

A Review of Goods Earnings of Indian Railways from Freight Operations

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Abstract

Indian Railways worthy of the tagline 'lifeline of the nation,' is resorted to by the common man for subsidized travel and by traders to haul their produce to various destinations. Being one of the largest transporters in the globe, the funds invested in infrastructure are also enormous. This heavy capital expenditure ought to be justified by the revenue generated from carrying passengers known as coaching earnings and hauling goods known as goods earnings. An analysis of revenue generated from carrying different classes of commodities over the railways can shed light on whether the gigantic proportion of capital expenditure is covered by earnings from freight operations.

A study is done on the revenue generated over the past few years which will project the trend exhibited by prominent commodities being carried by Indian Railways over its entire network. The trend of each class of commodity will bring forth which class the railways earn more and which needs to be given attention to enhance its revenue.

Keywords: Subsidy, Trading public, Coaching earnings, Freight operations, Class of commodity.

Introduction

Indian Railways (IR) plays a crucial role in the process of nation-building. Indian Railways possess a network of 1,28,305 track kilometres along the length and breadth of India. The tracks are occupied by a total of 22,593 trains running daily, which comprise 13,169 passenger trains and 9,141 freight trains. Besides, passenger traffic, Indian Railway caters to the needs of a wide network of businessmen, traders and consignors providing a means to transport their commodities or produce across the nation. Hence, the railway bridges the gap between production centres and ultimate consumers.

Indian Railways thrives to provide world-class facilities to all its customers and trading people whether it is through transportation or auxiliary services. The endeavour of the railways has gained momentum with more and more people availing the services of railways. Despite, the cut-throat competition faced by this transportation giant from roadways and airline companies' strategic moves and efficient management railways contribute in mammoth proportion to the exchequer of the nation. Being one of the largest transporters in the globe, the funds invested in infrastructure are also enormous. This heavy capital expenditure ought to be justified by the revenue generated from carrying passengers known as coaching earnings and hauling goods known as goods earnings.

Freight operations enable the carriage of essential commodities like food grains and sugar for the Public Distribution System through the intermediary called the Food Corporation of India. Consequently, a seamless flow of commodities for daily consumption is ensured by railways. The importance of freight traffic is proved beyond any doubt when all the above-mentioned services and affordable tariffs are provided to the common man.

Objectives of the Study

This research paper is primarily focused on earnings by transshipment of goods by Indian railways from freight operations. The major objectives of the study are:

To understand the various sources of revenue for Indian Railways from goods earnings with special reference to Southern Railway.

To study the significant parameters and benchmarks in the computation of revenue from goods movement for Southern Railway.

To analyse the earnings from each class of commodities in freight operations.

To examine the effect of the class of commodities in revenue generation concerning freight operations.

Hypotheses

Ho1- Quantity carried does not significantly enhance the revenue earned by Southern Railway from freight operations.

Ho2- Throughout the study, there is no significant increase in revenue earned by Southern Railway from freight operations.

Ho3- All commodities contribute equally to the total revenue earned by railways

Indian Railways - An Overview

Indian railways have attained the cliché 'Lifeline of the Nation' since the first train on 16th April 1853 ran in Bombay. The idea of railways was first conceived by Mr. George Clark, the Chief Engineer of Bombay Govt. during his visit to Bhandup in 1843. The idea was to connect Bombay with Thane, and Kalyan with

the Thal and Bhor ghat inclines. Indian Railway fills up the lacuna by making the North, East, West and South meet. This is made possible by thousands of track kilometres across the nation like blood vessels in the human body. Despite, the dwindling Cost Recovery Rate, railways kept in abeyance hikes in rates and tariffs. The passenger fare of Indian Railways is the lowest in the world.

Indian Railways play a pivotal role in the process of nation building also. The expenditure incurred by railways in laying tracks, bridges, constructing buildings, manufacturing locomotives, coaches, and wagons, and of course provision of passenger amenities emerges in leaps and bounds but the fare and rates to passengers and tradesmen are kept low. A common man can travel at affordable fares and tradesmen can transact business with reduced investment in the transportation of their produce.

Indian Railways has also played a key role in the promotion of tourism. With its feeder organisation known as the Indian Railway Catering and Tourism Corporation (IRCTC) the railways provide exclusive opportunity to passengers to book a ticket whereby they can avail all facilities like boarding, hotel, food, sight- seeing and travel in a single consolidated payment.

Several subsidiaries of Indian Railways either established as autonomous bodies or Public Sector Undertakings like:

CRIS- Centre for Railway Information System

CONCOR- Container Corporation of India

RITES- Rail India Technical and Economic Services Ltd.

IRCON- Indian Railway Construction Company Ltd.

KRCL- Konkan Railway Corporation Ltd.

RailTel- RailTel Corporation of India Ltd.

IRWO- Indian Railway Welfare Organisation,
cater to technical and administrative aspects of railways.

Indian Railways has profusely applied IT and ITES and the most modern technology in all its operations ranging from signalling, locomotives, ticketing, production units and workshops, transportation etc to ensure hassle-free services to the public.

Review of Literature

Loveleen Gupta (2021) observed that on the freight front, the maximum growth in net tons per kilometre was observed in North Western Railway (161.29 per cent) followed by South East Railway (136.54 per cent) and South Western Railway (124.55 per cent). This again confirmed a relatively higher growth in newly bifurcated zones than in the parent zones.

Bernard Aritua (2019) examined the relationship between logistics performance and the economic performance of countries. The study shows that the logistics performance and economic performance of countries are correlated. That is countries that score high on the Logistics Performance Index have higher income per capita. As a result, improvement in logistics including the critical role of railways is therefore treated as an important development issue.

Saruchera F. (2017) specified that different types of wagons can be used to carry various types of cargo, even dangerous goods can be carried using a particular wagon. The researcher, further stated that wagons can be classified as flat rail cars, refrigerated wagons, tank rail cars, gondola rail cars, livestock rail cars, etc. From this, it is understood that with an increased choice of wagons, the rail can carry different types of cargo.

Juliet Madubanya (2016) claimed that rail freight transportation is a business venture, which is extensively capital intensive, with a high percentage of fixed total costs. She further observed that the declining tonnages transported have led to a loss of revenue and underutilization of resources.

McKinnon (2015) opined in a research study that freight transport is a viable and vital activity for economic growth. However, he also stressed owing to the rarity of freight transport studies, especially at the macro level the situation is rather bleak in many developing countries. The research further stressed that performance needs to be improved.

Jackson R., Matsika E. et al. (2013) through research suggested that rail freight transport operators must take on new tracking and tracing solutions that work beyond the mere tracking of trains by the infrastructure manager and which involve tracking of goods themselves.

Gray, J. (2013) outlined in his research that longer trains are significant for the efficiency of freight railroads within the United States. Likewise, China and India have remarkably fewer track-km than the United States.

Arne Beck, Heiner Bente & Martin Schilling (2013) suggested that attention should be provided to rolling stock assets on the most used routes to improve utilization, as higher ridership can be anticipated on these routes. Fuller trains denote higher utilisation of rolling stock. This is useful for efficiency and railway revenue.

Arne Beck, Heiner Bente & Martin Schilling (2013) also observed that optimizing the network by selling off or decommissioning tracks that are seldom used will decrease maintenance and avoid costs.

Jitsuzumi, T. and Nakamura A., Charnes A., Cooper, W.W., Rhodes, E. (2010) asserted that the productive efficiency of railways is influenced by factors that are beyond the managerial control namely terrain (topography) and climate of the place, the advancement of other transportation modes, the volume of traffic, average load, average distance of haul, stage of the economic development stage of the nation, etc.

Wetzel, H. (2008) found in his study that technology enhancements were by far the foremost critical driver in proficiency improvements on European railways between 1990 and 2005, a period during which many deregulation activities took place.

Research Methodology & Design

Various statistical tools have been utilised for analysing the objectives outlined. To achieve the first s, a broad review of the past studies and expert committee reports on the performance of Indian Railways has been reviewed and presented. The second objective of the study was to examine the prominent parameters and yardsticks in the computation of revenue from freight movement. This is achieved by the detailed review of various research papers and publications which largely satisfy the objectives and outcomes. The third and fourth objectives are freight operations and revenue generation which was achieved by mean, standard deviation and t statistic.

For obtaining statistical inferences, three hypotheses were framed. These framed hypotheses were tested using appropriate and suitable statistical assessments.

Data Source: This study examines the freight operations and revenue generated by Indian Railways over time with special reference to Southern Railway. The data has been sourced from various published sources. The relevant data were taken from Annual Statistical Statements of Indian Railways, Year Book, and Annual Reports of the Railways, Government of India, New Delhi, Economic Survey Reports, Indian Statistical Abstracts and Statistical Abstracts published by the Directorate of Economics and Statistics.

Scope of the Study: The present study aims at a detailed analysis of the overall Railways' performance in freight operations for the period 2010-11 to 2021-22. The scope of the study is limited to the commodities that were shipped through wagons of Indian Railways which operates in the southern zone of Indian Railways. The commodities considered for this study include Coal, Fertilisers, Iron Ore, Cement, Mineral Oil, Food Grains, Pig Iron and Finished Steel.

Significance of the Study: An abundant amount of research has been carried out so far on the efficiency of railways at the international level. However inadequate research studies were conducted on the efficiency of Indian Railways over a period, especially in connection with freight operations and revenue generation.

Limitations of the Study

The various limitations of the study are.

The study is confined only to one zone of the Indian Railway i.e., the Southern Railway. So, the results obtained through this research have only limited applicability to other zones on the Indian Railway.

The study has considered the data of commodities and revenue only for twelve (12) years of Southern Railway.

This research has been limited to only five (5) principal commodities namely Coal, Iron Ore, Cement, Fertilisers, Food Grains, and Pig Iron and finished Finished Steel.

The study has not examined the role of rolling stock and infrastructure on revenue generation.

Data Analysis & Interpretation

Table 5
1.1 Tons Carried Vs Total Revenue (Closed Wagons)

Year	Tons Carried Vs Total Revenue (Closed Wagon)							
	Tons Carried (Food Grains)	Revenue (In INR) (Food Grains)	Tons Carried (Cement)	Revenue (In INR) (Cement)	Tons Carried (Fertilisers)	Revenue (In INR) (Fertilisers)	Tons Carried (Mineral Oil)	Revenue (Mineral Oil)
2021-22	11,893	58,43,352	7,841	39,34,544	3,890	21,37,767	4,589	22,96,256
2020-21	11,195	55,53,489	5,501	26,22,923	4,983	27,65,295	4,360	19,65,665
2019-20	8,427	41,12,642	4,623	21,99,510	4,363	24,67,453	4,910	24,79,227
2018-19	8,730	44,42,477	5,653	28,01,432	4,037	23,76,683	4,430	27,77,752
2017-18	8,872	46,04,640	5,736	25,70,127	4,070	23,53,406	3,885	26,15,919
2016-17	6,970	40,30,546	5,794	26,59,379	3,653	22,03,324	4,035	24,96,851
2015-16	8,865	49,19,710	7,322	31,96,219	4,502	25,61,481	4,648	26,91,553
2014-15	11,321	53,18,318	10,252	44,75,980	4,664	23,03,537	4,525	25,05,904
2013-14	11,711	50,61,791	10,813	45,44,534	4,155	19,40,957	4,361	22,76,651
2012-13	10,080	4,45,50,46	10,798	5,15,20,05	4,117	1,74,36,02	4,402	2,07,38,45
2011-12	9,571	3,79,03,38	9,571	3,79,03,38	5,647	2,10,14,44	3,794	1,57,99,85
2010-11	7,826	3,02,87,31	8,550	3,15,16,56	4,911	1,72,59,45	3,812	1,43,00,53

Source: Compiled from various sources of annual reports from 2010-11 to 2021-22

The above table depicts the comparison of total tons carried by the Southern Railway through closed wagons and the revenue generated for the 12 years under the study. The analysis of each commodity that is transhipped through closed wagons declares that there is an increase in shipments in tons of foodgrains from 2010-11 (7826 million tons); 2011-12 (9571 million tons) and 2012-13 to 2019-20; 2020-21 and 2021-22. On the contrary, the revenue generated is showing a declining trend over the 12 years taken for the study.

The trend of food grains is also depicted by commodity namely cement in the years 2010-11 (8550 million tons); 2011-12 (9571 million tons) and 2012-13 (10798 million tons), which brings to light that the commodity fared well during the three years. The commensurate revenue also increased over the years. But at the same time, the metrics showed a decline in the year 2019-20 of 1030 million tons and the effect of the same reflected in the revenue earned. Nevertheless, the railways were able to hike the commodity's share to the total share of revenue by 2340 million tons in the year 2021-22.

The quantity of fertilisers reduced drastically to 3890 million tons in the year 2021-22 while the revenue also plummeted to INR 2137767. The noteworthy aspect of fertilisers is that the tons carried and the revenue generated by the commodity followed a consistency during the rest of the period of study i.e., from 2010-11 to 2020-21. The reason for the decline is attributable to an acute shortage of fertilisers.

In the case of mineral oil, a hike in tons carried and respective revenue was observed during the six years from 2010-11 to 2015-16. There occurred a severe decline in the years 2016-17 (4035 million tons) and 2020-21 (4360 million tons). The shortage was to the tune of 613 million tons and 550 million tons as compared to the previous years. But, at the same time, Southern Railway was able to substantially increase the business in mineral oil in the year 2019-20 (4910 million tons), a hike of 480 million tons.

Table 5.1.2

Descriptive Statistics – Revenue from Commodities transhipped in Closed Wagons

Commodities	N	Mean	Std. Deviation
Food Grains	12	4596756.6667	798775.57376
Cement	12	3424887.2500	939613.06117
Fertilisers	12	2223407.8333	315419.05244
Mineral Oil	12	2265805.0833	428455.75517

Source: Authors' computation using SPSS

The above table depicts the revenue generated from commodities transhipped in closed wagons. In descriptive statistics, the computed mean values revealed that the transshipment of foodgrains has influenced the most (M = 4596756.6667) as compared to Cement (M = 3424887.2500), Fertilisers (M = 2223407.8333) and Mineral Oil (M = 2265805.0833). This makes it very clear that the necessity and requirements of foodgrains have increased over the years considered for this study, thus reflected in the revenue gained by Southern Railway.

Table 5.1.3
One-Sample Test: Revenue from Commodities transhipped in Closed Wagons

Commodities	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Food Grains	19.935	11	.000	4596756.66667	4089238.8801	5104274.4532
Cement	12.627	11	.000	3424887.25000	2827885.5931	4021888.9069
Fertilisers	24.419	11	.000	2223407.83333	2023000.1286	2423815.5381
Mineral Oil	18.319	11	.000	2265805.08333	1993577.2841	2538032.8825

Source: Author's computation using SPSS

The one-sample t-test has been applied to understand any significant difference between commodities transhipped through closed wagons and to corresponding revenue generated over the years under the study. The t-tests of various commodities transhipped through closed wagons during time revealed that there exists a significant difference in the revenue generated (Sig. = .000 2-tailed). Revenue from Fertilisers depicts the highest difference (t = 24.419, Sig = .000) followed by Food Grains (t = 19.935, Sig = .000) and Mineral Oil (t = 18.319, Sig = .000). The lowest difference in revenue during the period of study is attributed to Cement (t= 12.627, Sig = .000).

Table 5.2.1
Tons Carried Vs Total Revenue (Open Wagons)

Year	Tons Carried Vs Total Revenue (Open Wagon)					
	Tons Carried (Pig Iron & Finished Steel)	Revenue (In INR) (Pig Iron & Finished Steel)	Tons Carried (Iron Ore)	Revenue (In INR) (Iron Ore)	Tons Carried (Coal)	Revenue (In INR) (Coal)
2021-22	6,186	23,41,211	987	2,06,400	17,931	1,01,07,610
2020-21	5,096	20,33,867	1,920	4,36,458	11,970	70,76,205
2019-20	5,579	23,24,990	731	2,29,162	17,955	1,06,35,471
2018-19	5,692	24,28,896	2,577	6,89,369	20,505	1,12,72,893
2017-18	5,532	22,61,283	1,717	4,52,023	16,965	85,84,089
2016-17	4,617	19,74,933	2,852	7,15,199	18,366	84,05,095
2015-16	3,244	14,07,208	2,472	7,86,642	20,106	95,26,308
2014-15	4,736	18,43,976	3,158	9,43,387	22,210	90,43,476
2013-14	3,831	13,63,284	3,187	7,74,196	25,398	87,21,818
2012-13	3,237	1,13,51,38	3,126	66,79,94	22,144	6,97,91,60
2011-12	3,339	1,10,82,19	2,796	53,38,10	19,554	5,77,80,10
2010-11	2,675	1,03,51,09	2,015	30,10,22	18,754	5,18,06,91

Source: Compiled from various sources of annual reports from 2010-11 to 2021-22

On perusing the table, it is found that the commodity with the description Pig Iron and Finished Steel shows a fluctuating trend during the entire period of study. The tons carried in the year 2015-16 increased to 4,617 million tons in the subsequent year. A whopping 1,373 million tons increase has occurred during that period. The commensurate revenue has also increased to INR 5,67,725 during that period.

It can be observed from the table that the tons carried w.r.t. iron ore shows a steady increase in the years from 2010-11 to 2013-14. But the revenue originating from the quantity carried is exhibiting a declining trend. For instance, the revenue from iron ore increased to the tune of INR 2,32,788 in the year 2011-12 but despite the increase in tons carried, the revenue reduced to INR 1,34,184 in the subsequent year.

In the case of coal, the prominent commodity transported by railways in its network showed a steady climb concerning both tons carried and revenue generated. The increase in quantity and revenue was observed from 2010-11 to 2013-14. Thereafter, the tons carried by railways reduced during the term 2014-15 to 2017-18. Even though the quantity carried plummeted in the years 2014-15 and 2015-16, the revenue earned from the haulage of coal increased to the tune of INR 1,78,994. During the last five years of study, the tons carried and the resultant revenue show a fluctuating trend.

Table 5.2.2

Descriptive Statistics – Revenue from Commodities transhipped in Open Wagons

Commodities	N	Mean	Std. Deviation
Pig Iron & Finished Steel	12	1771509.5000	531291.03803
Iron Ore	12	561305.1667	238529.84676
Coal	12	8442568.8333	1882337.65566

Source: Author's computation using SPSS

The table above represents the revenue earned by railways from transporting commodities that can be carried in open wagons as they are not affected by natural elements like sunlight, snowfall, heat, or rain. When the data was subject to descriptive statistics, it was found that the commodity that (can be carried in open wagons) contributes the most to railways in terms of freight revenue is Coal (M= 8442568.8333) whether the commodity is meant for Finished Steel plants, washeries or thermal powerhouses. The second highest contributor to freight earnings of railways is Pig Iron and finished Steel (M= 1771509.5000) followed by Iron Ore (M= 561305.1667). Further, it can be noted that the contribution made by Iron Ore to revenue stands substantially less as compared to the other two commodities.

Table 5.2.3

One-Sample Test: Revenue from Commodities transhipped in Open Wagons

Commodities	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Pig Iron & Finished Steel	11.551	11	.000	1771509.50000	1433943.2793	2109075.7207
Iron Ore	8.152	11	.000	561305.16667	409750.5325	712859.8008
Coal	15.537	11	.000	8442568.83333	7246588.5456	9638549.1211

Source: Author's computation using SPSS

Like in the case of statistical techniques applied to Closed Wagons, the one-sample t-test is followed to find whether a significant difference exists in the case of commodities carried in open wagons. It has been found that a significant difference (Sig. =.000, 2-tailed) exists in the contribution made by commodities to freight earnings during the twelve years taken for study. The revenue earned from the transportation of Coal shows the highest difference (t= 15.537, Sig. =.000). The second highest difference is attributed to Pig Iron and Finished Steel (t= 11.551, Sig. =.000) followed by the transportation of Iron Ore (t= 8.152, Sig. =.000). It can be inferred on a look at the table that among the commodities that can be transported in open wagons, Coal is the prominent one that contribute the most to the freight earnings of Southern Railway.

The statistical technique namely the Kruskal Wallis test was administered to find out whether there is a significant difference in the contribution made by each of the commodities to the total revenue. As the data do not test the condition of homogeneity, the Kruskal Wallis test was applied which is a non-parametric test.

Test Statistics a, b	
	Revenue
Kruskal-Wallis H	30.294
df	2
Asymp. Sig.	.000
a. Kruskal Wallis Test	
b. Grouping Variable: Commodities transhipped in open wagons	

Test Statistics a, b	
	Revenue
Kruskal-Wallis H	32.404
df	3
Asymp. Sig.	.000
a. Kruskal Wallis Test	
b. Grouping Variable: Commodities transhipped in closed wagons	

There exists a significant difference as the computed H value is 32.404 with the p-value of the test (0.000) is less than 0.05, which makes sufficient evidence that there is a statistically significant difference between the four commodities of shipment by Southern Railway across the four groups namely Foodgrains, Cement, Fertilisers and Mineral Oil.

There exists a significant difference since H value (30.294) and p value of the test is 0.000 which is less than 0.05. The null hypothesis is rejected. So, from the analysis, it is sufficiently evident that there is a statistically significant difference in revenue generated across the three groups of commodities namely Pig Iron and Finished Steel, Iron Ore, and Coal.

Major Findings

The major findings of the study are.

The commodity namely Foodgrains (M=4596756.6667) which need to be transported in closed wagons contributes most to the revenue of the railways.

The least contribution to revenue was made by Fertilisers (M=2223407.8333). Since there was a crisis in fertilizer production and an acute shortage of the same commodity, the revenue earned from transportation also declined.

Another commodity in the class of those transported through closed wagons namely Cement (M=3424887.2500) had made a decent climb in revenue earnings of railways.

Mineral Oil (M=2265805.0833) which needs to be loaded in tanker wagons performed bleakly during the period undertaken for study.

Coal (M=8442568.8333) has been found as the leading revenue-generating commodity among all classes of commodities transported by railways in open wagons.

The commodity namely Pig Iron and Finished Steel (M=1771509.5000) is the second leading contributor to the freight revenue of railways.

The least contribution to the revenue is made by Iron Ore (M=561305.1667) among the commodities carried in open wagons.

There exists a significant difference in the revenue generated by commodities transhipped in closed wagons. The commodities are Foodgrains (t=19.935, Sig. 0.000), Cement (t=12.627, Sig. 0.000), Fertilisers (t=24.419, Sig. 0.000) and Mineral Oil (t=18.319, Sig. 0.000).

There also exists a significant difference in the revenue generated by commodities transhipped in open wagons. They include Pig Iron and Finished Steel (t=11.551, Sig. 0.000), Iron Ore (t=8.152, Sig. 0.000), and Coal (t=15.537, Sig. 0.000).

Suggestions & Managerial Implications

Based on the findings of the study, the suggestions the study can put forth are mentioned below;

Southern Railway may take a keen interest in securing business from major fertilizer manufacturers like FACT in Kerala, Mangalore Chemicals and Fertilisers Limited in Karnataka etc. to enhance the revenue.

Business in transporting Iron Ore needs to be enhanced considering the requirements of the industry in south India.

The railway may provide incentives to agriculturists as the commodity namely Foodgrains is the prominent one in adding money to the exchequer.

The requirement of a minimum number of wagons to run a full rake of goods train may be relaxed to the maximum extent possible as it can attract a greater number of the trading public to resort to railways.

Apart from the principal commodities, Southern Railway may take necessary initiatives in increasing the business of non-conventional commodities.

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