclusion of WWI.[22] Nevertheless technological innovations in freight handling and the use of heavier wagons that had been introduced by the more enterprising railway companies marked a qualitative change between prewar and postwar periods, while logistic improvements which had followed the provision of better statistical inputs on wartime traffic movements also improved the quality of railway monitoring after the war.

While the nature and organisation of British railway operations did differ markedly from those on the American railroads, the failure of the British railway companies to set a desired pace for innovation was rooted elsewhere, namely in the company railway institution rather than in its operations. Certain railway companies innovated while others did not, establishing that company initiative could have played a free part in reorganising traffic operations on more economical lines. The fragmentation in traffic that rendered bulk handling and movement inappropriate resulted to a large extent from the priorities accorded by the railway companies to specific traffic categories of traffic, regardless of the costs involved. Thus passenger services on the British railways offered the highest levels of passenger amenities - such as separate dining cars, for instance - even when such amenities were very expensive to provide, and their full costs could not be passed on to users. Similarly, the low demurrage rates in vogue on the British railway freight system provided an inducement to the freight consignees to use railway wagons as a cheap warehousing facility, reducing their effective deployment for traffic operations.

Much more than this however, railway innovation by the companies often encountered the institutional deterrent of investment at high and unaffordable capital costs, since the character of technological innovation on the railways usually involves cascading downstream investments on the adaptation of other facilities, thus greatly amplifying the eventual infrastructural cost of any improvement in equipment. Since the principal avenues for operational improvement involved the induction of heavier and larger traction and rolling stock, the absolute limits to which these could be sustained were laid down by route gradients and the radii of track curves, bridge heights, tunnel clearances, and the sidings and handling facilities at user-terminal installations. Having pioneered industrialisation since the first half of the 19th century, Britain now began to suffer limitations from the vintage of its capital and railway assets, while a late-industrialising nation like the US was favoured on the other hand by closer technological compatibility between its railway, industrial and port infrastructure. Secondly, the effectiveness of transport innovations applied by the railways depended on the

willingness and ability of major railway clients like the mines to invest on the upgradation of their own facilities to bring them into conformity with those owned by the railways after technological innovations had been effected. In most cases such willingness was not forthcoming, and thus most British client installations were unable to accommodate 20.32T or larger wagons, which most American client installations could.

Another form that the interrelatedness of railway institutions assumed arose from the existence of privately-owned rolling stock amounting to over half of the total wagons then in use on the British railways, as a partial carryover from the early railway days when traders had been required to provide their own wagons. Around 90 percent of these belonged to the colliery companies, who strongly opposed the introduction of larger wagons because of the restricted permissible heights of coal-pit headings and limitations of the existing track and sidings.[23] Railway companies on the other hand were unable to singly bear the development costs of these because of limitations on their rates and revenues, upward revision of which was also strongly opposed by their clients. Although it might superficially appear that joint efforts would have overcome such institutional obstacles through the sharing of development costs, new problems would inevitably have arisen over the apportionment of joint costs between the respective parties, and in any case the strong preference of freight consignors and consignees to send and receive their shipments in smalls instead of pooling them into trainloads did not warrant investment from them on bulk handling methods. At the other end, because of the commercial empire-building that was intrinsic to early railway enterprise, railway owners relegated the efficiency of operations to a secondary position while concentrating their attention on aggressive expansion of networks, which often implied the duplication of facilities and promotion of uneconomic lines and services in the effort to outdo rival companies. This single aspect is deemed to have contributed considerably to the lowering of average net returns on railway investment, since the provisioning of marginal lines entailed higher proportionate costs than the mainline system, in some cases even exceeding marginal revenues so that sectional losses occurred. Weaknesses also arose from the lackadaisical attitude of the railway companies towards the maintenance of statistical performance records of the type that had been advocated by Acworth and Paish. In fact the only data that were adequately maintained were of the balance-sheet type, accounting for profits earned and dividends distributed by the railway companies. Again, this was a carryover of the mindset of company construction and promotion of railways from the early railway days, which prevented British railway operations from acquiring the characteristics of a scientific transportation system. Rationalisation and reform of railways was also delayed on this account, because of the paucity of statistical information capable of identifying uneconomic sections of the company networks. This situation continued till the collection of adequate data was made compulsory by legislation just before WWI.

In contrast to British shipping, which was wholly unregulated, the development of railways in Britain from the 1830s onwards was never free from legislative controls. The peak period of regulation in the pre-nationalisation era occurred when government requisitioned the entire British railway network during WWI and vested its control with a Railway Executive Committee [REC] constituted by the general managers of major railway companies, against the incurred liability of compensating the companies at par with the net incomes they had earned in 1913, for the period that the railways would remain under government control.[24] Since payments on this account were to be met from traffic revenues, some focus naturally developed on the efficiency of operations. Traffic load on the British railway system over WWI increased immensely and traffic performance was equally creditable, because of vast reductions in operating expenses and the development of cooperative modes of operation, represented particularly in the pooling of company wagonfleets. Although the railways depended much less than British shipping on the scale of international traffic demand and physical damage to the British railway network resulting from war had been minimal, severe asset depreciation had occurred from the running down of rolling stock and equipment. The lessons of wartime railway coordination made it abundantly clear that there would be no going back to the prewar competition and that railway coordination was there to stay, and the REC's opinions in this regard were fully endorsed in 1918 by the Select Committee on Transport, which proposed the unification of railway ownership.[25]

Although government was thus persuaded to extend the period of control and guaranteed net receipts while a decision was pending, the commercial situation rapidly deteriorated between 1918-21, following sharply increased working expenses and higher compensation being paid out to the companies. The government's eventual intentions had already become clear, since railway nationalisation had occasionally been mooted in Parliament as a possible solution.[26] It was however the decline in the financial position of company railways which provided the first avenue for reorganising the railways. Accordingly, a Ministry of Transport was established in 1919, to which considerable powers over the railways and other modes of internal transport

were transferred. Most important among these were powers to set and alter railway rates flexibly, with the eventual intent of bringing these into line with working expenses. After a proposal for nationalisation was rejected in 1920, sharp enhancement was allowed in railway freight rates to wipe out the operational deficits that had placed an additional financial burden on government on account of the guaranteed net revenues that were being paid out to company owners. The operational situation was further compounded by general economic recession and recurrent strikes which had led to partial stoppage of the coal trade, and by the raised scale of maintenance expenditure to restore track and rolling stock back to health. Piecemeal tariff increases did not therefore appear to be capable of providing the ultimate solution. Although nationalisation was rejected as a possible alternative, the urgent need for operational reorganisation of the British railways had become apparent. Accordingly, the government set about reorganising the 130 assorted British railway companies then in existence into a few major groups and unifying the total existing rail network of about 40,000km, to ensure standardisation of equipment and operations and to eliminate direct railway competition as far as practicable.[27] The smaller individual railway companies were amalgamated under the 'Big Four', namely the Great Western Railway [GWR], the London Midland & Scottish Railway [LMSR], the London & North Eastern Railway [LNER], and the Southern Railway [SR].[28] The amalgamation resulting from the Railways Act of 1921 strove to preserve the combined net revenues of the amalgamated companies by allowing each newly amalgamated group the freedom to set railway rates that would compensate for losses in individual revenues. The 1921 Act is thus regarded as the most important piece of railway legislation following the original Railways Act of 1844, since it invested the amalgamated British railways with the responsibility for scientifically coordinating their operations. Meanwhile, a cumulative amount of £60 million was paid out as compensation by the government in full settlement of the claims and charges of the erstwhile owners.[29] Despite the newly granted flexibility in setting railway tariffs and downward revision of these in the hope that traffic elasticity would help to raise revenues, general slack conditions did not immediately let the reorganised railway system be restored to profitability. The results of post-WWI decontrol of railways were therefore mixed, in the sense that while operational efficiency improved, financial performance did not follow suit.

2.2.4 The Response to Competition

The decade immediately following WWI also witnessed the free and unregulated development of road transportation in Britain. The motor transport boom had commenced worldwide in the 1920s when, in an atmosphere of unbridled enterprise, thousands of small companies had entered the coaching business. Severe competition between these companies led to duplication of facilities, undercutting of fares, as well as resort to unscrupulous trading practices. Under the new clout over transportation modes that had been provided to the Ministry of Transport under the 1921 Railways Act, it now sought to regulate roadways development. Since safety and maintenance were also being given short shrift by the roadways, a Royal Commission on Transport reviewed the situation between 1928-31, and was accompanied by enactments of the Road Traffic Act of 1930 and the Road & Rail Traffic Act of 1933 to provide legislative means to the Ministry for imposing licensing regulations on the roadways.[30] With licensing being stringent, it constituted a sufficient barrier to the entry of the roadways into the preserve of the British railways, although allegations persisted that licensing stifled good competition along with the bad. Licensing nevertheless allowed the retention of passenger traffic by the railways at a time when railway development was stagnant relative to the boom in motor transportation, and also ensured intermodal coordination between the British railways and roadways. Fierce opposition from the railways to roadways services on the grounds of duplication also dwindled as the amalgamated railway companies gradually acquired an interest in running parallel roadways operations. Subsequently therefore, greater inclination emerged on the part of rail and road operators to enter into agreements which coordinated their respective services on long-distance as well as suburban routes. In sum, it might be said therefore that railways in Britain were not unduly protected by the regulatory legislation on the roadways. In fact, it was observed that the presence of the alternative mode spurred the amalgamated railway companies to compete through improved services, particularly for medium and long-distance passenger traffic where competition was stiffest.

A significant opportunity was provided by the advent of roadways for the technological upgradation of railways. The most remarkable railway innovation, after the initial introduction of steam, was the introduction of electric and diesel power into railway traction. However, inspite of the availability of this new technology

by the early 20th century, the observed tendency on most world railway systems was to persist with the use of steam traction for several decades thereafter, thereby giving it an extended lease of life well past the century where it had first appeared. An identical tendency was also noticeable in the case of the British railways, with no attempt being made to abandon steam traction till well after WWII. Thus in 1955, when the British Transport Commission launched its Modernisation Plan for the railways, steam still accounted for 87 percent of the total tractive haulage, against 10 percent for electric traction and 3 percent for diesel traction.[31] The majority of electric and diesel-powered services in any case comprised short-distance multiple units (*i.e.* EMUs and DMUs) for suburban passenger traffic rather than locomotives, while the mainline services still relied heavily on steam traction. The British railways, which had by then been nationalised and consolidated into British Rail, thus had a traction fleet of nearly 18000 steam locos, against just around 500 diesel and electric locos. The lag in the introduction of new tractive technology for nearly five decades after it had been proved viable needs to be explored, since delays of this long order were not witnessed in other railway systems. In the US for example, diesel traction had made rapid headway by the mid-1930s and accounted for over 12 percent of freight mileage and between 25-30 percent of passenger and marshalling mileage on the American railroads at the time of commencement of WWII and the construction of new steam locomotive units had practically been abandoned.[32] Sufficient evidence had also existed since the 1930s of the benefits to be drawn from the introduction of electric traction, including the provision of clean, fast and frequent services at lowered operational costs which could bring back traffic to the railways. The flexibility offered by EMUs also made them eminently suitable for suburban services. Of the amalgamated British railways however, only the Southern Railway had introduced electric traction from the 1930s and had made sufficient headway in traction conversion by the time of the outbreak of WWII.[33] Although financial results from this Railway revealed that substantial transportation economies had been gained, the other railway companies showed no inclination to follow suit. The situation persisted even after nationalisation, with no immediate advance being made in the introduction of diesel traction either, despite the similar scale of benefits it offered.

For the introduction of new technology, certain preconditions had to be fulfilled. Thus while average operating costs of the new technology had to be consistently lower than those for the technology already in service, the net expected returns had to be substantial enough to meet all interest charges arising from new investment. Even where such financial conditions were fulfilled, other features of the sector under consideration could conceivably constrain innovation. With respect to innovation on the British railways, the *natural monopoly* character of transportation services and the need to service innovation with further downstream investments in order to maintain compatibility between railway technology and other railway and industrial infrastructure, acted as powerful deterrents. Another limitation arose from pessimistic business expectations and the reduced availability of easy railway finance. With cash reserves running low over the interwar period, the pressure to innovate would have necessitated extensive market borrowing, for which neither resources were forthcoming, nor was the overall financial health of the railways system capable of inspiring investor confidence.

Other constraints on railway innovation were far more specific to the nature of railways. Because of Britain's strong domestic mining industry which moreover was the principal client of the British railways, relative factor prices favoured the continued use of coal, while depressed wages in the recession years firmly discouraged the adoption of capital-intensive innovations in traction. Meanwhile, as serious competition emerged from roadways transportation, the initiative taken by the railway companies to combat competition involved their entry into auxiliary motor transport operations, which in fact delayed railway innovation. The companies therefore continued to repose their faith in tried and tested steam traction into which a massive amount of railway capital had been sunk, instead of risking new experiments.

The major apprehensions inhibiting electrification of the British railways were institutional in character, relating to the magnitude of downstream investments to be made and sunk costs to be written off. The railway companies were strapped for funds because of commitment of a large part of current net revenues towards paying dividends and fulfilling the arrears in maintenance works which had accumulated over the WWI period.[34] By the end of the 1930s, an extraordinary financial situation already prevailed because of the outbreak of WWII. The situation was only reversed after wartime restrictions on capital investment were removed, and the shortages of labour and fuel which had constantly pinched the British economy during and after WWII made the foray into electrification inevitable. The Southern Railway, which was the only British railway to have made a serious foray into electrification before WWII, was assisted by the suitable nature of its traffic.[35] Nearly 80 percent of its revenues accrued from high-density peak loads of suburban passenger

traffic, which required rapid transit to avoid congestion. Since the major competition was from passenger roadways which also offered quick and efficient transit, the pressure on the company to improve service quality and reduce operating costs encouraged the adoption of EMU-type electrification, which the company could well afford to because of its more lucrative traffic earnings.

Diesel traction, which offered many of the advantages of railway electrification without requiring extensive adaptation of railway infrastructure and could be economically operated at lower traffic densities, had already become a viable and widely accepted option on the American railroads during the 1930s and 1940s.[36] The reluctance of the British railway companies to explore this alternative, stemmed from the auxiliary forays they made into motor and air transportation to ward off the competition. Investments that might have been fruitfully made into dieselising traction went instead into such monopoly-sequestering alternatives, in a classic case of adverse selection under which resources vital to improving railway efficiency were squandered elsewhere. The other major blindspot of the railway companies was their persisting faith in steam. This faith was founded on generations of railwaymen who had been reared in the environment of steam, and whose skills rested there. The technological response from this community to seek ways, instead, of increasing the efficiency of steam traction through engine redesign and streamlining of trains, etc., in the belief that the steam locomotive could be made to compete technologically, and still had a future. It was only after dramatic improvements in railway efficiency were witnessed in countries which had chosen to shed steam traction, that this mindset changed.[37]

2.2.5 Nationalisation & Denationalisation

Indifferent railway performance over the Depression period and the emergence of sharp competition from the roadways eventually prompted the government decision to consolidate the railway companies under the nationalised British Rail, and they passed into public ownership in 1948. British Rail commenced unified operations on 1 January 1948, amidst the wave of postwar nationalisation in Britain under the Labour government which had taken over the reins of power. Although a new phase of railway modernisation followed, recurrent revenue deficits began to occur from the mid-1950s, which no amount of general subsidies, reinvestments, closures of services and individual subsidies to unprofitable lines could undo. Restructuring of British Rail in the 1960s under the Beeching Report thus sought to rationalise these deficits through selective service closures. In the 1970s, clarification of the public service obligation [PSO] of British Rail allowed the commercial restructuring of other railway services, while reformulations of railway management over the 1980s laid the ultimate foundation for the privatisation of British Rail towards the end of the 1990s. The last significant change before actual privatisation was the internal reorganisation of railway management into the management of several business sectors resulting in cost consciousness, investment appraisal and controlled resource utilisation.

Private enterprise has been an almost permanent feature of the British economy, except for the short interregnum of nationalisation under the Labour governments that held power immediately following WWII. The railways were nevertheless among the last of the formerly-nationalised British enterprises to be privatised by the Conservative government in the early 1990s, the delay stemming mainly from the inability of the proposed privatised managements to subsidise uneconomic passenger routes that had to be maintained for sociopolitical reasons. Although a mechanism under which subsidies could continue was ultimately devised to avoid largescale route closures, this prevented the divestment of British Rail from yielding large revenues to the government, unlike those that had accrued from the divestment of other public utilities such as gas, electricity and telecom.

Alternative structures proposed for privatisation of the British railways at the time included

(a) *single-unit privatisation* under BR plc,

(b) *sectoral privatisation* which would hive off sectoral business,

(c) *regional privatisation* on the old structure of route-based companies,

(d) *track privatisation* under a private track authority which would exercise separate control over the track network while permitting competition in the use of the track, and

(e) *franchise privatisation* under arrangements where different categories of railway services would auctioned out to private bidders.

The eventual choice of the track authority and franchising mode was followed up in the Railways Act of 1993 that came into operation on 1 April 1994. Under provisions of the Act, British Rail was split up into several distinct entities, among which Railtrack took over infrastructural responsibilities including signalling, stations and depots, power supply, in addition to construction and maintenance of track. The costs incurred on these were to be covered by charges for the use of facilities, with provisions for a commercial rate of return on these assets. *Railtrack* was privatised in 1996 by listing its equity on the stock market. The franchising option was exercised in the case of passenger services and in channelling government subsidies to the franchisees. A regulatory authority was also set up to arbitrate and to ensure equitable access and reasonable railway charges, and empowered to direct and oversee Railtrack also regarding these aspects. Railway safety was entrusted to a separate executive which would monitor the compliance by individual railway operators to safety regulations. Under the arrangement, all existing railway passenger services, excluding charters, special trains and Eurostar Channel Tunnel services, were then franchised out under 25 separate components which the franchisees were to operate with rolling-stock leased from railway leasing companies formed within British Rail. Apprehensions did surface that sharp fare increases might occur on profitable traffic sections where the railway franchisees held a natural monopoly. However general fare controls introduced in 1995 reduced the scope for these through the introduction of a three-tier ticketing system on which fares were frozen on specific lengths of time.

The separation of infrastructure from services attempted through incorporation of Railtrack was primarily intended to make the provision of railway services more contestable by increasing the scope for transport competition. While this was eventually to be attempted by allowing open access, competition in the initial phase had to be limited to attract franchise bids. Thus under both initial and proposed bidding systems, franchisees were required to demarcate the services being competed for on the basis of point-to-point flows, with competition gradually being open upto various threshold levels of the total revenues represented by these flows. While franchisees could bid freely for various point-to-point services, overbidding on their part would raise the quantum of revenues bid for and proportionately open higher revenue threshold levels to competition, while underbidding would conversely reduce the degree of revenue protection offered. In operational terms, this was expected to optimise the competition by preventing individual franchisees from becoming too large or remaining too small.

Freight and parcel services on British Rail were also privatised - in the case of the latter, interestingly, by nominal sale to the management team. Trainload freight services however had to be reorganised by adding contract services, and regional separation of the organisation into *Loadhaul* which would cater to service and depot arrangements, *Mainline* which would administer the traction fleet, and *Transrail* which would handle long term contractual haulage arrangements. Although still separate, these were bought as a package by the American railroad company Wisconsin Central, which, again interestingly, also bought over rail express systems and appeared likely to takeover international rail freight. Two power utilities dealing with electric and nuclear power also set up their own freight operations for captive traffic by acquiring their own traction.

The principal object of privatising British Rail had been to induce competition in railway services which would improve efficiency, reduce costs, and improve service-quality and technological development. The competition that did develop particularly in passenger services however appeared at the bidding stage rather than ontrack, and route competition was therefore limited. Considerable competition did emerge in railway leasing operations particularly during renewals of leases, but the least degree of competition was seen in freight services because of the package sale. It was expected however that substantial competition might develop later in the maintenance of track and signalling infrastructure, one of the main items of outgo on the part of most railway systems. Under provisos that quality and safety would be strictly regulated, this was expected to lower overall railway costs substantially.

2.3 The French Railways

As in Britain and its other European neighbours, the growth of commerce in France had been triggered by the construction of state waterways during the 18th century. Riverine traffic had thus risen to a peak between 1750-1800, before declining thereafter. Railway development in France was also preceded by the complementary revolution in road transportation that commenced in 1730 under the agency of the state. Since several economic impediments had already been removed by the 1820s through creation of a superior

internal network of roads, the subsequent development of railways in France did not quite fill an empty space.[38] Nevertheless severe regional disparities between northern and southern France, traceable to the uneven provision of transportation facilities, had obstructed the creation of a national market during the preceding period. While the concentration of cities in the northern region had been a stimulus to the evolution of an intricate and efficient network of trunk and branch roads in their immediate periphery, transportation in the south had developed in a more unorganised manner and the localised roads around the few urban centres such as Marseilles and Bordeaux barely complemented the rivers and canals.[39]

2.3.1 The Railways under Monopoly

Development of the railways in France was therefore considered by the Railway Commission in 1839, which also examined possible modes of financing their construction. While a few horsedrawn railway lines had already been laid between 1826 and 1832, it was only from 1842 that railway development took off in earnest, under a well-conceived plan for constructing 9 radial trunklines from a railway hub at Paris to link the Rhineland to the Mediterranean and Atlantic seaboards. Construction and operation of these was to be undertaken by private railway companies under 40-year charter terms, with free provision of land, track beds and terminal facilities by the French government.[40] Under the principle of 'finance by the state and operation by concessionary companies' established in the Railway Bill of 1842, state support for the railways did not take the immediate form of direct subsidies, but was rendered in state loans and equity participation. Although the opening of the first railway between Paris and Rouen in 1843 was quickly followed by a construction boom, the problems that could have arisen from railway competition were eliminated through rapid consolidation of the French railways under 6 large monopoly companies.[41] Following the completion of the trunklines however, railway construction underwent a slump because of investor disinterest stoked by the 40-year charter limitation on private operations, and the lack of competitive stimulus. Consequently, the Railway Plan of 1842 was modified in two important respects by extending the charter duration to 99 years and by providing government guarantees on the minimum rates of return that would accrue to private capital investments. Capital for a renewed railway development phase was also mobilised domestically through bond issues on which the French Government guaranteed 4 percent interest.[42] Serious rethinking on the earlier financial principles and the minimalist role that had been occupied by the state began to surface however after three decades of railway development, following frequent skirmishes between the concessionary railway companies and industrial users regarding the alleged charging of complex and unfair rates for particular industrial traffic such as iron & steel.[43]

A concerted state programme for building a national navigation network in France was therefore revived in 1879 under the 'Freycinet Plan'. The objectives of this were to resume the grand 18th century canal-building works which had been interrupted by construction of the railways, and to classify the navigational gauges of French rivers so that a standardised barging fleet could be developed. While marking the first attempt at intermodal coordination in French transport, the Freycinet Plan also reflected the changing political mood of the period as the French Republicans sought to expand state participation into the provision of infrastructure. Although the Plan objectives were technically laudable, the basic difficulties in implementing Freycinet, which became evident by 1882, related to its weak financing arrangements as well as to the implacable opposition it encountered from railway operators. Thus while new canal works initially proceeded as planned, investment on the maintenance and improvement of the existing network lagged behind. Progress on the new canal works was also soon retarded by opposition from the railway companies and their political lobbies. As a direct consequence, investments on canal development which till 1883 had been rising, registered a sharp drop by 1887 and continued to fall steadily until 1899, before a new effort was made to revive the Freycinet Plan. By then the *free traders*, had become the main supporters of the proposed canal network, while *protectionists* still favoured the construction of railways. Mutual distrust between these two groups and the lack of cooperation from local and regional authorities considerably reduced the private investor response to both canal and railway works, despite the subsidies and toll concessions which were being offered under financing arrangements. Traffic response on the waterways also tended to be mixed, and while the number of boats declined between 1880-1913, their loss in numbers was compensated by the increase in their individual capacity under the policy of standardisation. As such, the contribution made by French waterways to the overall expansion of transportation facilities and towards economic growth between 1880-1914 was not particularly significant. This was then limited further by the economic recessions of the

early 20th century and by the strong rate-competition on freight traffic that the French railways began to offer after 1907. The regional imbalances in the French transportation network could not therefore be rectified, and network development remained aligned along the northern axis leading from the major port of Le Havre to Lyon.

The lingering economic depression between 1874-78 was also responsible for the failure of the Freycinet Plan, since it created pessimistic attitudes among the French industrialists who found themselves battling a financial crisis. Although the economy recovered slightly during 1879, it plunged back into renewed depression in 1883-87. The Freycinet Plan had apparently aimed at reconciling the free-traders and protectionists, through a compromise between state repurchase of railways versus continued concessionary funding of them by the state. But the projected order of state intervention envisaged under the Plan failed because of the inability of the state to mobilise sufficient funds for railway construction. Accordingly, the Railway Convention which was adopted in 1883 marked the demise of the republican ideal of active state participation, even while it brought into being state controls on railway rates and compelled the private railway companies to integrate less profitable lines into their respective networks. In retrospect, this has been seen as an alliance of *laissez faire*, under which private profits could be generated by the railway companies, and the Saint-Simonian public-utility concept, where the railways were to carry the obligation of providing public services through state regulation of their tariff structure and the continuance of uneconomic services. It was observed in practice that this alliance of objectives caused companies financing and operating lines in low-traffic conditions to run up considerable losses which they were not in a position to recover through the medium of tariff hikes.[44] From the practical perspective therefore, the railway companies did not exploit the state, since their combined investment on the less-profitable services they were forced to integrate greatly exceeded the minimum revenues guaranteed to them by the state. Operating performance consequently deteriorated and the railway companies that were running deficits proved incapable of financing incremental construction during the depression years between 1883-87. A case in point was the Ouest railway company serving western France which constantly lost money because of its high proportion of unprofitable lines, and had finally to be bought up by the government in 1908. On the other hand, more profitable networks such as the Nord flourished independently, proving that the nature of relationship between the railway companies and the state was in fact determined by the operating performance of each company network.

Historical review of railway development in France would thus divide the prenationalisation period into four distinct phases. The first of these between 1845-67 covers the grand period of railway construction, when the railway network was being created. The ideological battles between free traders and protectionists on the question of state participation in financing infrastructure leading up to the Freycinet Plan marked the second phase of railway development between 1867-83, during which however exceptional increases in traffic were recorded as usage of the network intensified. As no enduring arrangement for financing railway development could be reached, minimal investment was made on network expansion over the third phase from 1883-1914, despite rising costs. But as traffic expansion continued nonetheless because of increasing efficiency in railway operations, the period also saw growing control of the state over railway operations and the imposition of unrequited social burdens on the railway companies. The final prenationalisation phase between 1914-37 saw listless railway investment on account of the war, financial depression, and the rise of road competition which retarded the recovery of the French railway system from the destruction of WWI. The response to this further amplified the regulatory presence of the state through the Railway Convention of 1921, and culminated in nationalisation of the French railways under the Convention of 1937 which reconstituted them as the Société Nationale de Chemin de Fer [SNCF], or French National Railways, from 31 December 1937.[45]

The history of railway development in France was thus marked by periodic and lengthy debates between the merits of private ownership and commercial operation versus public utility arguments drawing from the Saint-Simonian formulation of social ownership. The first phase of infrastructural investment which focused on the construction of mainlines and a rudimentary secondary network was financed by private companies against guaranteed minimum rates of return on their capital investments. The frenetic pace of railway construction during this phase inevitably caused the emergence of 'excess' transport capacity, which was however soon absorbed by traffic development during the subsequent period. Falling profits and pricing anomalies nevertheless laid the foundation for government intervention and eventual takeover of private concessionary interests. Nationalisation which followed a period of sustained operating deficits for the railway

companies, also represented a situation where the companies did not want to bear, at very limited profit, organisational responsibilities for an enterprise whose costs depended on government pricing-decisions outside their direct control.[46]

Certain similarities are observable in the French and British inland transportation situations where traditional waterways and the nascent railways remained principal players for a long period of time following the 19th century industrialisation of these countries. Until full articulation of the railway network had been achieved, the relation between waterways and railways was either strictly complementary or benignly competitive, depending on the specific location and industry being addressed, while the railways slowly substituted road transportation in the passenger segments. Hence it was only after railway lines began to spread into industrial hinterlands traditionally catered to by water transport that competition began to emerge around the relative transit speeds and pricing per tonne of respective freight services. In France, till at least the early years of the post-WWII period, waterways remained the major rivals of the French railways especially along the principal axes of the transportation hub, and only in later years did roadways comprehensively displace the waterways in importance to become major competitors to SNCF.

For the greater part of the period under historical review, the role of the railways in freighting operations across the world was augmented through two roughly sequential expansions of freighting capacity, namely a *spatial* expansion of line networks and consequently of tonnages borne, and a *technical* expansion of carriage through incorporation of technologies augmenting axle-loads, trainweights and train running speeds. That the first of these should have preceded the second would appear quite logical in view of the lumpiness of infrastructural investments involved, since after each spatial expansion of the railway network, it took some time for traffic to grow past the point where the freighting capacity of the network had to be expanded by further investments in technology. Only after saturation was reached on both spatial and technical counts did a traffic situation emerge which warranted further expansion of the network in spatial terms.

It also becomes apparent, when examining the nature of industrial growth induced by railways in France during the prenationalisation period, that the decline in private investment and the increase in operating costs that accompanied the gradual evolution of the French railways into a state-regulated enterprise ultimately began to tell upon the backward linkages of railways with industry. As such, the initial market advantages of railway operators in selectively placing bulk orders for railway inputs with metallurgical and other industries was soon countered by cartelisation among the private input producers, who used their influence with government to secure better distribution of orders. However, since the mining and metallurgical industries of the French Rhineland were able draw both support and technological diffusion from the process of railway development, the backward linkages of railways remained pronounced in France. Railway development also generated forward linkages which promoted the nascent domestic industrial sector by inducing reduction in the pricing of its inputs. However cyclic traffic-to-cost relationships became peculiarly evident within the transmission process. The periods of falling industrial costs between 1852-67, 1872-83, 1888-1908 and 1920-29 succeeded periods with high levels of railway investment and technological advancement, which resulted in underutilisation of the augmented railway infrastructure and manifestation of excess traffic capacity while these forward and backward linkages were taking effect. Rising industrial costs during the intervening periods reflected the increased intensity of network-use without much augmentation of railway investment, so that the materialisation of new traffic first added to operating costs and then provoked upward revision of railway rates. Strong public opinion in France had initially opposed differential tariff-setting which, by allowing rate fixation relative to actual haulage costs, might have partially alleviated these cost-cycles. In fact during the later incursions of roadways competition that commenced from the 1920s, a transition was permitted to railway rates not unduly influenced by the public-utility principles of unity and equality, allowing railway rate-setting in France to become more flexible and more representative of actual railway costs. Shortly thereafter however, this sequential process of transport development and traffic rationalisation was rudely interrupted by the outbreak of WWII, which brought untold catastrophe to the French economy and the railways in its wake.

2.3.2 Early Railway Innovations

The virtual freight monopoly held by the French railways between 1842-1929 encouraged considerable technological and operational innovation on the French system, designed to improve traffic coordination

and consolidate the railway economies of scale against wasteful competition. An important principle within this was the optimisation of freight-flow through the railway network. The French system was thus among the first to adopt a regulatory framework under which negotiated railway tariffs were imposed by the Government. Under the system, differential freight tariffs were charged after prioritising the traffic into the fast [*Grande Vitesse*] GV and slow [*Petite Vitesse*] PV categories.[47] While PV freight rakes carrying nearly 95 percent of all railway freight initially ran as service trains offering economical rates, which halted at intermediate terminals in order to mop up piecemeal traffic, the GV rakes were assembled from high-priority parcels as traffic grew, to serve the freight-flow which had previously been attached in freight parcels to passenger trains. By offering guaranteed time-of-delivery to perishable traffic and retail consignments, the system also allowed the differential charging of priority consignments at higher rates. Gradually, as freight-flows expanded with the development of industry in France, a new freight stream developed comprising full wagonloads of critical industrial inputs like coal and metallurgical ores. These were consolidated into single rakes that could be directly routed without halting delays to their destination in the industrial belt in northern France. Segregation of freight-flows on the French network into three distinct streams with different priorities and running speeds allowed optimal technological innovation. By 1897, heavier wagon payloads and traction was introduced to facilitate efficient haulage of specialised industrial bulk-freight. Thus the improved 20T freight wagon with a loading tare of 9-10T soon became the *standard wagon* on the French railway system.[48]

Another important example of early technological innovation on the French railways was the quick interlinking of the French system with the landlocked Swiss railway systems. Although remarakable railway engineering was called for in order to achieve railway traverses over the Alpine passes, the building of the St.Gothard traverse in 1882 was soon followed by several others. The construction of these traverses provide early examples of railway cost-sharing between adjacent countries in order to derive mutual transportation benefits. By increasing tourist traffic to Switzerland, the interlinked system gave a competitive edge to the French railways over their other European competitors.[49] Freight competition between the French railways and other European railway networks had been quite significant, since the traffic to major European lading ports such as Marseille, Rotterdam and Genoa could be carried over more than one system. Mutual traffic-sharing agreements soon became common between the French, German and Italian railways, and even today the extent of port sharing continues to be a decisive factor in the operating efficiency on the French and other European railways.[50]

While continuing to operate through the agency of 6 large railway monopoly companies with zonal jurisdictions such as the *Ouest* (West), the *Nord* (North), the *Est* (East), the *Midi* (the midlands) and so on, the operations of the French railways were closely coordinated by the French Government. The importance of the railways for subsequent economic and industrial growth induced the regulation of railway tariffs and the imposition of public-service obligations on the companies, which included commitments to operate all franchised lines regard of their cost-of-carriage and profitability, and to accept all traffic entrusted to them and build transportation infrastructure accordingly. As a public-utility measure, the companies were also required to equalise rates and charges over their rail-routes regardless of the cost of sectional carriage on each line. By making the transportation of bulk-freight economical, the French railways aided agricultural and industrial development and the integration of the national market. Freight tonnages consequently rose continuously from 12MT in 1842 to 224MT in 1929-30.[51] Nevertheless, the construction of the network of low-density light railway lines (the so-called 'third network') between 1880-1892 began to eat into the operating margins of the railway companies, because of the increase in workforce costs without commensurate increase in operating revenues.

2.3.3 Impact of Railway Nationalisation

Wartime exigencies after the outbreak of WWI temporarily brought the French railway companies under the compulsory control of Government. Since France was an important theatre of war, railway operations were adapted to military perspectives and the devastatation caused by the war to the network was extensive. Although, the economic recovery after WWI restored financial balance to the railway companies temporarily, the looming global depression caused another economic slump between 1930-38 which affected the French railways adversely. During this time, the waterways began to offer renewed competition to the railways and increased their freight share from 18 percent to 33 percent. Meanwhile, the new public roadways had begun to compete with the French railways and were assigned a specific traffic quota in 1935. Since higher density

of use made road transportation economical and the operators did not have to carry the costs of their infrastructure, the French railways proved unequal to this new source of freight competition and slipped back into a financial deficit. The freight monopoly of the French railways was now over.

Much before the nationalisation of the French railways, a Supervisory Committee had been constituted under the Convention of 1921 to coordinate the activities of the French railway companies in order to put an end to wasteful freight competition between them. Since strict tariff regulation and the public service obligations were being widely held to blame for the dire financial situation of the French railway companies, a series of remits had been offered to the railways. The first of these was the Act of July 1933, which freed the companies from the statutory obligation of running a minimum number of trains on each line. Under several presidential decrees between 1933 and 1937, the process of tariff ratification was liberalised and the obligation to maintain services was relaxed on routes where the level of traffic had showed extreme decline. This was followed by the grant of tariff autonomy to run freight services at contracted delivery schedules and rates by mutual agreement with major railway clients. A scheme was also proposed in 1935 for regulating the roadways and preventing their reckless proliferation. Because of the persisting failure of these measures to restore efficiency to railway operations in France, the 6 large railway franchises were nationalised under the Convention of 1937 and renconstituted under SNCF.[52]

The nationalised French railways began functioning as SNCF in a favourable commercial environment following the end of the global depression. In the period of railway restructuring that followed, power was given to SNCF to restore closed services or to close sectional services where deemed necessary, and also to open new branch lines to the mines & quarries, ports & warehouses and industrial factories to secure a monopoly over bulk-freight from these sources. The 35 railway zones that had been created in 1935 became traffic districts on the SNCF network, and had increased to 140 by 1946. Organisational reorganisation also took place and new commercial and market research divisions were created to complement general management. This allowed SNCF to market new commercial services to railway clients. Several steps were taken to relieve the terminal delays that had become characteristic of the railways. These included the 'particular branching' of lines to provide doorstep service to major railway clients with financial support from SNCF. This single measure gave the railways a major advantage in the freight competition with roadways, since the heavy industriexs were not equipped with handling facilities for loading and unloading road vehicles. The branch lines on the SNCF system consequently grew steeply in number from 4300 in 1914 to 7700 in 1948.[53]

Besides marketing innovations, technological and organisational improvements were also needed that would increase the efficiency of freight flow through the SNCF network, since the success of the French roadways in wresting freight traffic away from the railways was based principally on the speed and efficiency of their services, with low detainment either of consignments or vehicles. In the case of the railways, considerably more time was being lost in the handling terminals and marshalling yards. The GV and PV channels into which freight movements had been categorised had by now metamorphosed into the *Régime Accéléré* (fast-track) and the *Régime Ordinaire* (slow-track). Of these, freight trains on the *Régime Accéléré* passed through special marshalling yards and were run on the trunk lines at accelerated speeds of upto 100kmph in order to provide fast freight services with guaranteed delivery times. In contrast, the *Régime Ordinaire* which preserved the traditional PV freight channel through slower sections of the SNCF network was proving inadequate in to the mounting challenge from roadfreight services, because of running inefficiency, slow speeds and irregular delivery times.[54]

To improve the attractiveness of PV services, land and warehousing was rented out to clients for private parcel terminals. Engineering innovations in braking and traction also increased the speeds of PV trains from 50kmph to 70-80kmph. An experimental PV subchannel had been offered to full-wagonload consignments since 1932, which guaranteed consignment delivery within a specified time. In 1933, a tariff in terms of wagon-km was introduced irrespective of the nature and weight of the freight transported, and provision was made so that the wagon could be hired by the client for a renewable period of three months. Thus since 1933 new methods were devised to counter balance the road competition. However the extra time spent in switching full wagons to other rakes in the marshalling yards made it difficult to maintain delivery schedules, and hence the channel was closed down by SNCF in 1939. Thus, while the fast-track freight services of the *Régime Accéléré* [RA] were unassailed in speed and efficiency by the roadways, the *Régime Ordinaire* [RO] was the main freight segment into which the roadways were able to make inroads. Hence a partial return was made in 1935 to the parcel system, under which fast parcels were attached to fast

passenger trains.

Meanwhile, SNCF also tried to introduce an 'origin to consignee' approach, which provided home delivery to parcel consignments in order to match the door-to-door concepts behind the success of roadfreight services. Extending this approach, containerisation of piecemeal freight began from 1935, although the rate of growth was low till after WWII when a container company CNC was established as a separate commercial entity to attend to the needs of railway clients who booked full container space. Technological adaptation was also made within the SNCF wagonfleet, by introducing an increasing proportion of special wagons designed for meeting specialised transportation needs. These included tankwagons, flatwagons, hopper designs, sealed chemical carriers, shelved automobile transporters, etc. Consequently, the SNCF wagonfleet declined from around 528,000 wagons in 1930 to 187,000 wagons in 1970. Against this, the stock of special wagons increased from 33,000 to 70,000 over the same period. The adaptations made to the standard covered (canopied) wagons to meet client and handling needs, which included the addition of big door panels, moving roofs and so on, also showed a high rate of adaptive innovation by SNCF to either win back or retain the freight market. The pooled space on most of these special wagons was used as a group and marketed through subsidiary service companies.[55]

Thus the immediate impact of nationalisation on the French railways was largely positive. The injection of new capital support from the French Government enabled the technological renewal of railway assets and encouraged commercial and marketing innovations, which allowed SNCF to compete aggressively with the roadways by focusing on the natural strengths of railway transportation, namely volumes, economies of scale and advanced technological specialisation. The key to the success of this package after unification of the French railway network under the unified administration of SNCF lay in organisational innovations that allowed the state-owned network to introduce a commercial focus in its freight services, which had been lacking under the monopoly companies. Soon after the end of the decade, however, WWII broke out and the French railways went into another spell of uncertainty and wartime devastation during the foreign occupation.

2.3.4 Postwar Railway Reconstruction

In the aftermath of war devastation during the German Occupation of France over WWII, the overwhelming postwar priority was on national restoration using planning as a coordinating instrument. The Monnet Plan for postwar reconstruction of the French economy thus laid the foundation for concentrated flow of investment into key economic sectors for a period of three decades or the 'Trente Glorieuses' between 1945-1975 . While this scale of priorities included the French railways, 38 percent of initial railway investment between 1947-1950 went into the restoration of the SNCF network and only 8 percent into railway modernisation.[56] Only after the First Plan (1947-53) did planning emphasis shift towards intensive modernisation of SNCF. Particular thrust was thus laid uptil the end of the Fourth Plan (1962-65) on the electrification of major SNCF arteries; [57] in order to create the technological capability for cost-efficient haulage of heavier trainloads which ultimately made SNCF the cornerstone of the postwar recovery in France. With the heaviest flows of traffic being located between mines and industry, electrification of the major rail artery between Lorraine and the Nord in Northeast France was accorded highest priority and was completed within three years of its commencement in 1952. Electrification then swiftly extended to capillary lines linking the mines to the steelworks, with the result that steam traction had completely disappeared from the main line by 1957, and from the last industrial capillary in 1965. Later technological improvements in diesel technology then provoked a reappraisal of the comparative returns of diesel versus electric traction, since the lower initial unit-costs of the former held intrinsic advantages for railway axes with lighter traffic loads.[58]

In contrast to the other smaller Western European railways, special advantages accrued to SNCF from operating over a large national space of 547,030sq.km, and from the vast scale of postwar investments on railway electrification. These provided greater insulation to the French railways during the inevitable increases in railway costs following the Oil Shocks of the 1970s. Formation of the European Community [EC] on the other hand worked to the advantage of the roadways, because of incompatibilities between the French railway system and those of neighbouring countries in terms of spatial coverage, trainloads and average trainspeeds on long-lead freight traffic. Although the comparative disadvantages to the French railway operations have been made more severe by the persistence of organisational handicaps such as the technical and commercial 'border problems' which reflect pre-EC administrative hangovers, the SNCF eventually stands to gain from

its vantaged location vis-a-vis the major Atlantic ports that form the hubs of the international transport and trading networks in Europe.

2.3.5 SNCF Tariff Reforms

Historically, the modern period of declining SNCF freight operations since the mid-1970s has been divided into two separate phases.[59] While the first phase of railway freight decline between the mid-1970s and the mid-1980s is thus attributed to *structural* change in the French economy with progressive decline in importance of the mining and heavy industrial sectors accompanying the rise of new locational patterns that reflected industrial diversification and dispersal, the second phase of decline since the mid-1980s is attributed to emergence of formidable freight competition from the French roadways following their liberalisation in 1985. The principal adaptations made by SNCF in response to these events were a shift from a historically-rooted structure of rigidly administered railway rates to a more market-responsive rate-structure, and a change in the balance between the various categories of rail-freight traffic in response to intermodal competition and structural change, which assumed the collective form of spatial polarisation of traffic and a slimming-down of the rest of the SNCF network.

The year 1974-75 marked a watershed in freight operations under SNCF, which had grown almost continuously in the past. The all-time freight peak that year was very soon followed by sharp traffic decline that set in from the subsequent year. The decline in the SNCF share of the freight-market over the period had till then been masked by the overall increase in the level of economic activity. The gains in market share made by roadfreight accompanied the increasing economic importance of commodity-freight with high value per unit weight and diffuse origins and destinations, to which the roadways were best adapted. However, the advent of economic recession in 1974 triggered a sharp decline in bulk-freight which had been the most profitable traffic segment for SNCF. Although railway freight movements had remained spatially concentrated till 1973, the freight-flows in 18 out of 27 mode-product groups were found to diffuse between 1971 and 1976. Diffusion in semi-finished products, in which SNCF specialised was still the least, although the tendency for these to diffuse was strong [60]

The response of SNCF to rising roadways competition was to accelerate tariff reform. To avoid abuse of transport monopoly and ensure market transparency, the French railway companies of the prenationalisation period had been compulsorily required to issue published schedules of rates that had been ratified by Government. Any change in railway tariffs had to be notified and approved by the Government. In a continuance of this practice, the *Cahier des Charges* adopted for SNCF at the time of nationalisation in 1937 had also required ministerial approval and publication of contracted rates. Till 1969, SNCF was thus required to submit its tariff-proposals for approval to the French Ministry of Transport.[61] Besides the published rates scheduled by distance for each commodity-group, numerous special tariffs existed for commodities like French coal, for which protection against foreign imports was deemed necessary.[62] Progressive reductions in freight tariffs were also offered by SNCF in the 1950s to mobilise heavier trainloads, with special terms being negotiable when private wagons and sidings were used.[63] Thus, special rates well below those published in the schedule could be negotiated with larger railway clients. The system of public notification of changes in the *Cahier des Charges* was thus seldom followed in practice, leading to about 900 secret contracts being in force in 1975 which represented 34 percent of railway freight-tonnages and 37 percent of gross SNCF freight receipts.[64]

The original structure of published SNCF rates schedules had been constantly afflicted by several inherited problems such as non-distinction between low and high cost routes during tariff-setting. Periodic reforms which sought to address this anomaly as part of an attempt to allow SNCF some flexibility in rate-setting, included the major initiative taken in 1962 of weighting charged distances to reflect actual costs of freight operations over specific track sections.[65] It is interesting to note that the factors entering the spatially-selective computation included the mode of traction (electric/diesel), the maximum trainload on the relevant track section under given traction, sectional profile, and transit speed. General tariff revision directed at raising overall rates on short-haul traffic while reducing those on traffic with very long leads also took place concurrently, along with narrowing of tariff differentials on various categories of traffic.[66] The impact of these tariff reforms was immediately felt by the roadways and waterways, which accused SNCF of undercutting them on key traffic routes. Regional protests in areas such as Brittany which were largely serviced by the so-

called 'difficult' routes on which the new tariff mode would imply significantly increased freightage costs forced a selective retreat which reduced SNCF rates on goods considered essential to the regional economy, especially agricultural products. This in effect amounted to a regional transport subsidy, for which SNCF was duly compensated by government. The regional subsidy remained a bone of contention for a long time to follow, since the larger industrial enterprises in the region claimed that it offered SNCF an excuse for not extending special rates to them.[67] Later, the Gillaumat Committee also criticised the subsidy as "a flawed form of regional assistance",[68] and at the eventual behest of the EC, the subsidy was abolished in 1985.

However further reforms that had eased state control on SNCF in 1969 and had given it more authority in setting its own freight tariffs, had also increased its latitude vis-a-vis the roadways to reduce specific rates, with the provisions of ministerial discretion now applying only to cases where the proposed rates either appeared to abuse SNCF's market-dominant position, or conversely to be insufficient to cover marginal costs. Under the new dispensation, further retreats from the time-honoured practice of *ad valorem* freight pricing took place following tariff restructuring undertaken on the recommendations of specially-commissioned studies in 1974 and 1975. However, the government continued until 1979 to restrict general levels of tariff increases to limits set by its policies against inflation. Following the Gillaumat Report, this last vestige of state control was dismantled via the *Contrat d'Entreprise* of 1979 between the SNCF and the government which ended anti-inflationary capping, and invested SNCF with the twin freedoms of structuring its services in line with the evolving economy and determining its tariffs on competitive principles, the latter of which it promised to do by cautiously increasing average tariff levels and widening the lateral spread between commodity charges.[69]

Realignment of tariffs downwards along those offered by roadways was unavoidable in any case in the general recessionary climate where an excess supply of transportation services was chasing dwindling freight demand, particularly on transport axes where competition was fiercest, with inevitable consequences that were enveloped with controversy. For instance, the maintenance of tariff escalation on the transport of cereals to Belgium and the Netherlands at low levels of 8 percent to circumvent competition from roadways was perceived by animal feed manufacturers in Brittany who faced 23 percent tariff escalation to have led to the export of the raw materials of their industry.[70] Again imported iron ore was being carried by SNCF at kilometre-rates well below those being offered to French ore.[71] While in principle, all SNCF rates had to be pegged at floor-levels which would cover marginal costs, the policy required systematic information on costs in order to tag them to particular shipments, rendering the idea unworkable in practice. Instead, accord between French and German railways which simplified tariff setting on the new international Nord-Mediterannée so that quick comparisons of intermodal rates became feasible, brought in the flexibility to align tariffs with roadways on case to case basis. Over the postwar period therefore, the SNCF was compelled to adapt to economic situations in a manner that made it behave "more like an enterprise and less like an administration."[72]

2.3.6 Impact of Roadways Competition

Tight state control over the French roadways between the 1930s and the 1980s had imposed fixed licensing quotas and controlled freight tariffs on long-distance roadfreight haulage to protect the SNCF share in this segment. The road tariffs fixed through the *Tarification Routière Obligatoire* [TRO] system quoted maximum permissible rates for a given haul, allowing downward modification through negotiation between operators and clients. In 1979, it was estimated that considerable subcontracting was taking place in the roadfreight sector, since while the bigger roadways operators found it difficult to offer covert reductions on the minimum TRO tariff, the smaller firms could oblige. Consequently, it was surmised that at least half of all roadfreight movements were being contracted at minimum or below-minimum tariffs.[73] However, although the system of regulating the roadways through licensing had been criticised by the Gillaumat Committee in 1978, the French Ministry of Transport replaced roadways licences by authorisations only in 1985 and also cushioned existing licensed holders from the possible impact of competition by continuing indefinite licences until 1996. This action nevertheless led to rapid expansion in the number of roadways operators.

The particular criticism of TRO had been in respect of international routes, where pricing was unrestricted even though quotas applied. This had permitted Belgian and Dutch transporters to steal a march over the French road operators and had made foreign ports such as Antwerp far more competitive than the French

ports.[74] Thus in 1987, TRO was replaced by a system of nominal rates on bulk and heavy goods which were indicative but not obligatory, and even these were annulled in 1989. Meanwhile, the significant fall in world diesel prices between 1985 and 1989 considerably lowered operating costs for the roadways sector, particularly for heavier vehicles and long-lead consignments. The atomistic character of private roadways enterprises led to a cascading impact on subcontracting and leasing, bringing roadfreight tariffs down by over 7 percent between 1987 and 1989, against 3.6 percent rise in costs. Although the rate of financial failures was consequently high, the constant entry of new roadways firms helped to maintain subcontracting and low tariff conditions. Meanwhile the larger firms graduated into controlling roadfreight inventories, orders and flows where greater profits could be earned, leaving the actual task of freightage to subcontractors who had multiplied in number from 4,000 to 10,000 in the five years from 1986 to 1991.[75] Chronic overcapacity in the roadways sector created cutthroat tariffs for the road subcontractors, leading to the French truckers' strike of 1992 which ultimately forced the Government to intervene and to ensure observance of minimum health and safety norms by the private road subcontractors.

International road transport had also been regulated quite severely in the past by bilateral quota agreements between countries. This began to ease with the renegotiation of EEC-wide quotas as part of the policy of lifting quantitative restrictions between EEC member-countries, and with the growth of the contract hiring system that began in the late 1980s While by 1988, 10 percent of the heavy vehicles on French roads were estimated to belong to foreign operators, their share in tonne-km terms was estimated at 20 percent and at 25 percent for freight traffic on the motorways.[76] Since Belgian and Dutch roadways firms had lower operating costs on account of differences in fuel taxes and VAT, and the ready availability of turnaround freight, the French operators had to cut margins by 1989 in order to align with the competing tariffs. More recent changes induced by the coming together of the European Community include the issuance of *cabotage* licences since 1990 w59hich have enabled licensed operators to freely transport consignments within the EC-member states, and the eventual full liberalisation which was due for attainment by July 1998.

2.3.7 Reorganisation of Freight Operations

Although after the 1974 peak and subsequent slide, SNCF domestic freight recovered temporarily in 1979 and a roadfreight peak was also reached the following year, the railways, roadways and waterways all showed freight declines during the recession of 1981-82. Nevertheless, while roadfreight rose steadily thereafter until 1991, SNCF freight volumes fell steadily and its share in intermodal freight traffic began to decline from 1985. Because of their larger shares in international freight traffic, the roadways and waterways thus began to tower above SNCF in terms of combined intermodal share. While the decline in railway freight partially followed the decline induced by the Oil Shock in industrial sectors like steel, coal and coke, minerals and construction material where the railway presence had traditionally been high, it also reflected the productivity gains made by the roadways through the use of heavier and more fuel-efficient vehicles. This was strengthened by the falling prices of diesel during the late 1980s, which forced SNCF to forego tariff increases for two years between 1986 to 1988 in order to combat roadways competition induced by falling diesel prices.[77] The freight competition from roadways mostly came in high-valued short-lead segment. Average freight leads on SNCF thus increased from 281km to 363km between 1970 and 1991, with. 53 percent of railway freight in 1991 having distance leads of more than 300km against 37 percent in 1972. Absolute tonnages carried by SNCF also fell over all distance bands. Thus while long-lead freight tonnages fell from the peak of 97.1MT to 72.6MT, freight tonnages with leads of less than 50km fell from 48.6MT to 11.4MT between 1974 and 1991.

Two segments of SNCF freight operations had proved successful and relatively profitable over the period between 1970 and 1988. These comprised SNCF freight operations under the *Régime Accéléré* and the operation of freight traffic in full trainloads. While the first of these offered premium commercial freight services and thus realised high revenues per traffic unit, its profitability was based more on rates than on traffic volumes. The full trainload freight services catered exclusively to bulk-freight and SNCF's major users, and thus operated in a traffic segment where railways held a natural monopoly on account of their technological advantages By contrast, freight traffic under the *Régime Ordinaire,* comprising traffic-smalls such as single wagonloads which had to pass through the marshalling yards declined rapidly over the same period.[78]

2.3.7a The Régime Accélére

Freight in the *Régime Accélére* had higher revenue-elasticity over equivalent tonnages and distances than other SNCF freight because of its premium rates. As such, freight-flows on the *Régime Accélére* in 1977 amounted to 19.6 percent of SNCF's tonne-km traffic, but contributed 21.2 percent of SNCF's freight revenues. Its share in total freight traffic rose progressively to a peak share of 28.8 percent in freight tonne-km in 1986 and was still high when the system was discontinued in 1988.[79] The average freight lead on the *Régime Accélére* was also higher at 576km in 1988. Hence, while more than half of the freight tonne-km traffic was being hauled on private wagons on the *Régime Accélére* against less than a quarter on the *Régime Ordinaire*, the freight carried in tonnage terms accounted for a much smaller proportionate share of 17.6 percent in total SNCF tonnages.[80] The *Régime Accélére* combined two distinct freight segments. The first of these, namely the Special Organisation coordinated all point-to-point freight operations including the movement of containerised traffic under Combined Transport in block trains, and also the transportation of fruit and vegetables, automobiles and auto spares, and groupage. Another section within the *Régime Accélére* was responsible for coordinating all freight traffic including diffuse container traffic or Combined Transport which passed through the special *Régime Accélére* marshalling yards. In 1990, traffic leads under the Special Organisation were longest for perishable goods, while the lead for Combined Transport averaged 598km.[81] Although freight trains under the Special Organisation trains ran according to timetables and were routed directly, bypassing the normal marshalling yards, they generally carried lighter trainloads. The *Rapilège* which was introduced in 1977 ran trainloads of 500-600T.

SNCF's top-of-the-line *Fret Chrono* service commenced in 1987 and numbered 20 fast trains by 1989, which guaranteed delivery times and generally ran at night. Trainspeeds were gradually raised from the routine limit of 80-90kmph and *Fret Chrono* set a speed record of 160kmph on its regular overnight service which supplied perishables to Paris. Premium tariffs for *Fret Chrono* services were relatively high.[82] By 1988, 10 trains under the Special Organisation were running at 140kmph and another 100 at 120kmph. But in spite of such high physical speeds, consignment delivery by roadfreight was still deemed to be faster, because of the losses of time at train terminals.[83] Thus, while the share of freight traffic under the Special Organisation in traffic under the *Régime Accélére* rose considerably between 1981 and 1987, mainly because of the rise in the proportion of block trains and the haulage of automobiles and parts, significant decline occurred in the traffic in fruit and vegetables. Over the same period, the proportion of small and medium container traffic under diffuse Combined Transport which passed through special marshalling yards under the *Régime Accélére* declined by 16 percent. To combat this loss of traffic, SNCF began consolidating the loads of different shippers into regular *Traincharters* which ran from point to point between different zones. Fast international freight services were also pioneered in 1981 by TRES [*Train rapide èconomique et sûr*], which were controlled in France under the *Régime Accélére*, and catered to freight originating in the Trieste-Venice-Ancona region of Italy and transiting via Verona and Bologna. The reverse flow of French exports to Italy however faced more difficulties because of the higher freight volume involved, and because of delays at the frontier yards caused by the shortage of freighting capacity on Italian Railways which had led to a quota system in 1974. Through the latter half of the 1980s, guaranteed delivery times and international through rates were also offered by SNCF on new block trains that provided point-to-point linkage between specified zones in partner countries like Belgium and Germany. This was aimed at drawing new freight flows onto the French network. Nevertheless, in 1984, *Rapilège* services carried only 2.1MT of freight, while TRES and other fast international services accounted for a mere 4 percent of the international freight traffic of which only a minor portion was genuinely new to the railways. Official reports thus noted the negative economic impact of these services on SNCF arising from the high volume of capital investment on specialised wagons, which also resulted in increased running of empty wagon kilometres on the turnaround journeys,[84] and it was decided to do away with the *Régime Accélére*. SNCF's Special Organisation was left as a sectional unit when the *Régime Accélére* was abolished in 1984, while its other remnants including its two special marshalling yards were merged into the *Régime Ordinaire*.[85]

While laying stress on speed as one of the aspects of high-quality freight services, the SNCF Contract Plan for 1990-94 thus also sought to streamline single wagonload operations so that 300 principal freight stations from the 1200 that would remain at the end of the Plan would offer fast-track transportation under the *Fretexpress* service which bypassed the intermediate marshalling yards. In addition, guaranteed delivery times and assured frequency were to be offered under contractual terms to the clientele of full trainload services, extending the old SNCF policy of offering special marshalling and distribution terms to its historical

clients, such as the steelworks. More customers would be offered special tailormade contracts, which would also holistically embrace stocking, packaging and accounting as additional value-added services. This was expected to help the railways to recapture a larger market-share of the traffic in high-rated low-bulk freight, which depended on the minimisation of freighting delays. SNCF was expected to gain substantially from computerisation of services under ETNA and the *EDI-Fret* [EDI=Electronic Data Interchange] service that had been created for full trainload traffic in 1990 and had been extended to *Fret Chrono* trains in 1991. These systems were expected to provide prime SNCF customers with real time information about the precise position of their freight shipments.

2.3.7b Full Trainload Traffic

The Gillaumat Report had envisaged in 1978 that the path to increased profitability for SNCF lay in widening the field of application for full trainload techniques of stock control and distribution management. It has been in the full trainload segment of consolidated freight that SNCF has achieved lowest operating and infrastructural costs and highest productivity, and can offer the most competition to other transportation modes. Full trainload traffic on the SNCF reached peak levels of 27 billion NTKm in 1974 and 1980 and stood at 24.42 billion NTKm in 1991. In proportion to total tonne-km traffic, the share of freight traffic in full trainloads rose steadily from 32.5 percent in 1970 to a peak of 49.4 percent in 1991, providing a stable base for French railway freight operations. By the 1980s, full trainloads were routinely of 1300MT, rising to more than 2000MT on better track.[86] Full trainload traffic however tended to have a shorter lead compared to traffic under the *Régime Accélére*, even though average leads had shown an increasing trend rising from 216km in 1977 to 302km in 1988, Full trainload traffic tended to originate and terminate at the private sidings of SNCF's major clients and thus involved the largest use of private wagons.

2.3.7c The Régime Ordinaire

The *Régime Ordinaire* has however continued to pose a major problem for SNCF, with the greatest loss of market share occurring in this segment. Freight operations under the *Régime Ordinaire* involve the coordination of small freight shipments in single wagonloads that have to be assembled and dispersed through the marshalling yards. This remains a problem because of marshalling delays that raise wagon turnaround times. While small freight services had historically played an important role in allowing rural industry direct access to rail freight services from nearby terminals, they have traditionally been loss-making both in terms of lost revenues and in terms of lost time. SNCF traffic volumes in this segment have thus shown continuous declines in recent decades, thereby also raising operating costs as a result of underutilisation of marshalling yards, terminal facilities, and certain sectional routes. Precisely for such reasons, road freight proves more economical for spatially diffused traffic.[87] The Gillaumat Report had identified the principal commodities passing through French marshalling yards in single wagonload consignments as including food products and other merchandise, motor vehicles, chemicals and finished steel, of which the first category had especially been showing fast decline. To restore competitiveness to SNCF, the Report suggested formation of a core network which would still be able to cater to the major part of traffic by selective shedding of uneconomic nodes. The Report's calculations envisaged a trimming down of SNCF's freight nodes from 4253 terminals down to 1649 terminals would form a core network which would cater to 93.3 percent of the net tonne-km traffic under the *Régime Accélére* traffic and 82.8 percent of the traffic under the *Régime Ordinaire* traffic, while still carrying all full trainload traffic and providing all mainline passenger services. The 2603 SNCF terminals which would have to be closed were to include 2020 terminals that were generating less than 30MT of freight per year *i.e. l*ess than 100T per working day.[88]

To achieve the purposes envisaged by the Gillaumat Report, SNCF set up a series of *Gares Multifonctions* [GMF] terminals comprising relatively central freight stations which would follow a 24-hour work schedule and would organise zonal collection and delivery of single wagonload consignments, availing both rail and road facilities as needed, and offering stocking, handling and other "logistical" facilities on contract to individual clients, instead of despatching trains no matter what the level of demand. Each of the 25 SNCF regions set up its own GMF and 578 were already functioning by 1987. However, the overall set of recommendations made in this respect by the Report were not fully implemented, as a result of which around 4000 separate terminals still existed on the SNCF network in 1986 and the new GMFs were still largely being served by rail. Several functioning sectional routes were still generating traffic of less than 100MT per day which did not cover their operating costs.

The studies that followed the Gillaumat Report had realised that a policy of cutbacks in freight tariffs to increase market shares and traffic volume would eventually raise SNCF's operational deficits on account of such lines where marginal costs were not covered. Nearly four-fifths of SNCF's losses on railway freight operations were attributed to inefficiencies in the coordination of single wagonload services under the *Régime Ordinaire*.[89] Accordingly, more stress was laid on improving SNCF's freight organisation.

Between 1987 and 1989, SNCF implemented the ETNA [*Etude Technologique pour un Nouvel Acheminement*] scheme for computerising the movement of single-wagon freight traffic through the marshalling yards. The introduction of ETNA coincided with the abolition of the *Régime Accélére* and *Régime Ordinaire* which had been used for prioritising SNCF freight since 1946. In replacement, a dedicated computer network was established around a central server located at Lyon and 30 local terminals at each of SNCF's marshalling yards. ETNA was designed to keep individual track of the movement of each wagon, whose progress through the marshalling yard would depend on the priority attached to it. Three priority levels were now recognised for freight traffic passing through marshalling yards. The fastest of these SNCF services was the premium *Fretexpress* which was to offer guaranteed delivery of the freight consignment within 48 hours or less. The delivery time offered by the slower and more moderately priced *Fretrapide* service was to be 72 hours or less, while delivery by the slowest *Fretecho* service would require 7 days. Among these schemes, SNCF was most optimistic that the *Fretecho* scheme in particular would raise traffic volumes by undercutting intermodal rate competitions, although critics pointed out that *Fretecho* would only the attract lowest-rated traffic, and that the underutilisation of SNCF installations as a result of decline in traffic and the rising costs at the marshalling yards would nullify the productivity gains from ETNA.

The extent of traffic decline in SNCF's freight operations is reflected by the fall in the number of loaded wagons handled by the marshalling yards from 12.4 million in 1964 to 3.4 million in 1984. Hence in its plan for 1990-94, SNCF sought to trim down single-wagonload freight through drastic thinning of terminal facilities. Although 3500 freight stations existed in 1990, 92 percent of freight passed through only 800 of them. By the end of 1991 they had been cut back to 2500 and further reductions were contemplated to bring them down to 1200 by 1994., concurrently with closure of 2200 private sidings from the total 7900 that existed in 1991. Over a long time previously, the number of such sidings had in fact gradually declined although in terms of traffic volume handled they remained more important than freight stations. The Bourdillon Report submitted in 1991 partially reversed the assessment by arguing that instead of abandoning single wagonload traffic altogether, it could be restructured to cover sections which assured daily absorption of a minimum 70 percent of freightage capacity and easy marshalling of wagons, thus maintaining the competitiveness of rail freight, so that its share in total rail freight might eventually stabilise at 25 percent of traffic.

2.3.7d Intermodal Transportation

Intermodal transportation involving the combined use of railways and roadways had earlier constituted the Combined Transport segment under the *Régime Accélére.* This SNCF freight service comprising the rail transport of lorries, their containers, or their loading units, has grown appreciably, to recent levels of 7.74 billion tonne-km with a share of 15 percent in total SNCF freight traffic. Carriage of this growing traffic has required special technological adaptation by SNCF because of the nature of the loading units. Loading units of the semitrailer type with vertical or horizontal loading are carried along with their road axles on special pocket wagons. Loading units with swap bodies and vertical loading which do not require the transportation of their road axles are better adapted to carriage on pallet wagons. The swap body has been increasing in popularity and includes isothermal units for carrying perishables controlled through *Chronofroid*, and liquid tank variants for chemicals and so on which are controlled through *TransEurochem.*[90]

Transport of semitrailers and swap bodies in most of Europe is a joint operation between railways and roadways. The operator in France is *Novatrans*, in which roadways hold 60 percent shares, while SNCF with 40 percent shares has only a basic haulage role, with no powers of control. Novatrans had 22 transfer terminals by 1990 which included 4 in the Paris region and owned 700 of the 1600 trucks at its disposal, as well as the transfer equipment at the terminals.[91] Domestic container traffic was controlled by *Compagnie Nationale des Cadres* [CNC], wholly owned by SNCF, which also controlled swap body traffic whenever the intermodal transfer unit was handed to the railways by the client under direct contractual terms. The importance of piggyback and container traffic as an area of new growth in railway freight holding vital importance towards the future of SNCF had been realised way back in 1986, when the operation itself was

barely profitable.[92] Part of its potential arose from concerns about the environment, which viewed railways as a clean means of transport. The Bourdillon Report had devoted special study to its potential and towards the identification of road freight-flows with leads of over 500km that were being carried on heavy road vehicles and could eventually be converted to Combined Transport. Hence the SNCF Contract Plan for 1990-94 proposed an investment of 1 billion francs towards raising its share in SNCF freight to 25 percent by 1994 The Bourdillon Report concluded subsequently that the investment for the development of Combined Transport under the Contract Plan was grossly inadequate. The Report therefore advocated an expansion in state support to SNCF, including financial support for infrastructural investment in the construction or upgradation of lines and transfer terminals.[93]

B Other Asian Railways

2.4 Railways in Japan

Construction of the Japanese railway lines formed an integral part of the concerted thrust towards industrialisation witnessed by the Japanese economy during the Meiji restoration. [1867-1912] The railway boom which took off from the late 1880s culminated in the peak years just following the Sino-Japanese war of 1894-95, during a period also characterised by significant growth in capitalism in Japan and the remarkable progress of light industries such as textiles. Extending this process, manufacturing industry in Japan's erstwhile rural districts also displayed significant downstream growth, as the market expansion required as a direct consequence to high economic growth rates over the period made it imperative to provide fast transportation interlinkages between the rural districts and Tokyo and also between the districts.[94] The large-scale promotion of private railway companies in Japan witnessed between the 1880s and 1890s thus reveals that railway development in Japan proceeded in response to, rather than as a precursor of, the growth of the domestic market.

The first Japanese railways had already commenced operations in 1872 when transportation services were launched between Shimbashi and Yokohama.[95] The early railway ventures made entirely in the government sector had operated 984km of routes, but the eager entry of private railway companies into the fray during the railway boom some fifteen years later quickly expanded the route network to 2124 km by 1892.[96] Yet even though private lines thus had much greater presence in terms of route kilometerage, nationalisation of Japanese railways excluding select urban lines was resorted to as early as 1906, and the nationalised railway system thus commenced operations with a route network of 7153km, of which only 2562km had been directly developed by government. A phase of rapid railway construction immediately followed nationalisation and the network had expanded to 9991km by 1919 and to 15,000km by 1931. By the end of WWII the nationalised railways in Japan operated over 20,056 route-km, substantially exceeding the 5543km of routes still under private operation. The Japanese National Railways [JNR] were subsequently incorporated in 1949 to take over the management of the nationalised railways while capital investment continued to be sourced from government, but from that time till 1981, JNR was only able to extend route kilometerage marginally to 21,419km.[97]

2.4.1 Investment by JNR and JR

With limited capacities of land transportation attributable to the size and topology of the country and the consequences of war devastation, it was necessary for Japan to first recover rail and shipping capacities and gradually develop road and air capacities. With high economic growth between mid-1950s and late 1960s, demand for transportation increased commensurately. Increased operating revenue encouraged investments from JNR to strengthen capacities, which in turn furthered demand and for 7 years from 1957 to 1963 there existed a balance between income and expenditure. This favourable cycle soon shifted to road transportation after the 1960s and the equilibrium could not be sustained because of indiscriminate investment in the near future without commensurate increase in train fares. Pressure from government to maintain low fares and the continued demand from the public to invest in new tracks in areas where there were existing tracks and expressways to meet the transport demand, led to the non-viability of many investment projects and the surrender of financial independence on the part of the JNR. During the 1960s JNR was subjected to sharp increase in investment liability and interest payments. Its long-term fiscal debt rose in proportion from 89 percent of its operating revenues in 1960 to 227 percent in 1970 and 486 percent by 1980. The associated

interest outgo over the same period increased from 5.9 percent of operating revenues to 13.3 percent in 1970 and 24.9 percent in 1980.

The toll of increased liability without any capital forthcoming, was very heavy. By 1960s the JNR had lost its capability to finance its own investments. At this stage adequate subsidy for serious investment could have saved the JNR. Continued investment to meet the overestimated demand on the part of the Government made things worse. If demand had risen as estimated then the operating revenues could partially offset the fiscal deficit. Freight transportation had lost to competition from trucks by 1966. However after reaching its peak in 1970 freight transportation had declined. JNR failed to switch to new directions for survival and continued to invest inspite of falling demand and the gap between JNR and road transportation continued to widen.

2.4.2 The JNR Crisis and Railway Reforms

Till WWII, the railways in Japan held the helm in surface transportation, and also appear to have been in good financial condition since no tariff revisions were made between 1920 and 1940. Although WWII radically altered this position, JNR managed to ride the storm of financial crises during postwar reconstruction and inflation by resorting to increases in railway rates in order to maintain financial and operational stability. But with the advent of the Japanese automobile industry in 1955, JNR traffic had begun to suffer from the inroads of the growing roadways. Consequently, the financial position of JNR also began to deteriorate from the loss of the railway monopoly over surface transportation. By 1964, JNR was operating at a deficit, even though it had just launched highly profitable passenger operations on the newly commenced ultra-fast Tokaido Shinkansen 'Bullet Train' service. The deficits rose sharply in the subsequent years to a point where the accumulated profit balances of past years had been liquidated by JNR's effort to contain the growing shortfalls in its revenue. The government effort at restoring JNR to its prior profitable position by allowing periodic tariff escalation proved counterproductive, since this increased the loss of traffic to the railways. Although as many as 13 tariff hikes were administered between 11974 and 1986, they failed to salvage the situation, and JNR sank deeper and deeper into financial distress. The annual operating losses also rose sharply and reached 15,500 billion yen in 1986, just prior to the privatisation of JNR.[98] The annuallly repeated fare-hikes on the JNR since 1974, and the recurrence of strikes accompanied by allegations of arrogance among JNR workers had previously led to a sharp exodus of passengers. As result, railway productivity in terms of passenger-km in 1986 was only 94 percent of the 1974 level.[99]

Coalesced within the financial and coordination failures that had confronted JNR was Japan's own critical situation following two consecutive Oil Shocks in the 1970s. The Second Ad Hoc Commission on Administrative Reform was therefore constituted in 1981] to improve conditions within the Japanese economy through the instrument of financial reforms.[100] The Report of the Commission held strongly to the view that financial and operational efficiency within the Japanese railway system was crucial to the economic health of Japanese trade and industry, and consequently proposed the privatisation of JNR . The Commission also held that since Japan's limited territorial area vis-a-vis settlement was manifested in transportation terms by intrinsically high densities of traffic, railway operations could be restored to profit through appropriate and purposeful reforms. Past JNR management policies were criticised in this regard for having misplaced their emphasis, since instead of restructuring JNR's traffic operations, these had been extended to the point where they became too unwieldy to be handled efficiently, under social compulsions that had committed JNR as a public corporation to the maintenance of uniform nationwide services. The Commission noted that the recurrent tendency in public corporations to fall back on government during times of crisis would in any case have proved such operational restructuring redundant. Observations of such nature led the Commission to recommend the rather drastic reform step of privatising JNR and breaking it up into 7 separate railway companies out of which only one would be catering to freight operations, in the belief that the return to private management would resuscitate the Japanese railways and restore their profitability. With the passing of related legislation in 1986 by the Japanese Diet, the JNR were reborn as the privatised Japanese Railways [JR] in April 1987.[101]

2.4.3 Causes of the JNR Crisis

Investment in transportation facilities often commences on identified high-demand segments to correct perceived shortages in capacity. The massive scale that railway infrastructural investments assume however brings about sharp and immediate upward swings in costs against slow rise of revenues. Thus in its initial operational stages, new railway enterprise can conceivably incur large losses which may nevertheless be offset by enhancing revenue realisation from the more profitable lines. However if in spite of the circumstances, the enterprise is compelled by national policies on price control to adhere to constant tariffs even in face of mounting losses, its efficiency is affected at both operational and organisational levels. Overestimation of traffic demands or underestimation of construction costs while investing in the creation of transportation facilities often leads transport undertakings into serious financial difficulties. When the investments made originate with government, the incidence of on-account financial burdens may ultimately shift to taxpayers.

The Japanese railway investment crisis was exacerbated by convergence of several subsidiary factors. Completion of the Shinkansen extension coincided with simultaneous growth of automobile ownership and air networks. Although traffic demand had been projected to rise commensurately in continuation of the high growth manifested over the 1960s, these expectations were falsified in the 1970s when there was a general shift from high to low economic growth rates, aggravated by the Oil Shock of October 1973, both contributing to the slowdown of traffic on all modes of transportation. Scarcity of land and building space in Japan's densely-populated larger cities also prevented the building of efficient service facilities along newly-laid railway tracks.[102] Consequently the deficits that the Japanese railways had already incurred on account of the large capital injection into the Shinkansen extension registered continuous increase, which the railways were unable to compensate by timely revision of tariffs.

It is not as if deficits that originated in the creation of excess transportation capacity compounded by the effects of general economic slack were not felt by the other transportation sectors. The new toll system introduced in 1972 to finance highway development, whereby profits from the Tokyo-Osaka Expressway were invested on the enterprise of extending the expressway, was also afflicted by high construction costs and low realisation of traffic demand. This reduced the room for independent manoeuvre on the part of the expressway vis-a-vis terms of financing, expenditure and income, in a process similar to that encountered by JNR. However as the oldest of Japan's transportation service providers and because of its investments in other non-profitable sections that were made under political pressure, the Japanese National Railways suffered the largest revenue shortfalls among transport undertakings. The impossibility of sustaining this deficit position contributed eventually to the privatisation of Japanese railways in 1987, after nearly eighty years of operations as a public undertaking.[103]

The railways in Japan had operated in the government sector since their nationalisation in 1907. The partial privatisation of Japanese railways that occurred in March 1987 dates to losses earlier incurred by the Japanese National Railways on the huge investments made in extending the Tokaido Shinkansen high-speed railway line beyond the lucrative Tokyo-Osaka section. By 1975, the railways were already in deep financial trouble because the levels of such investment proved to be unwarranted by the level of traffic demand.[104] Their predicament was rendered more severe by their inability to enhance tariffs to finance the investments, because of the exigencies of the national regime of price control. Thus the Japanese example and its aftermath of growing railway privatisation reveals how political expedients that underlie policies of price control can often work to the detriment of transport networks.

2.4.4 Transport Pricing on Japanese Railways

The fundamental operating principle for railway operations in Japan since their commencement had been pricing of the transport service at full user-cost. However, in all transportation sectors, a gestation lag is known to operate between inception of traffic service and attainment of break-even levels by passenger and freight traffic. Hence mechanisms must be devised for sharing the costs of development of new services, especially when extensions are demanded on the low-profit sections of the transportation network. These usually assume the form of subsidies that cover a part of capital-related construction costs, the burden of such subsidies eventually being borne by the taxpayer. To mitigate competition from roadways on traffic sections where competition is likely to occur, operating costs may also be lowered artificially by means of additional cost subsidies, the incidence of which is also liable to fall on the taxpayer. Certain differences

exist between the modes of accounting for development and operational costs of road versus rail transport, and while the *investment* head under roadways includes all categories of construction, maintenance and improvement costs, *investment* on railways only includes the capital costs of construction, while maintenance costs are separately accounted for under the head of *operating costs*. Thus the only items in railway expenditure that carry reflections of the investment outlays on the development of railways are depreciation provisions and the funds set aside for meeting dividend and interest obligations arising out of railway equity and debt. During the earlier era of the JNR, railway costs were classified as *operating costs*, which included staff, energy and material costs, and *capital-related costs*. The concept of dividend therefore did not exist, since interest payments were included within operating costs while the capital provisions for meeting interest and depreciation obligations qualified collectively as capital-related costs. Only since privatisation has interest been deemed non-operating expenditure by the Japan Railways.[105]

Besides providing passenger services in the larger cities on the Shinkansen lines as well as local railways, the Japanese railways also cater to the needs of long-distance and intercity passenger transportation, as well as freight transportation. Thus new railway projects can remain financially independent so long as construction is completed at minimum cost, and so long as the project will serve either one of these functions, which ensures there is traffic demand for its services. This conditionality becomes exceedingly difficult to adhere to with competition from other modes of transport. In the case of loss of financial independence from non-profitable lines, cost sharing by taxpayers is the ultimate resort.

Although there has been more reliance on railways for freight transportation rather than roadways to reduce pollution and energy cost, investment cost in this sector is still borne by the JNR/JR and not the taxpayers. This is primarily because the magnitude of freight transportation in Japan is limited by line capacity and loading gauge, and the pressure to bear the investment cost devolve son taxpayers. However, construction costs by and large were borne by JNR/JR or private companies since the pressure was mainly on the existing lines and substantial investment was therefore not required. Incremental investment was met by a moderate increase in fare.

2.4.5 Railway Privatisation & its Aftermath

The Japanese railways are not strictly comparable in situation to those in Europe because of the geographical conditions in an island country which compel dense populations to settle in districts surrounding large cities. The most prominent of these are Tokyo District with 30 million residents, Osaka District with 16 million residents and Nagoya District with 8 million residents, all concentrated in the northern part of the island of Honshu. Railway operations in Japan therefore impinge heavily on passenger services. A single privatised company, namely JR East, operated over 110 billion passenger-km over its 7,600 km route network in 1988, considerably more than passenger traffic handled in the same year by the German Deutsche Bahn and SNCF, and traffic density on JR East is six times higher than density on the combined DB and SNCF networks.[106] The main difference between passenger traffic in Europe and Japan, is that while in the former, passenger fares are individually borne by the railway commuters, in Japan such fares are borne by the employing companies. As a result, passenger fares in Japan can be pitched higher and in fact can almost cover railway costs. As such therefore, passenger-based railway services in Japan provide a much stabler revenue source than under other systems, without the burden of subsidised deficits that the latter face.

Although experiences associated with bad financial and operational decisions made by railway managements during the JNR era had initially created reservations among the railway workforce regarding the possible working of the new JR railway companies. A new edge was added to these by anxieties about the possible consequences of competition between the JR companies when profitability became their prime consideration. Under the terms of privatisation, while liabilities on account of debts outstanding and rehabilitation responsibilities for surplus personnel were to be shouldered by the JNR Settlement Corporation, the rest would have to be borne by the seven companies that comprised the reconstituted JR. Thus misgivings also existed among the workforce that the new companies might immediately resort to yet another fare hike to relieve the outstanding financial liabilities that had carried over from the erstwhile JNR.[107]

Inspite of such apprehensions, the financial results from railway operations that immediately followed privatisation proved favourable to the new JR companies, mainly because of substantial reduction in debt liabilities by 268.2 billion yen in 1987 and 357.9 billion yen in 1988. The interest rates chargeable on debts

outstanding were also lowered from the 7.13 percent level that had prevailed in 1987 to 6.89 percent in 1988 and to 6.47 percent in 1989.[108] The financial stimulus from these events was supplemented by improved traffic handling. This was achieved through overall productivity increases in terms of train-km and passenger-km per railway employee, without a corresponding augmentation in workforce numbers. Another factor that is deemed to have supported favourable operational trends under the reconstituted JR was the change in personnel attitudes that had occurred after privatisation.[109] Although JR operations had commenced amidst general misgivings among the workforce since the government would no longer be there to stand surety for the railway employees, the resurgence of their will to rebuild railways in Japan into a profitable enterprise soon overcame such anxieties. Decentralisation of railway activities also contributed substantially to streamlining the operations of the new railway companies. Instead of the centrally-controlled operation that had existed on the JNR, the 'frontline-first' principle adopted by the privatised companies was more appropriate to the worksite character of railway business, since it allowed railway workers to play a direct decision-making role. As a result, the trade union relationship between the railway workers and private managements also stabilised because of their mutual consensus over the necessity of raising JR's profitability and avoiding discord. The return of economic buoyancy to Japan after 1987 created a positive environment for improved railway performance because of the increase in business-related traffic demand. Commuter traffic trends, particularly towards Tokyo, showed a continuous increase which resulted partially from the soaring land-prices in that city which were compelling increasing numbers of people to reside in distant suburbs.

Since the true yardstick of the successful privatisation is the ability of the privatised railway company to pay a stable dividend without recourse to fare increases, this requires a reduction in the ratio of personnel costs to revenue, so that salary revisions do not introduce a strong cost-push factor. In its heyday in 1974, the JNR had an personnel-revenue ratio of 86 percent which had declined marginally to 63 percent in 1986. Privatisation of JNR however brought about an immediate decline in the ratio to 28 percent in 1988, considerably raising labour productivity. The eventual target is to reduce personnel from the present 68000 employees through introduction of high technology and computerisation, so that the personnel cost ratio stabilises at 20 percent.[110]

Like railway companies elsewhere, JNR held substantial land-assets at the time of privatisation. However, such assets not directly bring used in the railways, such as commercial lands suitable for housing, office blocks, and so on were transferred to the JNR Settlement Corporation rather than to the new railway companies. Although the prospects of commercial development of railway landed property are therefore limited to station and right-of-way lands, soaring land-prices in recent years render such development profitable and will expand railways. Another area of commercial advantage is the development of subsidiary business by the railway companies, particularly since surplus personnel can be reallocated to these. Again however, such business has to evolve around the concept of optimising the use of railway lands, since expansions in routes and services can hardly be expected to continue indefinitely. Although at present the ratio of traffic-to-other business on the Japanese railways is largely weighted towards the former, the new privatised companies anticipate a reversal of the ratio by the 21st century.

2.5 The China Railways

The first railway in China was the Shonghu line which was laid in Shanghai in 1874.[111] However the 16km light railway which ran from Shanghai to Wusong had been built without authorisation by British merchants. Hence it was demolished on orders of from the Chinese government soon after it was opened in July 1877. Through the early phase of the Railway Age, the Chinese government continued to resist the building of railways financed by foreign capital because they were averse to the entry of more foreigners into China. Although an abortive attempt was made in 1889 to build the Beijing-Hankou line using Chinese capital, it proved almost impossible to mobilise the sums required. Meanwhile a 10km mule-drawn line had been laid in 1880 by an English engineer C.W.Kinder at the Kaiping coalmines in Tangshan, on which steam traction was placed shortly after it was opened. This line was later to form the first stage of the Beijing-Shenyang line. After extension of the line was authorised, it reached Tianjin in 1894. In 1890 the Hanyang Iron Works had been built, which laid the foundation for the industrialisation of China. Thus by the end of the 1890s the Western powers had gained ascendancy over the Imperial Qing (Manchu) Court and compelled it into granting them concessions for the building of China's first major railways, which were to be financed by foreign capital. The three new lines to be authorised were the Beijing-Hankou and Kaifeng-Luoyang lines which were to be built by a Franco-Belgian consortium, the Tianjin-Pukou line which was to be built by an

Anglo-German consortium. The Beijing -Shenyang line was to be completed by British capital. Extensive Russian lines were also being laid at the time, including the Trans-Siberian line from Vladivostok, which touched Harbin in Manchuria, north of Beijing.[112]

Despite this early construction, the pace of railway development in China was much slower than elsewhere in the world. It was only after the Republican Revolution of 1911 had deposed the Imperial Qing and the foundation of the Chinese Republic had been laid that railway development started receiving serious attention. After taking over as the Director-General of the National Railways, the father of the Chinese Revolution Dr.Sun Zhongsan [Sun Yat Sen] forecast that China would need 160,000km of railways by the middle of the 20th century. Nevertheless, between 1874 when China's first railway had been built at Shanghai, and 1949 when the Proletarian Revolution led to the establishment of the People's Republic of China, only 21,800km of railway track had been laid.[113] Vast areas of China were still without railways, since the existing railway system was almost entirely in eastern China. Of the two main lines, the first stretched northward over a route of 2313km from Guangzhou (Canton) to Beijing, and then onwards to Shenyang and Manchuria. Another main line stretched southward over a route of 1462km from Beijing to Shanghai until it linked with the Guangzhou route. China's other railway routes that headed westwards soon had to cross hilly terrain.

2.5.1 Railways after the Revolution

After the Proletarian Revolution, Chairman Mao Zedong had targeted the country's need for railways at 200,000km. After 1949, railway construction was accelerated and track increased by 187 percent to reach a total of 62,615km in 1995, 54,616km of this track being laid directly by China Railways [CR], another 2965km by CR joint ventures, and 5034km by China's regional railways. China's rail network included around 17,000km of double-tracked lines and 9700km of electrified track, with diesel-powered trains servicing another 24,749 km.[114]

Freight handling by railways in 1995 totalled 1.59 billion tonnes of originating freight and 1283 billion tonne-km, or around 40 percent of the intermodal freight kilometerage in the country. China Railways also catered to 45 percent of all passenger mileage.[115] However, although the railways have proved the mode of transport most suited to the spatial circumstances of China as a country with vast population spread across a vast geographical territory, and faced with uneven distribution of natural resources, the tremendous volume of passenger and freight that are generated in these circumstances continue to pressure the railways, as a result of which many trains run at near or over capacity.

Although the high rate of expansion of railways reflects the rapid growth of China's economy since 1949, railway development has lagged economic growth and a gap prevails between what the railways can deliver and the economy's unfulfilled needs. The present 60000 km might therefore be considered a major bottleneck that impedes economic development. It is estimated that only 30-50 percent of freightage demands are currently being met in the heavily-used railway sections of Jiaxing, Pingshi and Xujia districts. Thus the current extent of railway services meets around 50-70 percent of the railway freight demand for the country as a whole. There is therefore considerable need for further expansion of railways to narrow the gap. At the rapid pace that economic growth has now assumed in China, increase in traffic demand to 1.6 billion passengers and around 2 billion tonnes of originating freight by the year 2000 is not unreasonable. Commensurate growth of the railway network would imply the construction of between 80 to 90 thousand km of additional track, and increase in freight handling volumes at the rate of 8 percent p.a. just to satisfy the growing demand.

2.5.2 New System Needs

However due to constraints, most notably the lack of capital, railway development will not be able to match demand, and only 70,000 km of track will exist by the turn of the century, if present trends continue. Accordingly, the feasible annual rate of increase in freight handling would be 4 percent, and China's railways would only be able to service 1.5 billion passengers and 1.8 billion tonnes of freight in the year 2000. Thus contradiction between rail capacity and development is a problem needing equal redress in China as well.

The two-pronged strategy adopted by China Railways to meet ever growing demand involved continual improvement to the rail infrastructure, and construction of new lines. The technical improvements made,

including electrification, double-tracking and conversion from steam to diesel or electric traction, were aimed at providing greater carrying capacity and faster transportation, and speeds of 160kmph on limited express trains, upgradation of the weight-capacity of specified tracks to carry 10,000T coal trains and in some cases also to handle 5000T freight loads on wagon-trains have since been attained.

Key railway construction projects undertaken since 1949 reflect the priorities of China's geographical regions. The strongest railway presence is found for historical reasons in the northern and northeastern regions where most big cities are concentrated. However the fact that average railway penetration in the northwest exceeds that in eastern, south central and southwestern China is the result of specific policies adopted by the People's Republic. New railways built between the Fifties and the Seventies thus reflected national strategies of regional self-reliance, military preparedness, establishment of heavy industry and dispersal of economic development over all parts of the country, particularly western China. Around 156 major planning, building and renovation projects were undertaken in many cities, along with the construction of intercity lines. Over the Eighties, national policy emphases realigned towards regional transportation in order to foster balanced regional development and to increase the rate of urbanisation, both considered critical for development of the country as a whole. The Nineties have drawn attention to the transportation bottlenecks which affect the pace of economic development, leading to a strategy devised to ease corridor transportation of freight and fuel at greater efficiency and speed, particularly freightage of coal from the mining areas. New construction works undertaken along the North-South, South-West and North-East corridors include double-tracking, electrification and other improvements. It is estimated that 6000 km of new track will have been laid by the turn of the century, enabling the railway network to reach the targeted length of 70,000km. Containerisation of freight and launching of high-speed trains are other leading projects, for which import of heavy-duty diesel and electric locomotives has been allowed from the US, France and other advanced countries. Comparative studies are also being conducted on the high-speed technologies of Japan, France, Germany Sweden, in anticipation of the proposed high-speed rail link between Beijing to Shanghai.[116]

2,5.3 Financing the New Railways

Most of the capital invested in building China's new railways after 1949 was drawn from the State budget. In 1985, the government began substituting the internal allocations with loans, and a new reform instituted in 1988, a new reform introduced special levies and other forms of development funding. From 1 March 1991, China Railways were allowed to charge freight fees of 0.002 yuan per tonne-km which was gradually increased to 0.028 yuan by 1 April 1996. In view of the expected growth of freightage capacity and traffic, the measure was anticipated to yield 60 billion yuan between 1996 and 2005.

To reach desired track-length of 70,000 km, 7400 km of new track would have to be laid. The financial requirement for this, along with the maintenance and upgradation of existing railway stock, would be 30 billion yuan p.a. between 1996 and 2001. However, the total cumulated borrowing by China's railways from domestic and international lenders also stood at around 30 billion yuan, and was growing at the rate of 3 billion yuan p.a., and between 1990 and 1995, only 10 billion yuan had been repaid as interest and principal. To overcome the standing crisis which threatened railway development, the Chinese Railway Ministry had entered into joint railway investment ventures with the national and regional governments since October 1981, and studies indicate that some 5000 km have been laid under this program, with cumulative investment of 15 billion yuan. The level of success achieved by this financing scheme offers model solutions to the difficult development situation faced by most world railways and might therefore be upheld as a paradigm for railway finance.

Since 1980, China Railways also began to enlist foreign capital for its projects, earmarking them mainly towards construction of new trunk lines and purchases of rolling stock and upgraded equipment, reflecting the new post-liberalisation strategy of technological modernisation. The inflow of foreign capital on this account was 3 billion USD between 1980 and 1990. To raise further finances, approval was also accorded to railway bond issues for 10 billion yuan by the Chinese Railway Ministry. Railway projects currently underway in China involve total onstream investments of 95 billion yuan.[117] The principal means adopted for raising this finance involve attracting domestic and foreign capital into railway development, attracting equity through promotional stock issues with market borrowing as a secondary credit source, encouragement of joint stock and other forms of stock holding as prevalent modes for reorganising new railway enterprise, and the laying

by of a certain amount of railway funds for investment in business diversification and other related projects.

The amount of development funding required by China Railways at the turn of the 21st century is estimated to be huge. Of this, 77 billion yuan would be generated through internal resource mobilisation, with an expected realisation of 60 billion yuan from freight and 17 billion yuan from special imposts on fast-transit traffic at rates of 1 yuan per passenger, and 1 yuan per freight-tonne. Budgetary support of 4 billion yuan would also be forthcoming for construction and development of the high-speed lines. Domestic debt instruments would raise another 15 billion yuan through loans sourced from the Chinese National Development Bank and the issuance of High-speed Railway Construction Bonds. Externally-sourced funding comprising both debt and equity instruments is also anticipated. 400 million USD is expected to flow in from international loans and 555 million USD from the global issue of development bonds in the name of the People's Republic by the Chinese Finance Ministry. Equity issues on the Hong Kong and New York stock markets would bring in 500 million USD.[118] To this would be added an unspecified amount raised through leasings of rolling stock.

C THE INDIAN RAILWAYS

2.6 The Mercantile Prelude

The Commercial Revolution which had defeudalised Britain and Europe over the 15th and 16th centuries laid the foundation for eventual industrialisation of the West. Among the principal flag-bearers of the mercantile age following the liberation of commercial enterprise was the East India Company [EIC] whose original charter had been granted by Elizabeth I in 1600 in order to break Dutch domination of the spice trade with the East Indies. Before the eclipse of that bid with the massacre of English traders in Indonesia by the Dutch in 1623, the EIC had already established a foothold for trade at Surat in Western India, from which it expanded its foray into India by founding another trading post in Madras in 1640. The new charter granting monopoly to the EIC in 1657 and renewable every 20 years redirected its operation towards India while increasing the Company's extra-commercial powers by assigning it rights of striking its own coinage, of exercising temporal jurisdiction over British subjects at its trading posts and of waging war and peace with the non-Christian powers of the subcontinent. The old Portuguese trading post of Bombay, acquired in dower by Catherine of Braganza's marriage to Charles II, was handed over to the EIC in 1668, and Calcutta, which was to become the EIC's main seat of power, was founded during the eastward expansion of operations in 1690.

The advent of the EIC also marked the first entry of foreign capital into India, which on account of monopoly profits accruing to the Indian trade earned British investors a dividend that averaged 25 percent *p.a.* between 1660 to 1700. The rise of the EIC to temporal ascendancy over India commenced with the subjugation of Bengal in 1757 by Robert Clive, and acquisition of revenue rights from the Mughal court at Delhi. As the trading monopoly declined with the imposition of regulations on the Indian trade, the India Act of 1784 instituted a board of governors to administer the Company under the Governor-General. The tenure of Lord Cornwallis in this position between 1786-93, oversaw the transformation the EIC from a commercial enterprise to an instrument for the spread of British power in India through alliance of military expertise with rampant palace intrigues in the Indian princely states, and by outright annexation of those where the erstwhile rulers had died intestate. What had begun under Cornwallis grew to strength under Lord Dalhousie over the first half of the 19th century, as more and more of India came under the EIC's sway. The annexationist policy, while proving conducive to the construction of infrastructure such as roads, railways, bridges and irrigation works, and to establishment of posts and telegraph services, also saw most of the EIC's commercial revenue being consumed by the costs of warfare and governance. Long before its trading monopoly was broken in 1813 and then virtually abolished in 1833, the EIC's commercial privileges had been progressively eroded during each renewal of its charter, and as such its profits increasingly came from the China trade. In 1853, its administrative functions were also clipped by the introduction of examinations to the civil service in a move to improve governance and allay suspicions that had been aroused by reformist legislation on the abolition of *sati* and slavery and by the institution of modern education. But the resentments continued to linger and rose to head during the Indian uprising of 1857. The following year, after the uprising had been quelled, the EIC was dissolved, and India came under the direct rule of the British Crown.

A number of changes occurred in the economic complexion of the country during the period of rule by the

EIC. For the first 150 years, the main focus of the EIC had been on the expansion of monopoly trade in the traditional handicraft exports of India such as indigo, spices, silks and other textiles, which before the discovery of the sea route had been carried over the difficult overland route. But acquisition of temporal power by the EIC over the later period at the expense of the Indian native states ended the royal patronage which had hitherto supported the artisan structure of the country, thereby killing the proverbial goose that laid the golden egg. Efforts to revive local industry after the institution of governor-generalship inevitably failed on account of the simultaneous rise of manufacturing in Britain and the framing of protective tariffs, along with improvements in communications that reversed the prior flow of manufactures and developed India into a market for British goods. After the middle of the 19th century, this pattern became firmly institutionalised.

Over the two centuries of growing EIC ascendancy prior to the introduction of the Indian railways, mercantile commerce had relied extensively on the waterways since the roads were rudimentary. The EIC thus operated from the port-cities set up to service its trade. Although no major navigable canals had been constructed over the period, the rise of Calcutta as a mercantile port marks the importance of riverborne freight to the EIC. Calcutta, on the estuary of the Ganges, stood at the headworks of the major navigable river of the country, and served as the point of transhipment of freight traffic to and from river boats to coastal or international shipping vessels. But dearth of navigable channels in the rest of the country meant that pressures inevitably arose for construction of railways to link the different regions of India.

2.6.1 Early History of Railways

The building of railways in India marks one of the most fascinating eras in the economic history of the country. Introduction of railways had in fact been opposed by many in Britain, as well as by certain distinguished Indians, as a premature and expensive undertaking or else a hazardous and dangerous venture. But the saga of railway development over 150 years speaks for the ingenuity and dedication of the ordinary Indian people who provided the actual labour, although railway construction and operation was initially entrusted to British companies on liberal terms to the exclusion of local enterprise.[119]

Railway development in Britain had required little more than guidance from state and parliament. Railway enterprises had grown with remarkable alacrity, soon providing popular means of transport to citizens who adapted themselves to railway travel when it became the cheapest transportation mode benefiting from economies of scale. It was argued that in India the position would be entirely different, since while it was anticipated that goods freightage would come to occupy a sizeable share in the total anticipated traffic, nothing could be conjectured with confidence about passenger traffic.

The Commercial Revolution in England and later in France had commenced along the network of inland canals which was later supplemented by the expansion of railways. Prior to the construction of railways, transportation infrastructure in India too comprised trunk roads and inland waterways. However, the association between railway and waterway systems that subsequently emerged in this country differed from the experience of most others. In India, the two transportation modes did not merely serve as twin alternatives within a unitary or consolidated commercial transportation network, since hardly any canals existed in India that had been built for transportation purposes, and since inland water transportation was only available along larger rivers which remained either fully or partially navigable throughout the year. The logistic weaknesses of the Indian transportation system were revealed particularly by the 1857 Indian revolt, which almost had adverse military consequences on the colonial power. To consolidate their rule over the country, the British therefore soon felt the imperative of constructing the Indian railways.

Plans for extending railway infrastructure to India were made under Lord Dalhousie, whose famous Note of 1853 exclaimed optimistically that 'great tracts are teeming with produce they cannot dispose of.'[120] It was also Dalhousie who drafted initial sketches of the routes to be followed by the main arterial lines. Railway development proceeded on the scheme of having grand trunk lines of the uniform gauge of 5'6" (1.6764m or the present Broad Gauge) traverse the length and breadth of the country, linking its larger inland cities with major ports at Calcutta, Bombay and Madras. Attention was therefore diverted from connection of contiguous commercial nodes, and from catalysis of intraregional trade by systematic construction of feeder lines within the districts which the trunk railways traversed. The trunk lines constructed were meant instead to open communication with the main agricultural tracts in the interior in order to facilitate the export of agricultural produce. It became possible, for instance, to reach Ahmedabad and the Gujarat cotton tracts, Nagpur and the

Khandesh and Berar cotton tract and Sholapur, and the adjacent Karnataka cotton tract from Bombay before 1870.[121]

The first railway extensions outwards from Calcutta headed towards the rich but congested northern provinces of the Ganga plain, and the Raniganj coalfields. These new rail routes also traversed inland cities such as Mirzapur, Allahabad and Kanpur. Bombay was connected by railway to Calcutta via Jabalpur in 1870, and to Madras in 1871. Calcutta and Delhi had been similarly connected in 1867. The trunk lines constructed helped to establish Calcutta as an important exit point for exports of produce originating in the Gangetic provinces. Karachi only acquired prominence as a port much later when the railway to the Punjab was opened. The most important of Indian foodtracts, Chattisgarh, was only linked by railway in the 1880s, with immediate impact on the food prices and food scarcities experienced by other parts of the country. The Deccan cotton-belt too had not been completely accessed when the railway reached Raichur, and other important centres at Belgaum, Dharwar and Hubli were linked only in the late 1880s. For the most part, however, the spread of railway communication was rapid and had touched the most important commercial centres fairly early, when over the 'Dalhousie-decade' between 1859-69, more than 8000km of railway lines were laid.[122]

Introduction of railways into India had in fact been delayed several years while the EIC directors had mulled over whether government should in any way mitigate the risks of private construction enterprise. It was only when Dalhousie assumed administrative charge that the matter was settled, since the new Governor-General staunchly believed that it was no business of government to get involved in railway enterprise. The initial government policy on railway construction executed through the Public Works Department operated therefore on the principle of *guaranteed* companies *i.e.* privately-held sterling companies which executed railway construction works on free land grants by sinking their own capital.[123] A return of 5 percent interest on their capital was guaranteed by government at the fixed conversion rate of 22 pence to the rupee, well above the interest yields on the London money market at the time. Surplus profit, if any, above 5 percent was to be equally divided between government and the private party. Under guarantee arrangements, government also reserved the right to repurchase the constructed lines after periods of 25 or 50 years at the mean valuation of the company on the London money market.[124] Although till 1869, railway construction in India was generally carried out on these guaranteed terms, the system soon proved uneconomical since government found itself paying out substantial sums as interest to construction companies which had incurred massive cost overruns on line construction, while virtually no operational profits accrued. Hence the system was abandoned and the government began the experiment of constructing railway lines entirely on its own between 1869 to 1879, after being granted authority to raise loans from the London money market in 1867 to finance its own public works.

A more drastic corollary of railway development in the second phase of construction after 1870, was substitution on the new lines of the uniform BG of 1.6764m (5'6") contemplated in Dalhousie's original plan by the reduced gauge of 1.0000m (3'3"or the present metre gauge [MG]) as a means of lowering construction costs after money market interest rates and the debt liability became worrying. Although the measure may have made short-run sense at the time because of the inevitable lag in traffic development, it also eventually saddled India with a large and incompatible MG network, which was to become the primary factor in later traffic bottlenecks, and which is still in the process of conversion to BG at heavy construction and write-off costs.

The system of guarantee as a means of railway finance had assured plentiful supply of capital, and Thorner has noted that 'capital which moved from England to India under these terms formed the largest single unit of international investment in the nineteenth century.'[125] Although with abandonment of the guarantee system, the onus of raising railway capital now passed to the state and had significant consequences on subsequent railway development, over 12,000km of railways had been constructed before 1878 at a total cost of 170 million pounds, combining costs of works and land as well as debt liability.

The Indian railway companies after the first quarter century of railway development were yielding operating profits. The time would then have been right for their takeover if the original thought behind their development had still prevailed. The first option for repurchase of concessionary lines however came and lapsed in 1874, when the concessions were renewed for another 25 years by the Home Government over the protests of the Government of India. Then, after ten years of government entrepreneurship, private companies were granted reentry into railway construction in 1880. This time around, there were no interest guarantees, and the

companies were instead supported financially through government loans and, in most cases, free land grants. Meanwhile, the British Indian government and the Indian princely states also continued with their own parallel construction works. Ongoing debate between the Home and Indian Governments at the time on the relative merits of protective *versus* productive works reflected similar debates around that time in countries such as France. The notable difference was that, in India, unprofitable railway lines remained the responsibility of the state and not the railway companies, as proof of the earnestness of government in restoring *laissez faire* conditions in railway *operation*. The Indian railways during the 19th century thus witnessed rapid and continuous development because of strong inflows of British capital, and the final decade of the century found India with an extensive and well-developed railway network. The existence of the guarantee initially, and then its subsequent replacement by financial support, did not however allow the extension of *laissez faire* conditions into railway *development*, especially after 1896 when curbs were placed on market borrowing by the railway companies. By becoming the *principal agent* in initiating railway development, government acquired the power to control railway construction and administration. Following the turn of the century, no major construction needed to be initiated immediately, and the effort now shifted towards fuller utilisation of railway capacity. Invoking repurchase clauses after recurrent operating losses, the government had by 1914 acquired all railways built under the old guarantee system. The Indian railways thereafter by and large became state-owned, since 'private' extension in the later period was insubstantial.

In their actual working, the modalities of railway construction and operation described above had important macroeconomic implications for India.

2.6.2 The Phase of Consolidation

Railway policy in India was thus mainly formulated around two major decisions made by Government. The first of these related to the network-plan on which the new railway lines would be constructed; the second was the mode of management of this enterprise.[126] At the background however lay the pressing need of the colonial government to establish its writ over Indian soil. The advent of railways itself may be dated to the opening to public traffic of the first railway line in India on 16 April 1853, which extended 33.8km. between Bombay and Thane in Western India. The first section of the East Indian Railway covering a distance of 37.01 km. from Howrah to Hooghly was opened shortly after on 15 August 1854, heralding the advent of railways in the east. The south did not lag behind either. The Madras Railway Company opened its first 104.6km. section from Rajapuram to Arcot in 1856. By 1867, construction of arterial rail-routes between Calcutta and Delhi, and Calcutta and Bombay was complete. Occurrences of war and famine between 1872 and 1890 then compelled government to initiate the construction of a large number of branch and feeder lines based on welfare, commercial and strategic considerations, such as those voiced by the Famine Commissioners in 1880 that had pressed the strong and immediate need for adding another 8045km (5,000 miles) of new track as a measure for the avoidance of frequent famine.

The principal part of the rail network in India comprising major trunk lines linking ports to hinterlands had thus largely been built in the first phase of railway development till the end of the 19th century. Construction since then till the outbreak of the world war concentrated on development of around 16000 km of branch and feeder lines as a means of strengthening the primary system. The lower expected traffic density on these was sufficient justification for growing state involvement in the building and running of railways, and with increase in the proportion of government-owned lines, the old mode of administering them, along with roads, irrigation, etc., through the Public Works Department [PWD] proved impracticable. Accordingly, the Railway Board was constituted under the Railway Convention of 1905 and took over charge from the PWD, although the financial burden of state funding continued to be met from general government revenues. By 1914, a combined rail network of 55762 km was already in place, three-fourths of which was owned by the state leaving around 14000 km under the ownership of small private companies or the princely states. Yet of the network of 41691 km under government ownership, only 11635 km was directly operated by the state leaving the major part to be run by private managing agencies.[127]

One consequence of the succession of phases in which the Indian railways were constructed and the manner in which rates were set was that the first development impact was the expansion of foreign trade because of concentration of the main trunk network on the port-hinterland axes. Even after the subsequent development of the secondary network, the structure of railway tariffs remained unchanged till 1914, and firmly discouraged

the development of internal industry and trade, because freight operations by the railways were mainly confined to the arterial routes serving the ports. On the other hand, the Indian plantation sector which came into being almost coterminously with the development of the railways became a major user or railway services because of its export orientation, and the quick pace of railway development in fact hastened the establishment of plantations over vast areas of previously underutilised lands through the system of land grants. Two other economic sectors that also rode the wave of railway development were the coalmines and the cotton and jute textile industries.

The Afghan Wars in particular had led the British Indian government to consider extension of railways as a means for improving movement of troops to the frontier. Augmentation of carrying-capacity on existing lines was also considered as an efficient means of linking the principal cantonments with each other. Heavy strain was again placed on the railway network which had evolved by the transportation needs of troops and war materials during World War I, which had to be accorded top priority. British India was also called upon to serve the heavy staffing and material needs of colonial and strategic railways being built in East Africa, Mesopotamia and elsewhere during the period. Uptil March 1916 for instance, foreign expeditionary forces had been provided 50 locomotives, 600 vehicles, 265.5km. of rails and fastenings, and half a million railway sleepers.[128] Large quantities of equipment for the construction, maintenance and operation of railways were also being requisitioned for military purposes in East Africa, and railway workshops were asked to divert their resources to the production of high-explosive shells, hospital trains and other war equipment.

The Indian Railways emerged devastated and dilapidated from the War, facing shortages in stock, worn-out tracks and ageing locomotives. Thus this war-torn period was a setback to railway development. Criticism in the Legislative Assembly was sharpened by revelation of a number of cases where railway companies had worked against national interest. Consequently the Indian Railway Committee under the chairmanship of Sir William Acworth was appointed in 1920 to devise alternative methods of administrative and financial management on state-owned railways. The Committee extensively reviewed the contentious issue of operational losses which had been under critical focus from the time of the old guarantee system, and estimated the cumulative railway deficits, exclusive of interest liability, between 1858-1918 to be Rs.77 crore [*1 crore = 10 million*], against cumulative surpluses of Rs.67 crore, leaving a net uncovered operational loss of Rs.10 crore.[129] One of the defects that the Indian enquiry shared with the enquiry on the operations of British railways also conducted by Acworth was that interest charges on the losses was left unreckoned, masking the true cumulative effect of railway losses. Nevertheless, on the Acworth Committee recommendations, many privately-managed lines were brought under state management on expiry of their operating contracts. By 1924, total route length on the Indian Railways stood at 61,285km. against the target of 160,900km (100,000 miles) set by the Mackay Committee for attainment by 1908. At the time of Independence, this had reached 65,203.1km. of which 10,521.3km. was apportioned to Pakistan Railways by the process of Partition, leaving Indian Railways with a post-1947 route-network of 54,681.9km.

The phase of post-WWI economic prosperity lasted till 1930, after which unparalleled recession affected the global economy till World War II. The recessionary impact of the Great Depression on the agricultural economy of India led to deficiency in freight traffic and resultant financial losses for the Indian Railways. The slowdown in the turnover of railway freight also reflected gradual commercial inroads being made into the transportation sector by nascent roadways. Although WWII itself was a period of financial prosperity for the railways, the spillovers from its ravages elsewhere and from intensification of the nationalist struggle for freedom also prevailed upon railway development to a great extent.

Railway development in the pre-Independence era is therefore seen to have passed through three distinct policy-phases. From inception uptil 1869, both construction and operation of railways was left entirely to the railway companies, under some form of guarantee. The argument favouring the guarantee system was that the initial injection of capital required for railway projects would not be forthcoming without an assurance that there would be returns on it at acceptable rates. But with the actual capital costs of construction and operation of the trunk lines significantly exceeding previously-anticipated levels, government coffers were severely taxed by the obligation of meeting the interest guarantees. With hindsight, the guarantee system is thus seen to have been a rather inefficient mode of railway finance, eliciting comment from observers that the railway companies had no inducement, on account of the guarantee, to be economical in their management.[130] During the later decade between 1870 and 1880, also part of the first phase, all new railway lines were therefore constructed under the direct agency of the State with finances from the State Fund.

From 1880 onwards till 1907 during the second phase, both the State and the Company railways operated concurrently, in a partial reversal of the previous policy. Thus while profitable routes were leased out to private operators, less profitable routes were either directly or indirectly constructed and operated by the State. The return of private railway construction companies has been mainly attributed to the 'co-existence of financial stringency with the necessity for accelerated construction' of lines.[131] However the new railway construction companies that began operation over the period were not guaranteed returns even though they received capital assistance from government.

After 1907, when all major railway lines had been acquired by the State and leased out to private agencies for management of operations, Company railways in India can no longer be characterised as private enterprise in the pure sense of the term., since their controlling interest in the railway undertakings did not resemble that of ordinary joint-stock companies. With nominal capital outlay and guarantees of interest, these companies were only managing agencies who worked the rail routes on behalf of the Government of India. By 1920, Government owned 73 percent of total route kilometerage in the country. Excluding the lines owned by the Indian Princely States, private railway companies would then account for route-ownership of only 250km (155 miles) from total network kilometerage of 59,580km (37,029 miles). However, inspite of its predominance in ownership, the State operated only 21 percent of the railway system, while 70 percent of it was managed and operated by the companies.

The Company railways operating in India were administered by Boards incorporated in England which delegated specific functions to their managing Agents in India. On the eve of Independence there were still as many as 42 different State and Company railway units that were subsequently merged into the nationalised Indian Railways, which became the largest public-sector undertaking in the country. The process of takeover of company-run railways had in fact commenced in 1925 under public pressure. Financial control over the railway companies had also been exercised in varying degrees by Government from the outset through its general budgetary provisions. Railway finance was eventually brought out of the ambit of the General Budget on the recommendation of the Finance Separation Convention of 1924, which also laid down the manner in which the Railway Budget was to be framed and placed.

The overwhelming stress on company management of railways however deprived the system of advantages that could have accrued from single-owner operation, and frivolous competition between railway companies often detracted from the national interest. Certain intrinsic differences in the consequences of competition, arising from the character of railways as an infrastructural sector also need to be analysed. Although the role of industrial competition in controlling mobility and directing the flow of capital-seeking investment held true for the railway companies, a major difference existed vis-a-vis the degree of mobility possible in railway investment, since railway capital tends to be immobile over short periods. In the case of railways, mobility of capital was therefore only possible in the long term. Again, in businesses from which capital can be withdrawn without sustaining substantial loss, an entrepreneur would be free to suspend operations temporarily or even permanently if they became unremunerative because of competition. However the competing railway company would be compelled to work the lines even when it was not earning any profit. Very little of the capital invested in railway construction by the company could be withdrawn. Many of its working expenses were independent of traffic, and three-fourths of total expenses would continue as a fixed cost even if operation ceased, because of the high ratio of fixed capital : working capital. Thus in unprofitable situations, the railway companies withheld investments from new lines, while financial pressure on existing lines also led to deterioration in the quality of service provided. This in effect was the general operating picture of railways in British India.

2.6.3 The Phase of Modernisation

At Independence, railways in India depended almost entirely on imports of capital equipment such as rolling stock, signalling equipment, rails and other track materials, bridge girders etc. Steam was the only mode of traction, except in the Bombay suburban area where DC electric traction had just been introduced. The standard Broad Gauge freight carrier was the 4-wheeler railway wagon with an axle-load of 16 tonnes, and only a very limited number of 8-wheeler bogie wagons were available for the transport of rails and other special traffic. The speed of trains was severely restricted by the semaphore mode of signalling, with the vast majority of railway stations being equipped with only the standard single signal system or rudimentary interlocking, and by the morse instrument providing the sole means of communication. Running-track quality

was poor and not conducive to carriage of trains with heavy loads, with even the trunk routes having only single line tracks, comprising 45kg rails laid on wooden, cast-iron or steel-trough sleepers, with dog-spike or key fastenings, and a density of 1300 sleepers per km.[132] The subsequent growth of the post-Independence Indian railway system has been closely linked with the agricultural and industrial development priorities instituted under planning. Thus construction of new lines was undertaken concurrently with the tapping of mineral resources like iron ore and coal, construction of steel and power plants and establishment of other major industries. A number of the new lines were also provided transportation links to new ports for furtherance of imports and exports.

From an initial focus on physical expansion of network and capacity during the early plans, railway infrastructure has subsequently also acquired a new focus on the technological expansion of capacity, and has been modernised in order to to handle steadily growing needs of different sectors in the economy which had led to increased movement of both men and materials. The rolling stock required for these expanded operations has either increased in number or has improved considerably in capacity. Thus, the number of wagons online had risen from 205,596 in 1950-51 to 400,946 by 1980-81 and had then declined to 312,405 in 1993-94, but their carrying capacity had increased several times over.. The number of locomotives had increased from 8486 in 1950-51 to 10908 in 1980-81 and had then declined subsequently to 7202 in 1993-94, but steam traction has largely been replaced by electric and diesel.[133] Consequently the numbers of passengers carried and the tonnages freighted by the Indian Railways has increased phenomenally. Performance and growth of railways since Independence has therefore been quite commendable. There has been manifold increase in traffic as well as technological upgradation to deal with this. In sum, the picture that railway development offers is one of expansion in traffic volumes handled, expansion and extension in capacity of technological equipment, and a shift progressively towards high-volume, high-density operations.

2.6.4 Reorganisation of the Indian Railways

Besides the events that demarcate the evolution of the Indian Railways from their advent to their present physical form, there has also been change in their mode of organisation. The structure of the Railway administration in India has evolved periodically, to accommodate operational exigencies and also to promote better coordination between the railways and Government. But while the predominance of private management in railway operations over most of the colonial period might superficially suggest the existence of competition between the railway companies, the colonial state exercised full control over their supervision, organisation and development. in furtherance of its own commercial and administrative interests.

Thus although the railway administration vested in the hands of the State Railway Secretariat during in the early phase of railway development, which was established in 1874, the Government decided to tighten its reins of control and constituted a Railway Board under terms of the Railway Board Act [1905]. All supervisory powers over the railways were assigned by the Act to the Board, which was placed under the Department of Commerce & Industry. In 1908 and 1921, the Mackay Committee and Acworth Committee made recommendations towards strengthening the Railways Board's position relative to the Government. The Government eventually did not assent to most of these .Although the Railway Budget was dissociated from the General Budget under the Finance Separation Convention of 1924, this did not bring appreciable improvement to the financial administration of railway undertakings. The Government of India Act [1935] therefore made provision for a Federal Railway Authority which was never implemented.

The shift in national perspective after Independence sought to refocus the Indian Railways towards the economic rejuvenation of the country in the aftermath of colonialism and Partition. The new mindset was strengthened by the recommendations of the Railway Enquiry Committee [1946-49] for setting up a Central Controlling Authority for the Indian Railways and the Railway Board was asked to provide the *raison d'etre* for its continued existence. Although no steps were taken to constitute the CCA, the Railway Board was reconstituted and assigned with even greater powers of central control. Since then and uptil the present, it frames railway policy and operates also as a corporate regulatory body analogous to a board of company directors for the Indian Railways. The present responsibilities of the Railway Board include the coordination and maintenance of all IR operations and also the preeparation of plans for the future development of the railways. A Directorate of Planning guides the planning systems of IRs zonal railways.[134]

IR's zonal railways were formed when the older State and Company were regrouped during the 1950s. Zonal

regrouping had also been a part of the railway debate during the 1920s and have been considered by the Acworth Committee. It had also been studied by several Committees who had made recommendations for and against it. While the companies had insisted that flexibility of operations was a key to railway profitability, it was also seen that large pre-Independence railway networks such as the East India Railway and the Great Indian Peninsular Railway ran more profitable operations than the branch railways. The railways in many other countries including France and Britain had been regrouped after the phase of railway construction was over. Regrouping was also justified by the arguments on the economies of scale from transportation. As a result, clusters of branch and trunk lines were amalgamated into networks in almost every country which had extensive railways. In India, this process had to wait till the nationalisation of IR and the setting of planning priorities for the country.

Zonalisation of IR began in 1951 when three large zonal networks were created. These were:

1. Southern Railway which was amalgamated from the erstwhile Madras & Southern Mahratta Railway, the South Indian Railway and the Mysore State Railway

2. Central Railway which was amalgamated from the erstwhile Great Indian Peninsular Railway, the Nizam's State Railway and the Scindia and Dholpur Railway

3. Western Railway which was amalgamated from the erstwhile BB&CI Railway and the Saurashtra, Rajasthan, Jaipur and Cutch Railways

Three new zones were created in 1952, comprising:

4. Northern Railway which was amalgamated from the erstwhile Jodhpur Railway, the Bikaner Railway, the Eastern Punjab Railway and the three divisions of the East Indian Railway which lay north-west of Mughalsarai Junction

5. Eastern Railway which amalgamated the remainder of the Eastern Railway with the erstwhile Bengal Nagpur Railway

6. North Eastern Railway which was amalgamated from the erstwhile Oudh-Tirhut Railway, the Assam Railway and the Kanpur-Achnera section of the BB&CI Railway

After zonal readjustment in 1955, a new zone was created, namely the

7.South Eastern Railway which was carved out of Eastern Railway, while Eastern Railway retained three railway divisions of the old East Indian Railway and the Sealdah division of the Bengal-Assam Railway

After another zonal adjustment made in 1958, another zone was created for strategic reasons, namely

8. North-East Frontier Railway which was carved out of the North Eastern RailwayIn 1958, the

The last major IR zonal railway was created in 1966, namely

9. South-Central Railway which was carved out of the Southern Railway, and includes the network of the erstwhile Nizam's State Railway as well as the erstwhile Madras & Southern Mahratta Railway.

Except for minor reallocations at divisional level, no major IR zonal railway was created thereafter. In a recent order however IR has proposed the creation of six more new zones by breaking up the existing zones and reorganising the divisions into more compact zonal railways. While the matter has been subject to some debate since 1996, when the proposal was first contemplated, the Chairman of the Railway Board has announced a rationale for the reorganisation. If the argument is accepted, the present IR organisation has become unweildy because of the growth in the size of its operations and in the number of trains. The Railway

Board now believes that leaner zones will be more efficient.

Reviewing the experience of the major railway systems that have been studied in the present chapter, it would seem that two scales of organisation are appropriate to railways. For large networks with a lot of freight-intensive operations, such as SNCF or IR, the benefits of technological modernisation can only accrue on large unified operations where good coordination is possible.On the other hand networks which cover a smaller area but have highly intensive passenger flows, such as British Rail plc. or JR, the compact mode of organisation is better because of the lower leads involved in passenger traffic . It will be seen in the next chapter that the character of operations on IR has been changing , and as passenger flows ahve expanded, the focus on freight operations has narrowed. Large parts of the IR network have become unviable because of the absence of adequate freight flows. Hence the decision on zonal railway reorganisation becomes critical for IR. Is IR to become a passenger intensive railway which runs compact operations to cater mainly to intercity passenger flows? Or is it to remain a large freight-based network which caters to the transportation needs of the entire country?

The financial health of any major railway system depends on the efficiency of its freight operations, unless passenger intensities on it are as high as they are on JR. The study of SNCF which has been made in this chapter becomes important in this light. SNCF has faced increasing competition on the roadways for several decades. As a state owned railway system, it resembles IR in many respects. The study of SNCF shows that a large railway system can only return the competition if it becomes more technologically efficient. While investment in railway infrastructure and technological renewal is most important, the returns from the large capital investments that have to be undertaken flow slowly and take some time to materialise. On the other hand the freight operations of a railway are commercial enterprise. In this respect, IR currently faces the same challenges as SNCF. However, the need for public investment on IR has not been recognised for some time, and the depreciation of IR's infrastructure has not been compensated in the manner needed.

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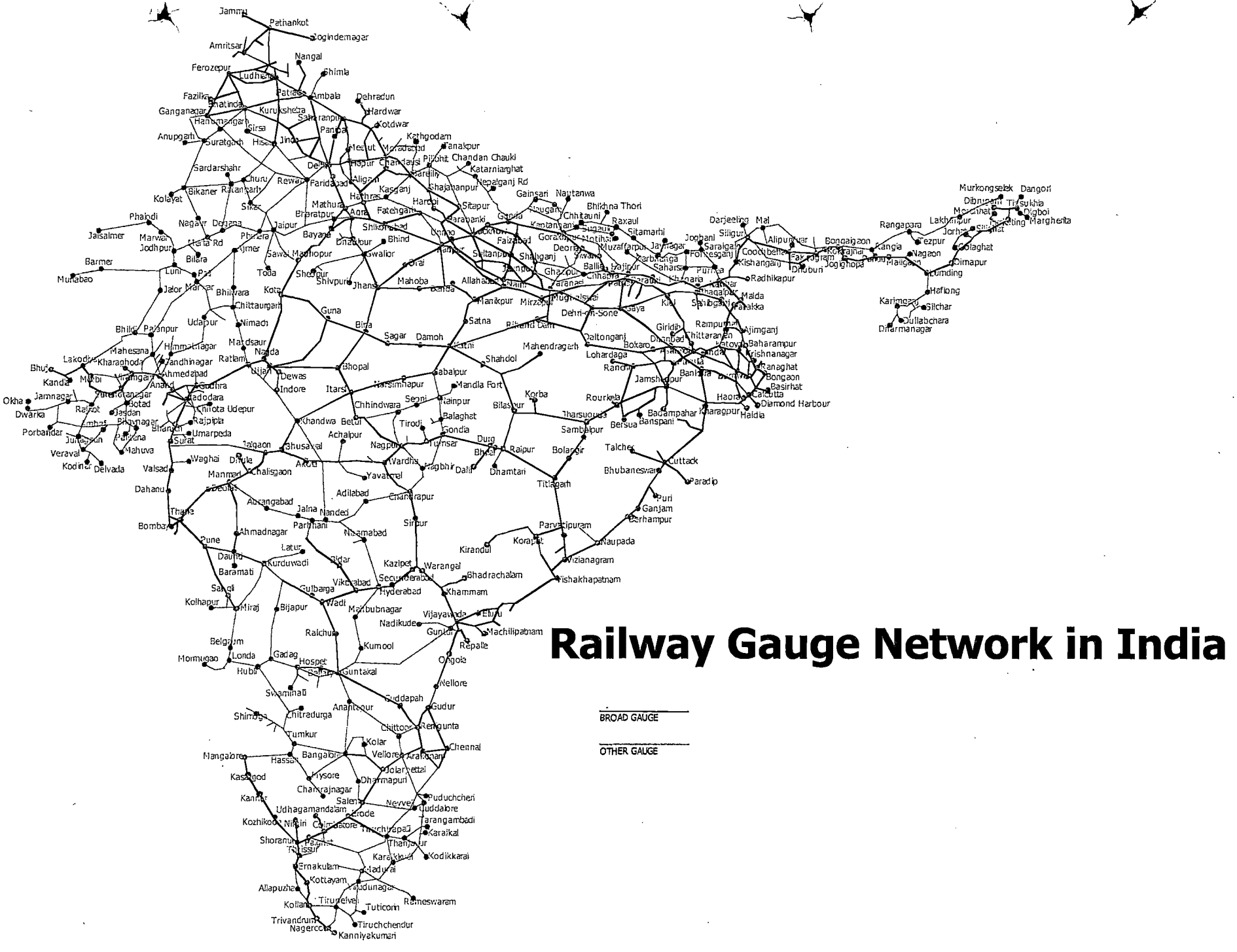
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Railway Gauge Network in India
BROAD GAUGE
OTHER GAUGE