Trans. Inst. Indian Geographers
Vol. 2, No, 1, January 1980

THE FUNCTIONS OF THE INDIAN RAILROAD SYSTEM : AN ENQUIRY INTO THE POSSIBLE AREAS OF RESEARCH

SATYESH C. CHAKRABORTY, Calcutta.

ABSTRACT : The study presents an overview of the areas of research in the functioning of the Indian railroad system that could be taken up jointly by geographers and economists and stresses the need for examining the history of the railroad system as it has influenced the structure or the organization of the territorial economy of India. Some basic facts about the growth of Indian railway vis-a-vis the growth of Indian economy and their spatial pattern have been examined. While the operational efficiency of the railways requires an understanding of their technological imperatives, their role in regulating the country's economy needs an in-depth study. The fact that the manufacturing sectors are getting proportionately less serviced than the agricultural sector, needs closer analysis. Some significant facts such as a higher growth rate of production and movement in Indian economy than what the railways are able to handle, or the extent to which other modes of transport have been able to substitute or complement the railways, need enquiry. It has been demonstrated that the relative shares of earning from the transhipment of sugar and salt whose consumption is related to broader population base have remained constant in contrast to those of coal, mineral oil, and iron ore which have been conspicuously increasing, suggest that the Indian railways are organized to subserve larger urban centres than the small urban centres and rural areas. A more generalized version of this specific case is that the emergence of metropolitain economic centres has been consistently promoted by the Indian railway system.

Preamble :

Amongst the diverse territorial infrastructures used for the circulation of men and materials, the Railroad system is perhaps the largest single such unit in India. It exerts enormous power in designing linkages or connections between resource bases, centres of production and areas of consumption. At the same time it can be made to respond to the public policies on development and commensurate changes in the structure of territorial economy of India. Unfortunately, however, the relationship between this system of transport and the economy of India has not attracted sustained interests of the researchers in social sciences. The objective of this paper is to provide a few meaningful perspectives of research on this reality. We propose to handle only the major issues in this regard in the belief that more elegant approaches to research and more efficient tools of analysis will emerge from the very exercises suggested here.

Some Basic Perspectives :

The railroads, as mechanics of transport, were introduced into India in the middle of the 19th century. The need arose more in sconsonance with the interest of an alien metropolitan economy about a colonial possession than in response to the technological needs of the production base of the then India. In fact, the technology of steam-locomotion on iron rails was itself new in England from where it was imported. England had her first railways in 1827 and within the next 26 years it started exporting the continually improved rolling-stocks to India. This was also the period when indigenous base of Indian technology was getting rapidly eroded in response to the Imperial administration of manufacture and economy in India. Therefore, the gap between the two levels of technology, one sustained within the Indian railways and the other within the rest of the Indian economy, remained large all throughout the 19th century. There was nothing in the Imperial policy on India as to bridge this technological gap. Such an alien and delinked disposition of the Indian railways, especially during the period of initial development, demands serious attention of the social scientists in so far as it affected the development of manufacturing in India.

The railroad system grew very rapidly in the first forty years. Since then, measured by the length of tracks alone, the pace had declined. In the post-Independence era, only six thousand kilometers of tracks have been added to some 55 thousand kilometers of track that the system had in 1947. However, the areal orientation of this system emerged in response to a rationale that was once again alien. The policymakers selected new locations for transportnodes and also new corridors of transport. They provided the facilities for inter-change between different systems of transport at locations which were mostly new. The earlier network of inter-regional transport, based as this was on roads and river navigation, was largely ignored. Consequently, the morphology of regional economic interactions changed rapidly during the first forty years of railroad development and apparently inflicted painful demands upon the Indian societal order to adapt. Many old towns decayed. Many new towns grew up. Areal distribution of economic activities changed. Extractive economy increased in importance. All these created problems of readjustment and required adoption of new norms of regulation for sustaining inter-regional economic linkages. The Indian social scientists, while analysing the process of economic transformation of the Indian societal order, have hardly examined this role of the Indian railroad system for mapping the structural changes brought within the Indian regional economy.

As an ideation, we need not ignore the alien origin of technology and the traumatic impact that the system had imparted to the Indian society. But we suggest that there is something more than mere shock that the Indian railways had to offer to India. The very circumstances of the shock prove that the railroad system had indeed the power to regulate inter-regional economic linkages, that it had the capacity to restrain or to facilitate the spread of industries and cities, and that it had intrinsic abilities to retain a premier position in facilitating the movements of materials, people and ideas within and between the diverse natural regions of India. Its contributions towards the emergence of a national identity, shared by the people with diverse cultural roots, both in the political and in the economic senses of the term, have been prodigious indeed. The Indian Railways is today the single largest subsector of the national economy as consumers of iron, steel, wood, coal, electricity and petroleum products. It is also the largest agency engaged in the transhipment of all these materials between discrete locations. It is the biggest single employer as an organisation. It can impinge upon the territorial circulation of men and materials through tariff adjustments and also through provision of special facilities differentially between the regions or subregions. In short, this is an institution that has established diverse interfaces with the economy and can be used as a possible instrument of intervention, if the objective is to regulate the economy. Considering that from 1925 onwards the ownership and management of the major private railways have been taken over by the Union Government, the potentials in this regard is within the means of the Indian polity. But the problem rests on obtaining an appropriate understanding of the present and the possible future roles of the Indian railroad system in regulating the economy, if our objective is to prescribe policies. However, little systematic study is available on this aspect of the Indian railways.

The basic reason for the continued neglect of this area of enquiry can possibly be ascribed to the very structure of the Indian academy. The two major social sciences disciplines, economics and geography, which have diverse tools to offer for a conjoint exposition of the space-economy, have hardly met within the ambit of the Indian Universities. It is obvious that a railroad system is basically a spatial network of connectivities between nodes, where each node is a function of the supporting spatial economy. Therefore, the role of the Indian railways cannot be properly appreciated by ignoring either the spatial or the economic dimensions of the system. To produce such a conjugate perception, the two basic disciplines of economics and geography have hardly interacted. But, whatever may be the reason for this neglect, we are required to make a beginning someday. The rest of paper concerns a search for providing the necessary meeting grounds in this regard.

We believe that such meeting grounds should be identified in terms of the current functions of the Indian railroad system vis-a-vis the economy of India. Our objective, therefore, is to select and highlight some of the major issues that are embedded on the interface between the two. In other words, our basic objective is to identify some areas of useful research in terms of the observed impacts of the Indian railroad system upon the Indian economy. The need for retrospection will emerge from the questions that we raise regarding the present situation. To facilitate appreciation of such questions as legitimate, we propose to provide some length of discussion on each.

Issues concerning the size of Railroad system :

In terms of the sheer length of the rail-routes, the size of the Indian railroad system would be the biggest in Asia. In 1974-75, India had some 60,301 kilometers of railway routes. But such an indicator of the size of the system will be misleading, for any analysis on the importance of the railroads in the economy of a country, although it may be indicative of the problems of management of the organisation as such. To make the indicator more meaningful for our present purpose, we may express the units of routes as ratios of population and/or area served. In terms of mid-census estimate (1976), there are 99 kilometers of rail-route per million persons in India. One should also find that there are 204 kilometers of rail-route per ten thousand square kilometer of land area in 1976.

Now in 1976, Japan had 187 kilometers of rail-route per million persons and 569 kilometers of rail-route per ten thousand square kilometers. The corresponding ratios for China in 1976 were 41 and 38 respectively. These are in no way very spectacular examples of the relative size of the different railroad system. For example, Democratic Republic of Germany (East) had 1345 kilometers of rail-route per ten thousand square kilometers of land area, whereas Canada had 3076 kilometers of rail-route per million persons in 1976. All these figures merely indicate that the spatial orientation of the railroad system and its relationship with population and geographic space varies between the countries and, for this reason, the design of research in this regard should be made with reference to specificities of geography and history of the country under study. The experience of one country need not be found suitable to explain the situation of any other country.

At the same time, we need to undertake cross-cultural studies, because these are important in revealing the variable circumstances that can be made to influence decisions on the possible models for optimising the size of railroad systems in a given country. These studies also reveal interesting relationships between the so optimised models and the levels of economic development. This is clearly discernible from **Table–I** where 19 countries, wellknown for their current dependence on railway transport, have been arranged according to their size and their levels of economic development, measured in terms of per capita income, and sizes of their railroad systems. This shows that the size of the system, as measured either in terms of served population or land area, has no relationship with the size of the countries. But it shows that per capita income is directly related to the size of the railroad system when measured in terms of the population served. This, therefore, emerges as an important guiding principle.

At closer scrutiny, **Table–I** will reveal that the countries having high concentration of population in parts of their territories, such as in Canada, USA, Sweden, Burma or Egypt, the size of the system measured by population served tends to appear bigger than the measure given by area-served. The reverse is true for countries where the population is fairly well-distributed over their territories. These are fairly obvious features of railroad systems. Nevertheless, these provide interesting directions of further research on the relationship between levels of economic development and the railroad system.

The above mentioned question can very well be addressed to analyse the situation of economic development obtaining between the different regions of a given country. This, we are attempting on India and some data in this regard are given in **Tables II and III. Table II** has been constructed in the same way as **Table–I** for the 15 major states of India. By major states we mean those states which had more than 10 million persons according to 1971 population census. The minor states together contained 14.49% of total area, 3.59% of total population and 1.17% of total railway route kilometers in India. In other words, the major states together reflect the major features of the railroad system of India.

It is possible to discern from the data in **Table-II** that the railroad system has been more prone to servicing the existing population concentration than the land areas as such. Such a conclusion is further confirmed from **Table-III.** In this table we are presenting coefficient of concentration between any two variables and for every variable, viz., area, population, agricultural income, income from manufacturing, total income, and railway route-kilometers as these are proportionately distributed between the states. We may recollect that such ratios approach zero when any pair of variables get distributed between tracts in identical proportions. It approaches one when their distribution becomes highly disproportion to each other. Keeping this in mind, we may examine the relationship between railroad system and the diverse facts of the regional economy of India.

We may note that the coefficient of concentration between route kilometer and total area is of the order of 0.226. But that between route-kilometer and population is of the order of 0.128 only. This means that the railroad system has developed more proportionately with the pattern of regional distribution of population than with area. Then we find that this ratio between total income and agricultural income is of the order of 0.051. This means that regional levels of economic development are defined primarily by the state of agriculture in India. Again, we find that this ratio between population and agricultural income is of the order of 0.081, indicating that the regional levels of agricultural income is defined primarily by the state of population concentration in India. Since concentration of population in terms of area is of significant order, it is not surprising that the regional levels of the economy, given by both agricultural income and total economy, are also significantly concentrated in terms of area and not so much in terms of either population or railway route kilometers. It is, however, important to note that the levels of regional economy in terms of income from manufacturing appear to be significantly concentrated in terms of area, population and railway route kilometers. That it is also concentrated in terms of agricultural income and less so in terms of total income merely suggests that agriculture and manufacturing act as substitute sectors over the states. If a state has a high share in manufacturing then it has a low share in agricultural income and vice versa. Set against such a state of affairs, a significantly high coefficient of concentration between income from manufacturing and railway route kilometers may indicate that this economic sector is getting proportionately less serviced than the agricultural sector. This is an important dimension of the relationship between the railroad system and the structure of the regional economy of India, which deserves closer analysis.

The relative under-servicing of the centres of manufacturing by the Indian railroad system may not be seen in too narrow a term. One need not, for example, presume that the failure of the Indian economy to generate satisfactory growth in the manufacturing sector is due to such lapses of the Indian railways. In fact, there are enough indications that the Indian railroad system is increasingly carrying greater volumes of cargo over the plan periods and that the major centres of manufacturing are getting increasing quantum of services through more intensive use of the railway tracks in and around such places. But it is also a fact that the rate of growth of production and the volume of commodity movement within the Indian economy has been higher than what the railroad system has so far succeeded to capture. This can be clearly seen from **Table-IV**, where the coefficients of railway transport for selected industrial and agricultural goods have been computed for the period between 1950-51 and 1976-77. During this period, production increased and so also increased the volume of cargo handled by the railways, yet the railway transport coefficient consistently decreased for industrial goods, both in the shape of raw materials and also in the form of manufactured goods. Decidedly, the situation provides a useful angle of study on the nature of interaction between railroad system and the regional economy of India.

The decline of railway transport coefficient really means that other modes of transport are becoming increasingly important in India. The importance of non-railway transport in the economy is indicated in **Table-IV** itsef. Since the transport coefficient is a percentage ratio between cargo-handled and production within India, therefore, all values more than 100 indicate import of those goods from beyond the boundaries of India. For example, iron and steel as raw materials and fertilizer as finished goods came from overseas. The point to note here is that the Indian railroad system has developed contacts with other forms of transport and the observed lag of the railways to catch up with growth in the economy has permitted the other forms of transport to grow in importance over time. This is discernible from **Table-V** where the relative shares of railways and roadways in goods and passenger movement in India have been computed for the period between 1950-51 and 1976-77. If we presume that the circulation of goods and passenger are both increasing in the urban and manufacturing centres at faster rates than in rural areas, the **Table-V** will be found to be corroborating all the observations that we have earlier made on **Table III and IV.**

One need not necessarily believe that the roadways are competing with the railways in this regard. Quite possibly, the road-network system may be found to be snugly nested within the rail-network system. To what extent this has really happened, becomes an important area of enquiry. This is a necessary area for deeper investigation, since options must be worked out between diverse forms of transport with a view to obtaining the most desirable spatial structure of complementarity between rail-road-river transport systems. Viewed in this manner, the questions related to optimum spatial structure of national transport system will require careful evaluation from the researchers.

There are many other issues related to the size of the railroad system which deserve research-investment. Most of these issues will emerge as research-studies progress on the topics that we have noted above. However, there is one important issue that deserves to be mentioned especially. This concerns the system of zonal-management of the railway net-work that we have adopted in India since Independence. At present there are nine zones into which the Indian railroad system has been divided for management purposes, where each zonal office enjoys some autonomy of decision making. There are obvious reasons for amalgamating the diverse privately held and regionally operating railroad systems into a well structured system for conducting regional operations. The point to examine is whether the zones as delineated at present have been the most effective units for attaining management efficiency.

Now, management efficiency is indeed a tricky measurement, especially when the researcher is not a part of the railway organisation itself. Such measurements are better done within the organisation, since there the imperatives of technology under use are more easily understood, up to a point at least. For example, the several indices of performance-efficiency of the Indian railways are given in **Table-VI** cannot be readily interpreted, unless one knows the imperatives of technology as these restrain full utilisation of route capacity, on the one hand, and of rolling-stock capacity, on the other. The questions of signalling, safety-margins, track, inventory, etc. obviously fix certain limits within which optimisation problems are to be solved. These are indeed important questions and deserve attention of the management specialists who are prepared to work in collaboration with the railway organisations.

There is, however, a much broader issue, concerning measurement of management efficiency, which is better handled by the experts located outside the railway organisation. Here we are concerned to see whether the partitioning of the territory of India into several railway administrative zones has been the best that could be obtained, given the inter-regional pattern of commodity movement. That this is a pertinent question becomes clear from **Table-VI** itself. For example, the index of wagon turn around time between 1950-51 and 1975-76 is consistently increasing. Coupled with this, the percentage of loaded wagon-kms to total wagon-km is consistently decreasing. This really means that the wagons are travelling greater distances for longer time and are partly coming back empty. Since inter-organisational information system is bound to be less effective than that obtaining within a single organisation, one may consider it pertinent to re-examine the existing boundaries of the railway zones to provide opportunities for reducing turn round time and for increasing the use of wagon capacities. Certainly, the need for a policy for redelineation of the zones is inherent in such studies and the social scientists can help by enlightening the people with their findings on the reality.

The role of the social scientists then would be to study the zonal management of the Indian railways against the peculiarities of the corresponding regional economics. In other words, the variety that the economy of a railway region (co-terminus with railway zones) entails, needs elaboration. Such studies will help everybody to appreciate that the economy of India over the regions does not describe any isoteric surface. The variations have been modelled by the geographical distribution of resources and landscape and also by the history of evolution of an integrated national economy, which have, in turn, required every zonal railway to arrange its specialised activities **ad variance** with the others.

To appreciate the above situation as an attribute of the process of integration in the diverse regional economies, we are to see whether the Indian railways primarily sub-serve the regional or the metropolitan economy. To what extent inter-regional (inter-zonal) commodity movements are confined within contiguous regions, also becomes a pertinent area of enquiry. We may also wish to see the special role played by the railways vis-a-vis the metropolitan cities in defining the inter-regional exchange of goods and services. There are evidences available from the data on station to station movement of commodities that a major part of the railways activities in this regard concerns the servicing of the cities and towns rather than the rural areas. These cities and towns, in turn, tend to describe a hierarchical disposition between themselves with the million class metropolitan cities sitting on the appex. If all these evidences suggest that the railways are preferentially imparting a power of dominance upon the metropolitan cities, then should we not consider it rather legitimate to partition the country for railway administration in accordance with the supporting spatial bases of the metropolitan cities than retain the present arrangement in this regard ?

Issues related to the processes of economic development:

It is obvious that many of the questions raised above cannot be effectively handled unless one appreciates the relationship between the railroad system and the processes of economic development as has been emerging in India. It is true that the results of enquiries on many of the topics identified above will produce substantial degree of understanding about this relationship. For example, a fuller analysis of the substantive meaning of **Tables II and III** will produce useful descriptions of the regional situation of Indian economic development. But, to judge whether or not such regional differentia are desirable, unavoidable, amendable, or otherwise, one requires a broader frame of analysis. The emergence of an integrated national economy in response to the rules of free-market mechanisms must necessarily produce the conditions for the re-structuring of diverse regional economies and can obtain it in many different ways. The differential levels of development of the regional economies observed over a relatively short period of time must therefore require us to interpret the situation in order to ascertain whether or not these are symptomatic of the process of emergence of an integrated national economy that has been operating over a longer time. Such a perspective is particularly necessary on the ground that the railroad system was introduced into India in the mid-nineteenth century with the ostensible intention of obtaining an integration of the diverse resource bases and the economies based on these. The Dalhousie memorandum before the British Parliament bears eloquent testimony to such purposes. The point to see is to what extent and through what mechanisms have the Indian railroads steered such a process.

The way the problem has deen formulated above may permit the researchers to choose between a long-range or a short-range view of the situation. The nature of the available data in this regard, which are qualitatively different over the periods, may not permit the scholars to use the same methodology to uncover the story for all the periods with equal proficiency. In many instances, specially for long-range reviews, the analysis will have to depend on circumstantial evidences, as more direct evidences will be available in lesser quantities as we go back into the earlier periods of railroad development. But, for the more recent periods, data base is rich enough to provide a relatively more comprehensive statement on the relationship between the railroad systems and the processes of economic development in India. Keeping this in mind, we may now search for the questions that will reveal the situation meaningfully.

In **Table-VII** we are presenting the index-numbers on some selected variables for selected years between 1950-51 and 1975-76 to provide a general understanding on the relationship between the railroad system and the state of the economy of India. The variables chosen are by no means exhaustive. But these are sufficiently potent for formulating the course of future enquiries in this regard.

We may notice that during this period the real-income has been falling relative to population growth. Since the index number of national income (per capita) refer to 1950–51 as base with 1960–61 prices, the real fall over these 25 years may be more palpable than what is indicated in this table. We may then notice that the movements of both passengers by numbers and goods by quantities have increased during this period at rates faster than that of population. This only means that the intensity of circulation of men and materials have increased within the given economy. This is further substantiated by the rate of growth of production in the sectors of agriculture, mining and manufacture. But the rates of growth in mining and manufacture have been higher than that in agriculture. This becomes a significant information if we remember that some three quarters of our labour force is engaged in agriculture.

Both manufacturing and mining are related to urban economies. Considering that the rate of growth of goods movement in terms of net tonne kilometers has been comparable to the rates of growth of manufacture and mining, we may assume that such production centres are getting assistance from the railroad system in order to extend their economic power over larger territories. In other words, the process of integration of the national economy is being obtained through manufacture and mining whatever may have been the level so far achieved. In this connection, we may notice that the rate of growth of workers in the combined sector of manufacture and mining has not been significantly higher than that of population. This fact, when interpreted with the rates of growth of production in manufacture and mining, will only indicate that productivity of labour in these sectors has been increasing at significant rates. This is a significant attribute of the process of integration of the territorial economies that is now obtaining in India.

However, we may notice in this regard that the rate of growth of passenger kilometers has been significantly less than that in tonne killometers in goods. This means that the economic advantages inherent in the given process of integration of the national economy has not produced the opportunities for commensurate participation of the people of diverse regions. The resources other than labour have been more mobile during this period. Scholars interested in studying the patterns of emerging inter-regional disparity in the levels of economic development may very well pursue this enquiry. But, our present interest is to examine how this process of development has influenced the functioning of the Indian railroad system.

From Table-VIII we may notice that the Indian railroad system is being increasedly used as bulk carriers. Both in terms of weight and earnings, the shares of the bulk commodities in total originating traffic are increasing over the years. These bulk commodities are coal, iron and steel, ores, stones, cement, fertilizer, foodgrains and mineral oil. That this is a part of a general policy is given by the fact that these bulk commodities are not the best revenue earners for the railways.

In **Table-IX**, a more comprehensive picture of this discriminating policy is available. It shows that the shares of railway's earnings from the transhipment of coal, mineral oil, iron-ore, iron and steel, fertilizer and cement have been conspicuously increasing over this period. These commodities, for production, for consumption or for both, are related to the larger urban centres. In contrast, the relative shares of earnings from the transhipment of sugar and salt, whose consumption is related to a broader population base, have remained more or less unchanged. We may, therefore, suspect that the abovementioned policy has been purposively designed to facilitate the growth of the economy based on larger urban centres and in distinct preference against the economy of the small urban and the rural areas. Such an assumption is further corroborated by the fact of relative decline of the shares of foodgrains and oilseeds in the railway's earnings as seen from **Table-IX.**

The effects of such a policy oriented developmental process upon the Indian railroad system have been varied indeed. We wish to select one interesting aspect of the spatial orientation of commodity-movement that has presumably originated from such a policy prescription. Needless to mention that the phenomenon is very difficult to describe and requires very careful selection of the indicators. Just to initiate an enquiry, we are selecting some indicators to show the nature of concentration of economic activities that is obtaining over the national territory during the period under review.

In 1965–66, a tonne of goods used to travel over a distance of 611 killometers on the average. This figure refers to revenue earning goods movement only. The average leads for some export oriented goods like iron-ore and manganese were 513 and 664 kilometers respectively. Import dependent mineral oil travelled over an average distance of 598 kilometers during the same year. The closeness of these figures with that for total revenue earning traffic is indeed suggestive of the fact of our dependence on export economy. Coming to the industrial goods produced within the country, we may notice a different spatial orientation of commodity movement. We may find that the raw materials for steel plants moved in 1965–66 over an average distance of 192 kilometers. But the finished products from the steel plants moved on an average over a distance of 821 kilometers. This means that the production base is proximately located in terms of raw materials, whereas the markets for the products are scattered over a larger area. But, the average lead of cement in the same year was only 456 kilometers. This only means that construction activity was less widespread than the market for iron and steel. These two sets of information together mean that the manufacturing activity was highly concentrated although its market was relatively widespread. The average lead for coal being 571 kilometers in the same year, more or less conforms with this observation. We may incidentally mention that average lead for foodgrains and fertilizers were 808 and 752 kilometers respectively.

The situation described above can be better appreciated if we review the trend as obtaining between 1950–51 and 1975–76. In **Table–X** the necessary statistics in this regard have been presented. It shows that the spatial distances between the centres of production and consumption with regard to coal, raw materials for steel plants and mineral oil have remained practically unchanged during this period. It has considerably declined with regards to manganese for export. In all other commodities, such distances have significantly increased. Excluding the case of iron-ore for export, phenomenal changes have taken place with cement, iron and steel, foodgrains and fertilizers.

Such increments of average lead merely suggest that during this period the locations of activities related to the production of these goods have remained confined in small areas while their markets have increased in spatial size. If we accept this as a symptom of the process of emergence of an integrated metropolitan economy, then we may see how complimentary has been the participation of the Indian railroad system in it.

We may incidentally mention that the Indian railroad system has been used in similar fashion and perhaps to meet similar goals over the last one hundred years. This is verifiable from **Table-XI**, where the average distance travelled by passenger and tonne of goods for the period between 1885 and 1960 have been presented. This shows that throughout this period materials moved over longer distances than the labour did. It also shows that the average lead per passenger decreased as that for materials increased over time. In other words the emergence of metropolitan economic centres has been consistently promoted by the Indian railroad system since its inception.

Given the perspective as noted above, it is certainly worthwhile to examine the history of railroad development as it has influenced the structure or the organisation of the territorial economy of India. The growth and development of the urban system of India vis-a-vis its supporting economic base can thus be properly mapped, which may provide a more meaningful understanding of the part played by the Indian railroad system therein. Needless to mention that the structure of the territorial economy that has developed overtime is likely to hold itself for many years to come, unless changes are induced through policies. In order to effectively implement such changes through policies one must accept the Indian railroad system as an important instrument. The social-science researches may help in this regard by studying the system in its historical and geographical dimensions.

Issues concerning policy instrumentation :

In order to use the railroads to fructify the policy objectives, one must appreciate how the system is capable of responding to these without violating the imperatives of its own technology and also that of the regional and/or national economy. For example, the objective of full capacity utilisation of the regional infrastructure of the railways must be matched by commensurate policy changes on railway-inventory. Without matching these two, either objective will remain unfulfilled or create situations of breakdown of the system. Then, the need for capacity utilisation must be commensurate to needs of economic growth in those regions. Necessarily, answers to the questions related to the desirable ways of capital formation within the railways and also within these regions are to be obtained. Scholars prone to retrospection may find these questions interesting to pursue and may rewardingly find out how these were resolved in the different periods of railroad-history in India. Closer examination of the situation over the more recent decades is also desirable to obtain better understanding of the legitimacy of the past policy-prescriptions made in this regard.

It is true that an organisation after having established its roots within the social milieu becomes amenable to change through regulations of rates and tariffs. Enquiry into these rates and tariffs, as these have affected changes in the economy in the past, are worthy of enquiry. The insight to be so derived would help us appreciate the problems raised in the earlier para. One may, thereby ponder whether the increase in commuter's fare with regard to large metropolitan cities, for example, are to be seen merely as an instrument for increasing revenue of the railways or as a force to demand higher investment on housing, transport and conservancy-services within the inner city. Similarly, one may ask what tariff policy can sustain spread of manufacturing activity over larger regions and how discriminating must the policy be with regard to commodities and regions. While reviewing these issues, one may not forget the kind of impact it will necessarily have upon the railways as an organisation.

It is possile to quotc umpteen number of issues for which research fundings can be legitimate. We need not continue such a game any further in this paper. Such games are useful only when one is assured that there is a general willingness to see that the railroad system in India can be made to perform a more effective role in bringing about economic development of the country through desirable processes.

Table I : Size of Railroad Systems of Selected Countries
(Ranked by size of territory)

Country	Per Capita Income in Rs. (1976)	Route kms 1975-76 Per million persons (1976)	Route kms 1975-76 Per 10-thousand Square Kilometers (1976)
1	2	3	4
1. USSR	2380	539	62
2. China	300	41	38
3. Canada	7340	3076	77
4. USA	6995	2506	591
5. India	139	99	204
6. Algeria	291	228	17
7. Mexico	1130	399	126
8. Egypt	263	118	45
9. Zambia	391	228	16
10. Burma	74	100	47
11. Pakistan	179	76	70
12. France	5860	658	638
13. Japan	4478	187	569
14. Malayasia	718*	148	55
15. Sweden	8044	1473	295
16. German FR(W)	6451	468	1180
17. Ghana	394	92	41
18. UK	3530	324	749
19. Sri Lanka	214	116	246

Rank Correlation Coefficient :

Columns	(1) & (2)	-0.06	Columns	(2) & (3)	0.84
Columns	(1) & (3)	0.13	Columns	(2) & (4)	0.55
Columns	(1) & (4)	-0.38	Columns	(3) & (4)	0.52

Table II : Size of Railroad System of the Major States of India

States	Route — Kilometers Per million persons (1975-76)	Route — Kilometers Per 10 thousand Square Kilometers	Per Capita Income (Rs.) (1973-74)
1	2	3	4
1. Uttar Pardesh	90	2.9	726
2. Bihar	84	3.0	604
3. Maharashtra	93	1.7	1080
4. West Bengal	76	4.3	910
5. Andhra Pradesh	99	1.7	808
6. Madhya Pradesh	118	1.3	720
7. Tamil Nadu	83	2.9	870
8. Karnataka	86	1.5	704
9. Gujarat	187	2.9	1034
10. Rajasthan	194	1.6	780
11. Orissa	80	1.3	690
12. Kerala	37	2.3	785
13. Assam	126	2.8	614
14. Punjab	142	4.3	1386
15. Haryana	125	3.2	1168

Source for Column (4) : Central Statistical Organisation. Ministry of Planning, Government of India, **National Accounts Statistics**, 1960-61 - 1974-75, October, 1976.

Table III : Coefficient of Concentration

Variables	Area	Population	Agricultural Income	Income from Manufacturing	Total income	Railway Route km.
Area	0.000	0.252	0.271	0.318	0.249	0.226
Population	0.252	0.000	0.082	0.235	0.102	0.128
Agricultural Income	0.271	0.082	0.000	0.268	0.051	0.134
Income from Manufacturing	0.318	0.235	0.268	0.000	0.152	0.272
Total Income	0.249	0.102	0.051	0.152	0.000	0.160
Railway route km.	0.226	0.128	0.134	0.272	0.160	0.000

N.B. Income relates to 1973-74 situation
Population relates to 1971 situation
Route km relates to 1976 situation

Table IV : Railroad Transport Coefficient

Year	Coal	Iron & Steel	Iron ore	Cement	Fetilizer	Sugar	Oil seeds	Food-grains
1	2	3	4	5	6	7	8	9
1950–51	94.2	146.3	82.3	89.0	N. A.	92.5	30.4	14.5
1955–56	92.4	126.6	80.0	84.8	911.1	77.5	30.9	13.4
1960–61	90.8	138.3	95.7	82.0	926.7	55.2	21.7	15.4
1965–66	94.9	126.2	97.7	79.9	720.6	45.4	23.0	20.1
1968–69	73.5	127.3	97.8	77.4	662.7	28.0	19.9	16.9
1973–74	75.9	N.A.	56.4	68.2	385.5	34.9	11.5	14.0
1974–75	77.5	N.A.	58.2	53.4	396.0	32.8	12.7	13.7
1975–76	78.4	N.A.	60.7	61.7	385.5	47.9	11.5	13.4
1976–77	78.5	N.A.	N.A.	71.4	335.3	N.A.	N.A.	17.9

N.B. Transport Coefficient $= \left(\dfrac{\text{Quantity moved by Railways}}{\text{Quantity Produced in India}} \right) \times 100$

N.A. = not available.

Source : Railway Tariff Commission, 1978.

Table V : Relative Growth of Railways & Roadways as means of transport in India

Year	Volume of movement *			Percentage share of	
	Railways	Roadways	Total	Railways	Roadways
Cargo					
1950—51	44	6	50	80	12
1960—61	88	17	105	84	16
1965—66	117	34	151	77	23
1973—74	122	67	189	67	33
1976—77	157	67	233	67	33
Passenger					
1950—51	67	23	90	74	26
1960—61	78	57	135	58	42
1965—66	96	82	178	54	46
1973—74	136	211	347	39	61
1976—77	164	261	425	39	61

* Goods = 10^9 tonne kilometers
Passenger = 10^9 passenger kilometers
Source : Railway Tariff Commission, 1978.

Table VI : Selected Indicators of Performance-efficiency of the Indian Railways

Indicator	Base function 1950-51	Index 100 — 1950-51 year 1950-51	1955-56	1960-61	1965-66	1970-71	1975-76	Remarks
Engine-kms per engine-day on hire	122	100	111	112	116	127	135	Broad Gauge
	119	100	104	100	108	111	112	Meter Gauge
Net Tonne-kms per goods-engine hour	3283	100	106	127	135	150	170	Broad Gauge
	1238	100	121	143	177	204	229	Meter Gauge
Wagon-kms per Wagon-day	62.3	100	121	123	118	118	123	Broad Gauge
	50.2	100	91	103	120	116	112	Meter Gauge
Wagon turn round by days	11.0	100	96	102	108	121	123	Broad Gauge
Percentage of Loaded wagon-kms	69.2	100	104	111	99	103	98	Broad Gauge
to total wagon-kms	76.2	100	103	97	95	97	93	Meter Gauge
Passenger-kms per route km(000)	1765	100	92	115	135	163	208	Broad Gauge
	853	100	91	104	125	146	164	Meter Gauge

Source : Railway Tariff Commission, New Delhi, 1978.

Table VII : State of Economy & Work-load upon Railroad System

(Index Base — 1950-51)

Year	Population	No. of Industrial workers	Industrial Production	Agricultural Production	Mineral Production	National Income	Railway Freight Traffic		Railway Passenger Traffic	
							Origination Tonnes	Tonne Kilometers	Originating	Passenegr Kilometers
1	2	3	4	5	6	7	8	9	10	11
1950–51	100	100	100	100	100	100	100	100	100	100
1955–56	107	106	143	122	120	109	125	135	99	94
1960–61	119	126	183	149	152	121	168	199	124	117
1965–66	134	155	281	139	210	123	218	265	162	145
1970–71	153	155 *	330	191	265	140	211	289	189	178
1975–76	169	183 **	395	216	341	145	240	336	229	224

N.B. Column (2) — Mid-year estimate
Column (3) — Includes workers in Factories & Rivers : * 1969–70. ** 1974–75
Columns (4), (5) & (6) - Calendar years
Column (7) - at 1960–61 prices
Columns (8), (9), (10) & (11) - accounting years

Source : Railway Tariff Commission, 1978

Table VIII : Share of Bulk Commodity in Total Originating Traffic

(in ratio percentam)

Years	Tonnage	Earning
1950-51	58.2	45.0
1960-61	72.8	59.0
1965-66	77.0	64.2
1973-74	80.6	68.2
1976-77	83.6	73.7

Table IX : Relative Share of Earnings through Movement of Major Bulk Commodities

(Total Earning from all commodities 100%)

Commodity	Years					
	1950-51	1955-56	1960-61	1965-66	1970-71	1975-76
1	2	3	4	5	6	7
Foodgrains	9.8	10.3	10.3	8.8	8.9	7.8
Oil seeds	2.7	2.2	1.9	1.4	1.0	1.0
Sugar	1.9	2.2	2.3	1.7	1.1	1.7
Salt	2.2	2.1	2.0	2.1	2.2	2.1
Manganese Ore	1.1	1.3	1.0	0.7	0.6	0.5
Iron Ore	0.8	2.1	4.3	5.4	7.4	7.7
Mineral Oils	N.A.	7.2	6.2	7.3	7.7	7.9
Coal	11.3	12.1	15.8	17.4	17.5	22.4
Iron & Steel	6.6	7.1	11.3	13.0	11.8	10.8
Cement	2.5	3.3	4.2	4.5	6.5	6.6
Fertilizer	0.7	0.8	1.1	1.7	3.3	4.8
Other Commodities	60.4	49 3	39.6	36.0	32.0	26.8
Total Earning from all Commodity in Rs. Crores	139.30	177.16	279.90	452.35	600.67	1095.74

Source : Railway Tariff Commission, 1978

N. A. = not available

Table X : Average distance travelled by one tonne of goods
(Index 100 – 1965-66)

Commodity	1950–51	1955–56	1960–61	1965–66	1970-71	1975–76
1	2	3	4	5	6	7
Coal	98	100	116	100	102	102
Raw materials for Steel Plant	–	–	98	100	88	104
Finished goods from Steel Plant	–	–	106	100	121	122
Iron Ore for export	–	–	–	100	109	124
Manganese Ore for export	-	–	–	100	69	84
Mineral Oils	–	–	91	100	99	101
Cement	–	–	82	100	139	163
Fertilizers	–	–	–	100	108	114
Food Growers	63	75	94	100	119	118
Total Traffic	–	90	99	100	108	112

Source : Railway Tariff Commission, 1978

Table XI : Average distance (Km) travelled per Passenger & per tonne of goods

	Year	Passenger distance	Goods distance
0	1885	72.02	272.69
0	1890	67.55	260.60
0	1895	64.78	236.10
0	1900	62.95	254.67
0	1905	63.50	269.52
*	1910	71.39	344.92
*	1915	58.51	341.47
*	1920	59.30	352.62
*	1925	55.14	406.35
*	1930	57.40	393.24
*	1935	57.56	396.28
*	1940	56.70	438.50
*	1945	61.32	461.67
*	1950	51.33	462.41
*	1955	49.05	505.93
*	1960	48.02	557.39

N.B. : 0 Calender Year; * = financial year.
Source : History of Indian Railways, corrected up to March 31, 1964, Railway Board, New Delhi.

Address of the author
Prof. S. C. Chakraborty, Professor of Regional Development, Indian Institute of Management, Calcutta,