ASSESSING COMMERCIAL VIABILITY OF
RAIL TRANSPORT OPERATIONS IN NIGERIA

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ABSTRACT

Rail transport in Nigeria has suffered serious neglect for the past two and half decades by the Government of Nigeria. However, in 2012 the Federal Government started the process of revamping the rail transport system in order to make it more operational. Through this effort, the Nigerian Railway Corporation (NRC); the Agency responsible for infrastructure development and operation of rail services resumed rail operations in 2012. This study therefore examines commercial viability of rail passenger and freight operations using its operation data from 2012 to 2014. The results of data analysis showed that rail transport operations presently are not commercially viable. The NRC ran its operation at an average annual loss of 58.3% for passenger operation and 32.8% for freight operation. However, it is revealed that increase in the operational capacity of NRC will enhance the commercial viability of rail services in the country. It is therefore suggested that rail operational capacity should be increased by providing more locomotives, wagons, coaches and improving its operational efficiency.

Key Words: rail transport, operations, commercial, viability, passenger and freight

1.1 Introduction

Rail transport plays a significant role in the development and overall growth of any economy, it is often regarded as the wheels of economic activity, because of its crucial role in catalysing economic growth and development. It opens up regions, hinterlands and rural areas by facilitating agricultural development as well as the growth of cottage and large scale industries .Nigerian railways played a very active role in land transport in the early years after national independence in 1960, to the extent that it accounted for approximately one-third of freight traffic. At some point in time, the Nigerian railways played a key role in enhancing colonial administration, by maintaining links between the central seat of colonial government in Lagos and other parts of Nigeria (Adesanya 2002). It also served as a major mode of transport used in facilitating the opening up of several mineral producing and agricultural areas. It was also a major mover of freight and passengers across the country, especially where the rail lines traverse.

The availability of efficient railway system is crucial as transport services are essential for economic development (Oni and Okanlawon, 2006). In many countries of the world, rail transport has continued to play catalytic role in bringing socio-economic development, as it contributes substantially to the movement of goods and passengers. Empirical works have shown that rail transport provides the most cost-effective, affordable, energy saving and environmentally friendly form of transportation especially in areas where traffic densities are high (Onakomaiya, 1977; Olanrewaju, 1987).

Challenges facing the Nigerian railways include poor productivity (and its negative effect on staff morale), retention and maintenance of non-profitable routes, huge wage and pension bills - despite the reduction in staff strength of the NRC from about 45,000 in the 1970s to about 7,000 in 2004, and poor quality of service (Odeleye, 2000 and Adesanya, 2002). Agwu and Emet posited that poor quality of rail service made NRC to lose the patronage of most of its passengers as well as its principal clients: Nigerian National Petroleum Corporation (NNPC), Lafarge Cement PLC, Peugeot Automobile of Nigeria (PAN) and Nigerian Flour Mills Limited. These problems have combined to weaken the railway transport system in Nigeria and the railway system today is a complete shadow of itself during her hey days (Agbaeze and Onwuka, 2014).

A retrospective look at the operational performance of the Nigerian Railway Corporation (NRC) particularly somewhere around 1955 and 1977 paints a picture of great productivity in its operations up till 1984 when it began a process of decrease in its business operations. Statistical records of the Nigerian railroad Corporation's passenger and freight traffic demonstrates that the Corporation in 1964 conveyed 11,288,000 passengers and 2,960,000 tonnes of freight. It was observed that 10 years after these figures had dropped to 4,342,000 passengers and 1,098,000 tons of freight (The Nigerian Railway Corporation, 2006). Somewhere around 1974 and 1989, the Corporation's performance profile demonstrated a fluctuating pattern. Along these lines, figures for the Corporation's operation in 1995 demonstrated a marginal decrease from 6,755,000 passengers and 1,612,000 tons of freight to 6,520,000 and 202,000 tonnes of freight in 1989, (Agunloye, 2008).

The immediate past Federal Government administration of President Goodluck Ebele Jonathan tried to revamp the Nigerian Railway System in 2012 by rehabilitation existing rail lines, refurbishing of the old wagons and coaches and procured new ones to enhance the operations of rail transport in Nigeria. In spite of this efforts, the rail transport service still remained erratic and poor. The main aim of this paper is to find out how commercially viable is the rail transport service in Nigeria. With its current operational performance is ity commercially viable to the extent that it can attract private operators to invest in its operations? The need to determine the commercial viability of rail transport service in Nigeria is very crucial to the implementation of Public- Private Partnership policy of government in the rail transport sub-

sector. This paper therefore tries to assess the commercial viability of rail transport operations in Nigeria in order to provide useful inputs for policy implementation in rail transport mode in Nigeria

2.1 Literature Review

For some ventures, viability is ultimately connected to profits (Veryard 2002). However, Thompson, (2003) outlined the five dimensions of commercial viability which are; market viability, technical viability, business model viability, management viability and financial viability. These dimensions form the methodological approaches through which most viability studies are carried out. This study also tries to adopt some of these models in the assessment of rail service viability in Nigeria.

Rail transport in most developing nations is typically the least developed mode. For instance, Nigeria with a total land area of 923,768 km^2 has just only 3,557km of rail network. Out of this, 98% is single-track of 1067-mm gauge with either steel or timber sleepers (Jaekel, 1997). The remaining 2% is made up of standard gauge. The length of rail network has remained at 3,505km for over 54 years. Adesanya (2002) expressed that one of the issues is poor funding and huge operational misfortunes. The reduction in value of the railways has been somewhat a consequence of absence of adequate budgetary allocation by the Federal Government in addition to the poor management by the Nigerian Railways Corporation (NRC). The rail transport subsector barely gets up to one-fifth of the allocation to the transport sector. According to Odeleye, (2012), he stated that the capital intensive nature of railway projects has been the main reason why government has been in charge of the railway system in Nigeria but he argued that the Railway Act of Parliament 1955 that makes the Federal government the sole owner and operator of railway is long overdue for repealing or amended. The issue of vandalism of railway facilities and encroachment of right of way of railways is a concern expressed in many studies (Shehu, 2011). As indicated by Agbaeze and Onwuka (2014) numerous years of underfunding, technical problems, excessive government interference with management, conflicting government policies, falling rolling stocks levels, worn out and outdated infrastructure have been the factors militating against effective and efficient operation and management of the Nigerian Railway Corporation.

The importance of rail transport cannot be over emphasised in the local and regional economies of any country. According to Adesanya (2010) when rail transport is appropriately incorporated with other modes, economic level of traffic can be merged to enable the railway provide efficient and effective services for high density flow of homogenous traffic carried over generally on long distance route, including high volumes of containerized freight or bulk cargo. Abdulsalami (2014) on the other hand, stated that rail transport system in Nigeria has facilitated the movement of internal and long-distance trade. Shehu (2011), also pointed out that by far, rail transport transformed the growth of the economy, especially in the export of groundnut and other cash crops in the early stage of the country's development. According to Adenji (1995) quoting from Agbaeze and Onwuka (2014) rail transportation helped to reduce the cost of road maintenance and repairs and at the same increased the lifespan road infrastructure.

From this review, it is obvious that rail transport needs to be improved upon in Nigeria and doing this require a comprehensive study of the different aspects of the rail transport system to provide the necessary inputs for policy formulation and implementation in the sub-sector.

3.1　　Methodology

In carrying out this study, the researcher collected mainly secondary data. The secondary data collected cover operational data of Nigerian Railway Corporation (NRC), which includes number of train services run per week, the rates charged per kilogram of load per kilometre, fare charged per passenger, cost of running train per week and cost of crew members per trip. The data also include number of passengers carried monthly and yearly, revenue generated, number of freights carried per month. The data in this category also include volume of passengers and freight carried between 2012 and 2014 which was the year NRC resumed operation. The above data were retrieved from operational records of NRC in October, 2015.

The data collected were analysed using both descriptive statistics such tabulation, averages and percentages and inferential statistics. A regression analysis was run on Statistical Package for Social Science (SPSS Version 20) to determine the factors that influence the commercial viability of rail transport service in Nigeria.

4.1　　Brief History of the Nigerian Railway Corporation (NRC)

The Nigerian Railway Corporation is the body in charge of the operations railway services, provision and maintenance of rail infrastructure in Nigeria. It was established in 1898 and is owned by the Federal Government. The headquarters of the NRC is at Ebute Metta, Lagos. For administrative convenience, the entire network was divided into seven autonomous districts namely; Lagos (Ebute-Metta junction), West (Ibadan), North (Zaria), East (Enugu), North-west (Minna), North- central (Kanfanchan) and North-east (Bauchi). The NRC serves 22 states out of the 36 states in Nigeria and has staff strength of 12,748, (Nigerian Railway Corporation, 2010).

The study route connects the economic and financial city of Nigeria; Lagos and the largest commercial city in Northern Nigeria. The two cities are considered as most populous and major centers of economic and commercial activities. They both generate high volume of freight and passenger traffic which are suitable for rail transportation. The rail transport operation was resumed on this route after the rehabilitation programme embarked upon by the NRC on December 2012. The rail corridor transverses through Lagos, Ogun, Oyo, Osun, Kwara, Niger, Kaduna and Kano States. These states generate and attract more than 70% of industrial and economic goods of the country. It will be expected that rail service will be of great need to the area in order to meet up with the transport demands of the various states, (Nigerian Railway Corporation, 2005).
The corridor has a total number of 162 rail stations and operates on a narrow guage of 1067mm made up of wooden, concrete and steel sleeper. The passenger train runs at a speed of 60km/h while the freight train runs at a speed of 45km/h and the total length of the rail line is 1,112km. For the passenger train, it has three types of class; the Economy Class, First Class Seater and First Class Sleeper which have different rates. The rail terminals have the capacity to accommodate more than 2,000 passengers. The rail station in Lagos consists of 5 platforms from which different trains arrive and depart from. The middle route also known as the escape route is used for shunting operations, that is to move one coach or wagon from one rail line to another rail line. The types of trains used are diesel locomotives and diesel multiple units. In terms of signaling and communication systems, flags are used to indicate when a train should stop and when it should move, whistle is used by the driver to indicate when a train wants to take off. (Nigerian Railway Corporation, 2005).

5.1 Discussion of the Findings

5.1.1   Train Passenger traffic analysis

After many years of non-operation of train passenger service, NRC resumed train operations in 2012 during the administration of the President Goodluck Ebele Jonathan, who rehabilitated rail lines, refurbished the old wagons and coaches and procurement of new ones to revamp the rail transport system in Nigeria. Table 1 and figure 1 show a steady growth in the passenger traffic since NRC resumed its operation.

Table 1: Monthly passenger traffic of NRC from 2012-2014

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
2012	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	385,387	395,387
2013	345,889	295,039	342,257	341,270	359,317	309,597	432,202	374,533	387,533	379,185	386,755	383,069	4,328,787
2014	416,646	426,119	455,015	455,015	496,632	362,110	345,437	313,749	379,941	386,091	336,441	326,767	4,685,570
Total	763,535	721,158	797,272	797,892	781,892	671,707	768,639	768,639	767,615	765,276	723,196	1,095,223	9,399,744
Average	381,768	360,579	398,636	390,946	427,975	335,854	348,320	344,141	383,808	382,638	361,598	601,686	

Source: Nigerian Railway Corporation 2015
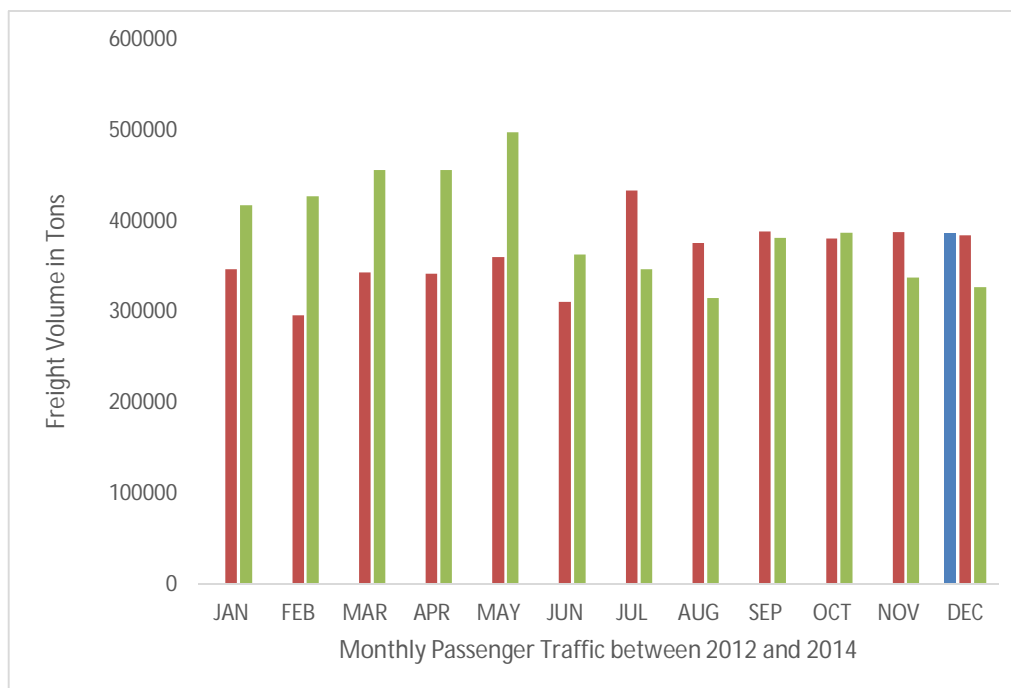
Figure 1: Train monthly passenger traffic for between 2012 and 2014

Source: NRC 2015

From Table 1 and Figure 1, there is a fluctuation in the passenger traffic flow within the two years of effective operations. In year 2013, the passenger traffic was low at the beginning of the year, particularly the first half of the year, but in the second half of the year there was an appreciable increase in the passenger traffic carried. However in the year 2014, the passenger traffic increased remarkably in the first half of the year, but it started to decline in the second half of the year of the same year. So many factors may be responsible for this, among them, is the frequency of service offered, the level of economic activities in the country and the prevailing social and political circumstances especially the volatile security situation in the country at that time

5.1.2   Freight traffic analysis

Table 2: Monthly freight traffic Carried by NRC in tonnes between 2012 and 2014

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOT
2012	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	3.442	3,442
2013	7,515	7,661	9,951	12,927	5,722	6,659	6,678	8,243	5,958	9,324	10,746	6,334	97,718
2014	11,914	14,286	16,044	11,914	14,869	14,431	12,767	17,197	17,740	21,338	34,123	24,023	210,646
Total	19,445	21,947	25,995	24,841	20,591	21,090	19,445	25,440	23,698	30,662	44,869	33,799	311,809
Average	9,715	10,974	12.998	12,421	10,296	10,545	9,723	12,720	11,849	15,351	22,435	11,266	

Source: Nigerian Railway Corporation. 2015
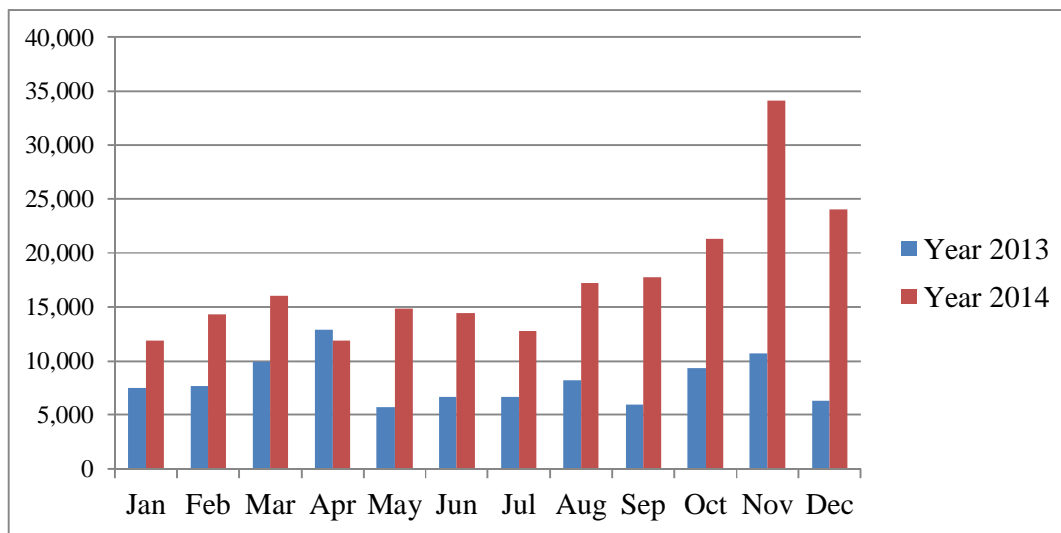
Figure 4.3: Rail Freight Traffic Volume carried between 2013 and 2014.

A close examination of Table 2 and Figure 2 reveals that there was a dramatic increase in the volume of freight carried by rail transport in 2014. The month with the highest volume of freight was in 2013 was April and the month with the lowest number of freight was May. A total number of freights moved in tones in the same year was 97,718 in 2013. In 2014, the month with the highest volume of freight was November and the month with the lowest amount of freight carried was April. The total volume of freight carried in that year was 210,646 tons which implies an increase of 46.4% over the previous year.

5.1.3 Economic and Financial viability of rail transport

The main objective of this paper is to examine the financial viability of the train operation from 2012 to 2014 in order to provide useful information that can guide policy action of government towards providing sustainable rail transport system in Nigeria. Table 3 provides some cost elements of passenger train operations, the analysis provided was based on the operational data collected from the NRC headquarters in Lagos.

Table 3: Operating cost and revenue analysis of rail passenger operation

Year	Operating cost/passenger/km (₦)	Revenue generated/passenger/km (₦)	Difference (Operating cost - Revenue)	% Profit or Loss Operating cost - Revenue x 100 / Operating cost
2012	16	5	11	68 (Loss)
2013	22	9	13	59 (Loss)
2014	25	13	12	48 (Loss)

Source: Nigerian Railway Corporation 2015.

From Table 3, the operating cost calculated on the basis of passenger per kilometre in 2012 was N16, this increased to N22 in 2013 and by 2014 it has increased to N25 per kilometre. This yearly increase may be due to general inflationary condition of the country. However, the analysis of revenue generated per passenger per kilometre show a lower rate. The revenue generated on a passenger over one kilometre was N5 in 2012 and it increased to N9 in 2013 and there was just a marginal increase of N13 in 2014. This clearly shows that NRC is running train service in Nigeria at a deficit. In the year 2012 when the new operation started, the NRC ran its operations at a loss of 68%, in 2013, train operation was run at a loss of 59% and in 2014 the percentage loss was 48%. This implies that a further increase in capacity of the train service and frequency might further reduce the loss margin. This is an indication that a continuous increase in the capacity of the rail transport operation will eventually lead to point of breaking even and also make some profits.

5.1.4 Cost and revenue analysis of rail freight operation

The same financial viability analysis was done for rail freight operation. The results of the analysis are presented in Table 4.

Table 4: Operating cost and revenue analysis of rail freight operation

Year	Operating cost/freight/ton (₦)	Revenue generated/freight/ton (₦)	Difference (Operating cost - Revenue)	% Profit or Loss Operating cost - Revenue x 100 / Operating cost
2012	7.10	3.95	3.15	44.3 (Loss)
2013	8.70	5.36	3.34	38.3 (Loss)
2014	9.15	7.55	1.6	16 (Loss)

Source: Nigerian Railway Corporation.

As indicated in the Table 4, the operating cost per ton of freight per kilometre is about N7 in 2012, it increased to about N8.7 in 2013 and by 2104 it has increased to about N9.2. The revenue generated in the same corresponding was far less. For instance freight operation ran at a 44% loss in 2012, by 2013 the percentage loss decreased to 38.3% and by 2014 the percentage loss has further reduced to 16%. When comparing the percentage loss of rail passenger operation (see Table 3) and the percentage loss of rail freight operation the freight operation has greater viability prospect than passenger operation. This implies NRC should increase its operation of freight services in order to enhance its viability.

5.1.5　Estimating Revenue of Rail operation

One of the key elements of viability of a train operating company is its financial capacity which is a direct function of revenue generated. Attempt is made in this section to analyse the determinants of revenue generated by the NRC for both passenger and freight operation. To do this, 4 variables that characterized the operation of rail transport were identified namely;

- Volume of passenger/ freight carried
- Operating cost
- Number of trips
- Number of locomotives/wagons and coaches available

A regression analysis was carried out separately for revenue generated by passengers and also for freight operation in order to predict the major variables that determine the amount of revenue that can be generated by NRC. The data used for this analysis were extracted from the operational records of NRC. The operational records of 2013 were used as a case study for this analysis

The formula for multiple regression model is stated as:

$$\hat{Y} = b_0 + b_1(x1) + b_2(x2) + b_3(x3) + \cdots \ldots . + b_k(xK) \text{ ------------------ equation (i)}$$

Where, **y** = dependent variable

　　　X_1, X_2, X_3-------- xk= independent variables

　　　b_0 = constant and

　　　$b_{1-------bk}$ = coefficient of x.

In this study, the monthly revenue generated in 2013 by the NRC is the dependent variable Y, while

　X_1 = monthly passenger carried
　X_2 = number of monthly trips
　X_3 = monthly operating cost and
　X_4 = monthly locomotive available

The first step taken was to do a correlation analysis of these variables to determine how they are related, this is presented in Table 6

Table 6: Correlation analysis of Passenger Revenue

	Revenue	Passenger	Trips	Operating cost	Locomotives
Revenue	1.000				
Passenger	.760	1.000			
Trips	.164	.296	1.000		
Operating cost	.937	.839	.320	1.000	
Locomotives	-.403	-.248	-.037	-.295	1.000

Source: Computer Output

The correlation between passenger revenue and passenger volume is very high, this is about 76%. Also, the highest correlation is found between revenue and operating cost indicating 93.7%. The relationship between passenger revenue and number of locomotives is 40.3% while the number of trips made records the lowest correlation value of 16% with revenue. This is however surprising because one would expect that the number of trips run by the NRC should be highly correlated with revenue generated. This implies that operating cost has a very strong relationship with passenger revenue generated. This is normal because both the operating cost and revenue generated are a function of the scale of operation.

Table 7: Model summary of passenger analysis Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.957[a]	.916	.868	3607129.91357

a. Predictors: (Constant), locomotives, trips, passenger, operating cost

The result of the regression analysis as shown in Table 7 reveals that operating cost, number of trips made, the capacity of train service and volume of passengers carried were major determinants of estimating revenue generated from passenger operation. About 91.6% of these variables accounted for the amount of revenue generated by rail passenger operations.

Table 8: Coefficient of independent variables for passenger revenue

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	29103064.002	14666168.099		1.984	.088
Trips	-21.293	55.804	-.077	-.382	.714
Passenger	-28037.579	22936.587	-.142	-1.222	.261
Operating cost	.853	.174	1.009	4.893	.002
Locomotives	-3808.139	3365.367	-.130	-1.132	.295

a. Dependent Variable: revenue
Source: Computer Output

The table above shows the extent to which all the dependent variables are related to the independent variable. The model coefficient of the four variables is;

$Y = 29103064 + (-21.293)x_1 + (-28037.570)x_2 + (0.853)x_3 + (-3808.139)x_4$

Determinants of Rail Freight Revenue

The same of analysis was done on revenue generated by rail freight operation within the same period to predict the revenue that can be generated through freight operation.

The formula for the regression model is stated as:

$$\hat{Y} = b_0 + b_1(x1) + b_2(x2) + b_3(x3) + \cdots \ldots + b_k(xK)$$ ------------------ **equation (i)**

Where, **y** = dependent variable

x_n = independent variable

b_0 = constant and

b_n = coefficient of x.

In this study, the monthly revenue generated from freight operation in 2013 by the NRC is the dependent variable Y, while

X_1 = monthly freight volume carried

X_2 = number of monthly trips

X_3 = monthly operating cost and

X_4 = monthly wagon available

The first step taken was to do a correlation analysis of these variables to determine how they are related, this is presented in Table 12

Table 12: Correlation analysis for freight revenue

Correlations

	Revenue	Freight	Wagons	Trips	Operating cost
Revenue	1.000				
Freight	.406	1.000			
Wagon	.087	-.090	1.000		
Trips	.087	-.142	.038	1.000	
Operating cost	.944	.344	.073	.051	1.000

Table 12 shows the correlation analysis between freight revenue and the independent variables which are freight volume, number of trips, operating cost and number of wagons. The correlation between freight

revenue and freight volume is 40.6%, between freight revenue and number of trips is 8.7%, between revenue and operating cost is 94.4% and between freight revenue and number of wagons is 8.7%. This goes to say that operating cost has a very strong relationship with freight revenue generated.

Table 11: Model summary of the regression analysis for freight revenue

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.950[a]	.902	.847	3877332.22291

a. Predictors: (Constant), Operating cost, Trips, Wagon, Freight

The result of the regression analysis shows that operating cost, number of trips made, the capacity of train service and volume of freight carried were major determinants of estimating revenue generated from passenger operation. The variables account for 90.2% of the factors that determine the amount of revenue generated from freight operation s of rail transportation in Nigeria.

Table 13: Coefficient of independent variables for freight analysis Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	-15786839.733	13524566.026		-1.167	.281
Freight	35.247	42.809	.106	.823	.437
Wagon	2518.170	10498.945	.029	.240	.817
Trips	10847.122	23652.899	.055	.459	.660
Operating Cost	1.022	.144	.903	7.092	.000

a. Dependent Variable: Revenue

Table 4.27 shows the extent to which all the dependent variables are related to the independent variable. The

model coefficient of the four variables is;

$Y = -15786839.733 + (35.247)x_1 + (2518.170)x_2 + (10847.122)x_3 + (1.022)x_4$

6.1   Recommendations

Commercial viability of railway transport in Nigeria is presently low but it does not mean that it cannot be commercially viable. In view of this, the researcher makes the following recommendations:

i.   Rail transport should be operated purely on economic principles. The areas of revenue leakages should be identified and blocked, also economic fare should be charged in order to break even.

ii.   If Nigerian railway is to witness a rapid improvement in infrastructure, train service and operations there should be a repeal of the 1955 Act of parliament which gives NRC monopoly in the operations of rail transport in Nigeria.

iii.   There is need for Public-Private Partnership in the development and operations of rail transport in Nigeria in order to inject the needed investment in the sector.

iv.   Deregulating the rail industry in Nigeria should be encouraged by government, such that healthy competition and rivalry among diverse operators could be created in the industry. But before deregulation, the Federal Government should provide fund to rehabilitate the NRC so that investors can be interested in buying it, because, the way it is presently, investors would continue to avoid buying it, even if it is deregulated..

v.   There is the need to increase public awareness on the economic advantages of using rail transport as well improving operational performance in order to attract more patronage from the users.

vi.   The capacity of the trains and frequency of service needs to be increased and also improved upon in order to cater for the demands of the public as also make the services more attractive to the users.

vii.   There is need to pay more attention on the operation of freight rail services as this seems to have a better prospect in terms of economic and commercial viability.

7.1   Conclusion

The findings so far have revealed that rail transport operations in Nigeria as it is currently being run is not commercially viable However, the prospect is very high, further efforts are needed to made by the NRC and the Federal Government in the area of deregulations and injection of capital to modernized the infrastructure and allow the private operators' participation in the provision of rail transport service. This will no doubt help greatly to make rail transport service commercially viable in Nigeria.

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