Assessment of the performance of railway transportation in Nigeria from 1970 to 2010

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ABSTRACT

Railway transportation is globally seen as an environmentally-friendly mode of mass transit system. Hence, many countries have continued to take steps to enhance the efficiency of their rail transportation industry. In Nigeria, efforts at reviving the railway transportation system have seen the adoption of two managerial options: public-private partnership (PPP) (concession) and public management, but the performance of this transport system under these two managerial regimes is yet to be investigated. Therefore, this research assessed the performance of railway transportation in these two managerial options in Nigeria for a 40-year period, between 1970 and 2010. The study is based on documentary analysis with data sourced mainly from archival records. The performance variables investigated were total revenue and total number of passengers and freight carriages handled as contained in the Nigeria Railway Corporation (NRC) Annual Reports from 1970 to 2010. The data were analyzed using simple descriptive statistics and ANOVA. The results revealed a significant difference in the performance of railway transportation between the two management options. Whereas a marginal increase in performance was observed during concession, a drastic decline in performance occurred in the public management era under NRC. It was also observed that there was no statistically significant difference in the performance of railway transportation across the geo-political zones in the country. These results imply that poor management is one of the principal factors that had affected the performance of the railway industry in the country in the period under review. The study concluded that for Nigeria to enhance the performance of railway transportation and maximize the benefits thereof, the issue of poor management must be addressed in this vital sub-sector of the transportation industry.

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Introduction

In Nigeria, railway transportation has been experiencing crisis in the last three decades. Today, railway transport accounts for an insignificant part of the transport sub-sector and contributes a very small proportion of value added in the transportation system [6]. Anecdotal evidence shows that the only operational segment of Nigeria's railway network today is between Lagos and Kano and Abuja and Kaduna, while it has ceased to function in the South East Zone since 2004. In the North Central Zone and North West Zone, it has been functioning partially in freight carriages. As a result of these developments, road transportation has taken over virtually all the traffic services previously rendered by railway with severe consequences on the state of the roads and level of greenhouse gas (GHG) emission in this country. Previous authors assert that the dominant mode of city transportation to be by road (90%) with automobiles having the largest modal share [18,43,46]

Various studies such as Rail News [34], Abubakar [1], Adesenya [5], Odeleye [37], and Ademiluyi and Dina [2] attributed the problem in the performance of Nigeria railway transportation to several factors, including poor management, poor maintenance, negligence by the government and the lack of functional transport policy. In the light of this, several attempts have been made in recent years to address these problems in order to revival railway transport. Spontaneous contracts were awarded to foreign companies on revamping the railway transportation without success [4]. In a bid to revive the railway sub-sector, the Obasanjo administration in 1978 awarded a contract to Rail India Technical and Economic services to rehabilitate the railway track and build a standard gauge railway line within a time frame of fifteen years (1978-1992). This was incorporated into the Third National Development Plan. President Babangida administration in 1989 appointed Ogbemudia as a sole administrator of the NRC and awarded contract to the Romania project for the supply of rolling stock. This period was known as Ogbemudia Revolution. The contract was within a time frame of ten years (1986-1996). In the same vein in 1995 the then president (Abacha) awarded contract to the China Civil Engineering Construction (CCECC) within a frame of fifteen years to transform the railway system through the rehabilitation of railway tracks and supply of rolling stock including locomotive, coaches, and wagons. Also, president Obasanjo administration rewarded a contract to CCECC in 1999 for the rehabilitation, redevelopment, and building standard gauge railway as incorporated in the third national development plan. Currently the government came up in 2006 as part of its seven-point agenda to revitalize the nation railways. The government-initiated rehabilitation and modernization plan in order to solve the problem of track structure. Some 25 new locomotives were procured, and the Nigeria railway bill was drafted to correct the obsolete and retrogressive 1955 Act and give room for public-private participation. The bill was said to be awaiting the second reading at the National Assembly as of October 2011 (Rail [34]). A breakdown of the annual budget also shows that there has been an increase in budgetary allocation to NRC. Despite the federal government's effort over the years to revamp the railway transportation system in the country, railway transportation still remains inefficient. Notably, one key objective of the current reforms in the railway transportation system in Nigeria is to attract private sector investments into the industry [49,50]. Consequently, the Nigerian railway transport system has over the years experimented with two management options: the public management option under the NRC and the concession option under the private sector [15]. This is in line with global best practices in railway infrastructure provision and service delivery as evident in the literature (see [12–14]).

Meanwhile, the persistent railway transportation crisis situation in the country has remained unabated and some predictions have been made concerning the performance of the sector over the years (see for examples [2,3]). However, it is observed that most of the predictions are based on speculations and devoid of any empirical backing. As a result, there is a limited understanding of the performance of the railway transportation in Nigeria under these two management regimes. A knowledge of this is vital in identifying the most effective management option for repositioning the railway transport sub-sector in meeting the mobility needs of the teeming population in the country. This study therefore assessed the performance of railway transportation in Nigeria between 1970 and 2010. The specific objectives were to: (1) to compare the performance of the railway transportation in Nigeria under the public management and PPP management regimes; and (2) to examine whether there is a significant difference in the performance of the railway districts in the geo-political zones in Nigeria.

Following from these objectives, two hypotheses were postulated and tested in this study. The first one is that there is no significant difference in the railway performance across the two managerial regimes in Nigeria (H_1). The second hypothesis (H_2) is that there is no significant variation in the performance of the railway districts in the geo-political zones of Nigeria. Due to excessive reliance on secondary data which is a deficiency usually associated with archival research of this nature, the present study encountered a limitation of paucity of current reliable statistics as from the year 2010, therefore limiting it research window to four decades (1970 - 2010). The study is however, valuable in uncovering the performance of the Nigerian transportation system with respect to the volume of passengers and freight carried as well as revenue generated between 1970 and 2010. It also makes contributions to knowledge by identifying which of the two management options is capable of enhancing the performance of the railway transport system in Nigeria; and thus, providing input for policy formulation and management practice in the railway transport sub-sector of Nigeria.

Literature Review

The rapid opening up of many geographical locations in Nigeria was championed by the railway system, solely operated and managed by the Nigerian Railway Corporation (NRC) founded in 1955. It is a government owned establishment that

runs a unilaterally designed track system of over 1000mm cape gauge. However, it has suffered decline in output and thus occasioned a shift to Public Private Partnership administration at some points. Globally, PPPs (Public-Private Partnerships) became popular as a governance mechanism for public policy in the 1990s [52], when Africa's governance issue drew international attention [50], and the need to efficiently deliver government projects in collaboration with private investors was eminent.

PPP also referred to as the 'New Public Management' (NPM) did evolve from public reform movement, which emphasizes autonomy of government public services, leasing out for private sector investment and or full privatization of public services; are employed in a variety of ways in different nations. Though some countries have utilized PPP and its variants like the Private Finance Initiative (PFI) to pursue private enterprise funding and relieve pressure of capital investment, others have used them as part of the New Public Management (NPM) strategy for enhancing public sector efficiency in the development and maintenance of public and social facilities [48]. In sub Saharan Africa especially Nigeria, PPP has been embraced as a governance approach in order to address a huge infrastructure deficit caused by decades of declining infrastructural development. An example of this is restoring the Nigerian rail transportation, which for more than two decades has been on the decline in terms of capacity and functionality. In contrast to PPP is public management on which every responsibility from financing to management and maintenance rest totally on the shoulders of the government.

Theoretical framework

The assessment of performance of any transportation system is based on the notion of its contribution to overall sustainable development. Richardson [53] described this as the "triple bottom line" of economic, social and environmental sustainability. According to the World Bank [59], e*conomic sustainability* of transportation ensures continuing capability to support transportation demand with cost-effective and competitive solutions; s*ocial sustainability* addresses transportation needs of the poor and equitable sharing of benefits of transportation by all sections of society; and e*nvironmental sustainability* ensures reduction of negative impacts on environment and generation of possible improvement in the general quality of life. This concept of sustainable transportation confirms well with the three components of urban sustainability – economic efficiency, social wellbeing and ecological acceptability [32].

Notably, the economic dimension of the transportation system looks at its productivity, resource use and contribution to the economy, suggesting that transportation needs to be cost-effective and financially sustainable. Economic sustainability requires sustainability in vehicle fleet, transportation infrastructure and public transportation system [59]. Transportation planning has social implications in terms of equity and inclusion [11,25]. The prioritization of highway infrastructure over railway and public transportation system has had grossly unequal consequence on low income groups, limiting their access to economic and social benefits [45]. Environmental dimension of transportation is concerned with renewability of resources and a cleaner environment.

Research has shown that the transportation sector contributes significantly to environmental pollution by producing around 14% of greenhouse gas emissions globally [22,54]. The study by Loo [29] revealed that in 1999, vehicles were responsible for between 90% and 95% of CO_2 and lead, and between 60% and 70% of nitrogen oxide and hydrocarbon emissions in cities across the world. In addition, traffic noise, a nuisance of transportation, is also known as a major factor in decreasing the quality of ambience [51]. Therefore, a sustainable transport system requires effective integration of environmental, social, and economic factors in developing optimal solutions to current and emerging issues, especially energy security, emissions, and climate change [55].

Some authors have advocated quantifying performance assessment of sustainability of transportation systems [27,40,60]. Though there is a consensus in the research literature on the three dimensions (*economic, social and ecological)* of sustainability, there is no consensus on the indicators that represent each of these dimensions in the transport sector [24]. In sustainable development indicators (SDI), 21 initiates were developed, of which 10 appear to be holistic initiatives within the transportation sector and 11 were exclusive initiatives. All the four initiatives identified by the UNCSD [58], WBCSD Mobility Indicators [17], OECD [39], and UNCHS [57] have both local and global applications.

Multi-view black box (MVBB) in Figure 1, is a modified systems framework and was introduced to incorporate a sustainable development paradigm in the transportation sector globally [32]. It is based on a three-dimensions: economic efficiency, social well-being and ecological acceptability. The basic sustainability goal in this framework is the futuristic agenda of reduced input, greater livability and reduced waste. The input resources in the transportation sector are vehicles, fuel for vehicles and materials to construct railway networks. The output relates to the optimal mobility of goods and people leading to greater accessibility to workplaces, schools, markets and other basic services with healthier and comfortable travelling modes. The undesirable output or waste includes air pollutants, traffic noise, solid waste and accidents. The goal of sustainable transportation under MVBB is to achieve greater livability with reduced resource inputs and waste through higher efficiency, greater wellbeing and better environmental compatibility.

As it relates to the current study, the focus is on economic sustainability of the railway transportation system in Nigeria with specific emphasis on the output in terms of mobility of goods and people and well as economic efficiency (i.e. revenue generation). The choice of economic sustainability is based on the availability of data that can help to assess the productivity and financial sustainability of the railway transportation system in Nigeria.

Table 1
Railway Construction in Nigeria

Section	Year	Distance	Gauge
Lagos – Ibadan	1898-1901	193km	Narrow Gauge
Ibadan – Jebba	1901-1909	295km	'
Kano – Baro	1907-1911	562km	'
Jebba – Minna	1909 -1916	225km	'
Enugu – Makurdi	1914-1916	243km	'
Kaduna Junction – Kafanchan	1916-1924	179km	'
Kafanchan – Jos	1924-1927	101km	'
Kuru – Bauchi	1958-1961	166lm	'
Bauchi – Gombe	1961-1963	155km	'
Gombe – Maiduguri	1963-1964	302km	'
Itakpe - Ajaokuta	1986-2020	277km	Standard Guage on going
Ajaokuta – Warri	1986-2020	275km	Standard Guage
Port-Harcourt – Onne	On going	19km	1067mm

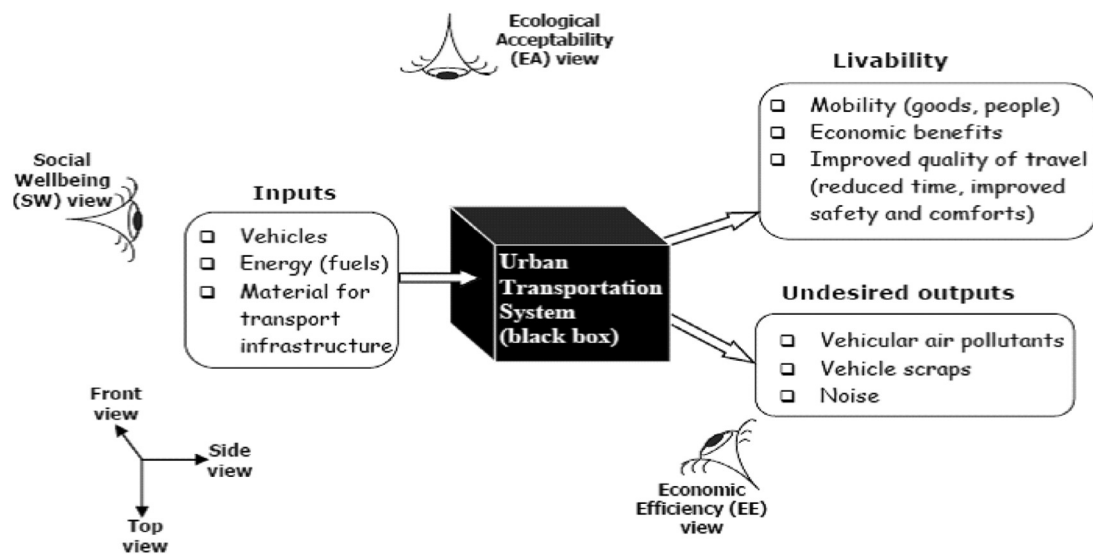Source: Nigerian Railway Corporation 2010

Figure 1. Multi-view Black-Box Framework (MVBB) for Sustainable Urban Transportation System
Source: Nathan, H. S. K. and Reddy, B. S. (2011)

Review of Railway Development in Nigeria

The development of the railway transportation system in Nigeria was the initiative of the British colonial government, with the objectives of penetrating the hinterland, and evacuating goods to the coast for export to feed its industries [19,23]. It commenced in 1898 with the construction of 32km of a 1067mm gauge railway line from Iddo (Lagos) to Otta (Ogun State). This was extended to Ibadan covering a total of 193km in 1901 and continued incrementally to Ilorin and reaching Kano in 1912. The construction of the second rail line which started in 1913 from Port Harcourt passing through Aba, Enugu, Jos, Kafanchan reaching Kaduna in 1923. The railway system in Nigeria started with the use of black, monstrous and convulsively smoky steam engines and later changed to diesel engines in the 1970s. For 31 years, which is between 1927 and 1958, there was no railway construction in Nigeria (Rail [33]). However, in 1958, the track between Kafanchan and Bauchi (238km) was constructed and this was extended to Maiduguri in 1964 (302km). This development brought the total rail route in Nigeria railway network to 3505km and track kilometers to 4,332km as shown in Table 1 and Figure 2. In 1986 the government embarked on the construction of a 19km (1069mm gauge) rail line from Port Harcourt seaport and 277km (standard gauge) line from Itakpe through Ajaokuta to Warri, which was commissioned in 2020. As at 2006, only 19 states of the 36 states of Nigeria are connected by railways and only Apapa and Port Harcourt seaports are served by railways [41].

The railways in Nigeria are old and dilapidated narrow-gauge single tracks with no standard gauge. The railway system is characterized by declining traffic volumes following the declining quality of railway assets and train services. Odeleye [36] noted that at independence in 1960, the NRC had 257 locomotives, 339 carriages, and 3,885 wagons to serve an estimated population of 21 million people. Although the single-track narrow-gauge network ran across the country from the north to the seaports in Lagos and Port Harcourt, they were generally considered efficient and vibrant in conveying passengers and freight along the north-south axis. However, in the mid-1970s and early 1980s, following the discovery of crude oil
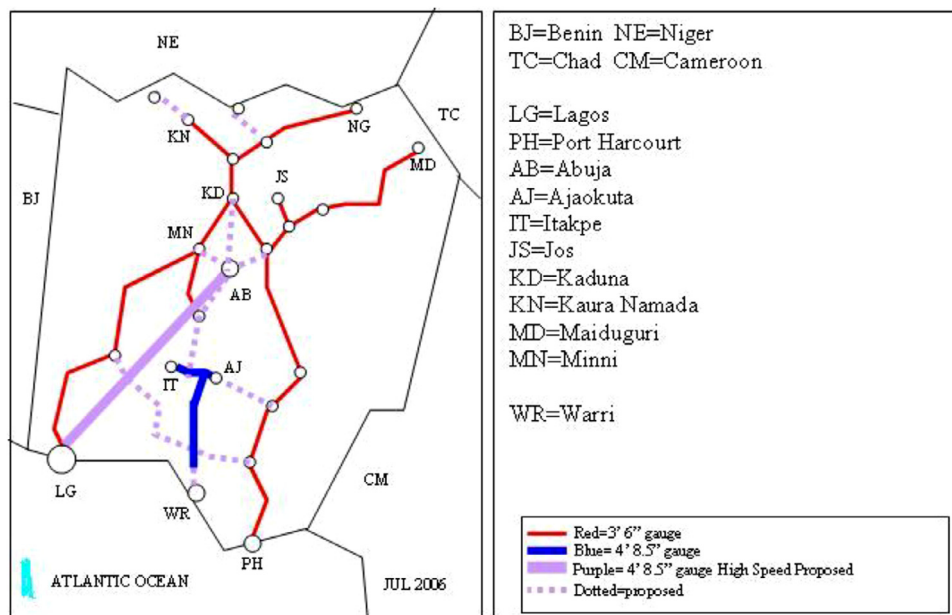
Figure 2. The Nigerian Railway map
Source: Nigeria Railway Corporation 2010

in commercial quantity and the subsequent transition from agro-based to petro-propelled economy, agriculture ceased to be the mainstay of the Nigerian economy both the volume of passengers and goods carried by the Nigerian Railway had started to drop dramatically [7]. Consequently, the fortunes of the rail transport sub-sector declined massively as the nation's rail tracks were abandoned and there was no need to transport crude oil through the rail lines since crude oil is produced in the coastal areas and easily pumped into vessels for shipment.

Notably, Nigeria has made several efforts in the last 20 years to revive the railway transportation system. Such efforts include the contractual agreement between Nigeria and Rail India Technical Services (RITES) between 1978 and 1982; Ogbemudia Revolution in 1989-1992, CCECC and NRC Rehabilitation Project in 1995-1999. In addition, there was technical cooperation between the NRC and the Rail India Technical and Economic Services (between 1979 and 1982) and the China Civil Engineering Construction Corporation (between 1995 and 1999). These agreements were designed to improve rail tracks and communications facilities; rehabilitate the existing locomotives, coaches, and wagons and the supply of new ones; and re-opening of hitherto closed routes. There is also a 25 years' strategic development plan which was developed for the Nigerian Railways, by the Federal Executive Council on the 13th of November, 2002; this plan, which was designed to be implemented in three phases and cost about $60 billion, was expected to be funded mainly through multilateral grants and private sector investment [49]. Furthermore, in October 2006, the Federal Government of Nigeria signed an $8.3billion contract with the China Civil Engineering Construction Corporation (CCECC) for the construction of 1,315km of a standard gauge railway line from Lagos to Kano. In view of the fact that the Nigeria Railway Corporation (NRC) established in 1899 by the colonial administration was the sole manager and operator Nigeria's railway system, there was a fresh thinking of evolving and adopting a new management approach that is based on the public-private-partnerships (i.e. concession), which is different from the public sector-based approach that has been used by the NRC over the years. The success recorded in the Abuja-Kaduna section, appears to be a significant milestone in the rehabilitation efforts.

In the Lagos district there has been both passenger and freight carriages. Passengers are usually carried from Iddo and other stations within the district by express train to the Northern part of the country. Mass transit trains are also in operation within Lagos metropolis while suburban local trains operate from Iddo in Lagos State to Ijoko in Ogun State. The North-Central District covering three states - Benue, Plateau and Kaduna had enormous traffic that created the enabling environment for enhanced revenue generation. In the area of freight, the major business concentration is in the haulage of barytes from Agyaragy in Plateau State to Port Harcourt Refinery. The Western District runs through five states namely: Ogun, Oyo, Osun, Kwara and part of Niger State. The Northern District has rail lines stretching from Minna to Kano, spread across seven states of Nigeria namely: Niger, Kaduna, Kano, Jigawa, Katsina, Sokoto and Yobe. Major commercial cities/towns within the district include Kano, Zaria, Kaduna, Minna, Guasau, Funtua and Nguru. Goods and passenger traffic were in abundance in the district.

The North Eastern District has a great number of traffic potentials located in various towns and cities in the district. Though there was some level of passenger traffic, it is highly negligible compared to freight traffic. The freight traffic potentials in the North Eastern District are in the Bajowa area where Ashaka Cement Factory is located. Clinker traffic is also

moved from Ashaka as a third freight offering from Ashaka Cement Factory to Ewekoro, Ogun State, where it serves as a raw material for the production of cement. Other freight traffic in the district includes barytes from Agyaru to Port Harcourt, cattle traffic from Maiduguri, Buni, Gombe and Bukuru. Eastern District of the NRC maintains weekly passenger service and freight traffic of fertilizers and raw materials for the production of fertilizer from Port Harcourt to Kaduna in hopper wagons on regular basis and soap and detergent produced from PZ factory in Aba were moved to the depots situated in Northern and North-Eastern Districts.

Performance Railway Transportation: review of empirical studies

The review of literature revealed several definitions of performance. For example, Liyanage and Villalba-Romero [28] defined performance as a comparison of input and output (productivity) of any system, while National Research Council [35], viewed performance as a comparison of actual returns against a pre-specific benchmark. These definitions suggest that performance is a measure of worth or value of a product, service, system, or organization based on established performance objectives. Therefore, as used in the current research, performance of rail transportation in Nigeria refers to the productivity of the railway transport sub-sector in this country. In assessing railway transportation performance in the world, Adesanya [5] used indicators such as passengers carried, goods hauled and total route kilometer to show that developed countries have performed better than developing countries. Using passenger and freight services, Lan and Lin [26], measured railway performance with two stochastic distance function approaches. The empirical analysis examined 39 worldwide railway systems over 8 years (1995-2002) using inputs of number of passenger cars, number of freight cars and number of employees; and outputs of passenger train-kilometers and freight train-kilometers. That study revealed that railways' technical efficiency and service effectiveness were negatively influenced by gross national income per capita, percentage of electrified lines and line density.

Another study by Grimm and Sapienza [21], identified demographic and management variables in the assessment of the performance of railway transportation. Talking about, the management aspect of railway infrastructure, studies [30] have shown that this has received increased attention in recent years. Mayowa et al., [30] discussed outcome-oriented approach to maintenance outsourcing; performance-based railway infrastructure maintenance and contracting issues and challenges. Mediawiki [31], showed that in the EU after a period of sustained growth, rail transport performance in passenger-kilometers was affected by the economic crisis at the beginning of 2009. Rail passenger transport nevertheless remained less affected than rail freight transport, and registered a slight recovery during 2010 and 2011. Cuoto and Daniel [16], evaluated the economic performance of European railways over the period 1972 to 1999 using a stochastic frontier approach estimated within the framework of a translog cost system. The result confirmed that European railways experienced significant cost increases due to inefficient behaviour. The estimates indicate a much greater role for allocative rather than technical inefficiency. Overall, inefficiencies were essentially explained by supply of excess capacity and by over-employment of labour inputs. Regarding productivity, it appears to be technological progress, and not levels of efficiency or scale economies that provided the most convincing explanation for variance in growth rates within the system

Railway transportation performance is high in some African countries such as South Africa, Egypt and Ivory Coast compared to Nigeria [47]. Abubakar [1] and Okeke et al., [44] observed that the shift in government priority to the development of infrastructure for motorized transportation has affected the performance of railway transportation in Nigeria. According to the author, there has been a persistent downward trend in recent times in Nigeria railway's fortunes. He contended that the neglect of railways transport by the public is consequent on its inability to improve its operational efficiency and probably speed thus making the road network more desirable to commuters. Adesanya [5], identified the challenges to the performance of railway transportation in Nigeria as poor funding and huge operating losses, inadequate locomotive and rolling stock, loss of patronage to the road transport sector and weak political commitment. Others are poor communication facilities; government interference with management structure; lack of freedom to set tariffs; inadequate funding; falling rolling stock level; plummeting traffic levels (freight and passenger); inflexible bureaucracy; and volatile staff training.

Rail News [34], emphasized on poor track structure and low maximum speed as the major factors that affect the performance of railway transportation in Nigeria. The quality of rail passengers' services is affected by smoothness of the ride, cleanliness of the train and timely arrival at stations [20]. Agunloye [8] noted that the track system affects the viability, efficiency, performance, and the strategic relevance of the railway system in national development. Agunloye [8] examined users' opinion on the factors that influence the quality of rail service in Lagos and observed that the smoothness of train ride is poor, thus 80% of train patrons in Lagos metropolis rated the service as ineffective and inadequate. A majority of the respondents rated the cleanliness of the coaches as poor and with inferential evidence that only the arrival time of trains at stations has a significant relationship with the patrons' trip frequency, out of the various determinants [10]. According to Agunloye, and Ilechukwu [9], the performance of the Nigerian Railway Corporation between 1955 and 1989, measured with passenger and freight traffic, paints a picture of boom in operations up till 1974 when it started to decline. The underlying factors for this situation according to Odeleye [38] are lack of a functional transportation policy and maladministration.

However, Tajani [56] argued that railway transport provides a valid alternative to other modes of transport against a backdrop of rising fuel prices and the increasing impact of transport on the environment, particularly the emission of greenhouse gases. Odeleye [38], have also observed that railway administration in developed nations like Japan, France, and Canada, has become more rational with time as new management structure, such as public–private partnerships, build-operate-transfer (BOT) arrangements and privatization, were being adopted in an attempt to enhance railway safety, punctuality and reli-

ability. Furthermore, there is increasing interest worldwide in expanding high-speed rail networks. The priority for these changes has environmental undertones, and railways are increasingly being seen as environment-friendly. In developed countries, transport policy is dynamic and changes responsively according to technological trends in the transport sector. Government policy in respect of rail transport innovation and development are fairly consistent and largely limited to policymaking and execution.

Research Methods

The research design for this study is documentary analysis (Archival research). This was informed by the nature of the research objectives and the major merits of archival research which involves studying past state of a problem and carrying out comprehensive analysis of the issue. These help researchers to trace various antecedents of an issue and provide full account of the existing issue to proffer solutions to contemporary problems that occurred in the past. Consequently, the data were sourced mainly from the Nigerian Railway Corporation (NRC) Annual Reports for the period of 40 years (1970-2010). The key variables investigated were the number of passengers and freight carried, total revenue generated from number of (passenger/freight carried) for the period under review. The data on railway operation in the different districts of the geo-political zones of Nigeria, namely, Lagos, Western, North West, Northern, North East, North Central, and Eastern zones were also sourced from their Annual Reports.

The analysis was carried out using the statistical package for social sciences. One-way Analysis of Variance (ANOVA) was used in the hypothesis testing. This is because ANOVA allows multivariable comparison of mean and helps to calculate the significance of the association for more than one predictor variable at a time and the data set meets the assumptions for ANOVA. In addition, it also employs variances entirely instead of actual differences and standard error. The two variances are marched against each other; one is said to be presumably due to experimental variances (independent variances) and the other presumably due to error or randomness. Therefore, ANOVA tests the hypothesis that the sample means are the same, equal as presented as follows Ho: $M_1 = M_2 = M_3$. The current research took advantage of all the aforementioned demerits of ANOVA in the data analysis.

The statistics F was employed for the null hypothesis in an ANOVA problem statement that is, to test significance in difference in the means between and among groups. In this study, the null hypothesis sought to determine whether a significant difference exists in railway performance between the managerial eras and among the six geo-political regions in the country. The equations of the simple factor analysis of variance technique are given as:

$$SST = \sum X2 - \left(\sum X \right)^2 \tag{1}$$

$$\begin{aligned} &N \\ &SSb = (\sum X1)^2 + (\sum X2)^2 + (\sum X3)^2 + (\sum X1)^2 \end{aligned} \tag{2}$$

$$\begin{aligned} &N \quad NNN \\ &SSw = SSt - -SSb \end{aligned} \tag{3}$$

Where SSt = Total variation (total sum of squares); SSb = Variation between groups (sum of squares between) and SSw = Variation within groups (sum of squares within). The results are presented using tables and line graphs

Results

The data in Table 2 show the aggregate of total number of passengers and freight carried as well as the total revenue generated by the NRC between 1970 and 2010 extracted from the Nigeria Railway Corporation Annual Reports. It is evident from Table 2 that the highest volume of passengers carried by the NRC was 15,553,000 and this happened in 1984 under public management and the revenue generated from this was ₦33,147,000. This is followed by 1985 with 11,324,000 persons with ₦36, 205,000 accruing from these, while the least number of passengers carried was in 2006 with 708 persons and these resulted in revenue of ₦84, 322.

It is also evident in table 2 that the largest freight carried was 2,543,000 in 1979 and the revenue generated was ₦16, 251,000, while the lowest quantity of freight carried was 36 in 2007 and these brought a revenue of ₦82, 811.

Figure 3 shows a comparison between passenger and freight carried by the NRC between 1970 and 2010, respectively. Examination of the results reveals a common trend in the volume of passenger and freight carried by the NRC within the period under review. It is evident that the highest volume of passengers and freights carried by the Corporation were between 1983 and 1985, while the least were between 2006 and 2010 as seen in figure 3.

Figure 4 shows the trend in revenue generation by the NRC between 1970 and 2010. It is evident in Figure 4 that the highest revenue generated from both passengers and freights by the NRC was in 1998 with a total revenue of ₦513, 236, 80. This comprised ₦74, 457,194 from passengers and ₦438, 779,607 from freight. The lowest total revenue of ₦1, 572, 70 was generated in 2006.

Table 2
Managerial regimes; Passengers + Freight Carried; Total Revenue Generated

Year	Managerial regime	Passengers carried	Revenue generated ₦: K	Freights carried	Revenue generated ₦: K	Total Revenue Passengers+Freights ₦: K	Total Revenue Passengers+Freights $
1970	Public	8,942,000	4,676,000	1,311,000	18,438,000	23,114,000	56,379.65
1971	Public	6,151,000	6,296,000	1,311,000	15,680,000	21,976,000	53,603.84
1972	Public	5,819,000	7,477,000	1,519.000	17,095,000	24,542,000	59,317.58
1973	Public	5,131,000	6,906,000	2,129,000	18,025,000	24,931,000	60,257.79
1974	Public	4,324,000	6,067,000	1,098,000	12,205,000	18,272,000	44,163.10
1975	Public	6,755,000	11,003,000	1,612,000	14,724,000	25,727,000	62,181.70
1976	Public	7,491,000	10,004,000	1,452,000	16,232,000	26,726,000	64,596.27
1977	Public	6,747,000	10,822,000	2,375,000	16,772,00	27,994,000	67,661.00
1978	Public	6,750,000	12,982,000	1,592,000	17,172,00	29,233,000	70,655.51
1979	Public/ private	6,771,000	18,716,000	2,543,000	16,251,000	40,577,000	98,073.71
1980	Public/ private	4,917,000	17,290,000	1,153,000	21,861,000	40,603,000	98,136.55
1981	Public/ private	9,638,000	26,623,000	1,932,000	23,313,000	71,713,000	173,328.74
1982	Public/ private	1,1612,000	28,288,000	2,185,000	45,090,000	77,309,000	186,854.15
1983	Public	13,142,000	29,877,000	1,619,000	36,499,000	66,376,000	160,429.33
1984	Public	15,553,000	33,147,000	1,458,0000	33,335,000	66,482,000	160,685.53
1985	Public	11,324,000	36,205,000	1,182,000	34,247,000	70,452,000	170,280.93
1986	Public	9,878,000	39,059,000	852,000	26,335,000	65,394,000	158,055.85
1987	Public	7,383,000	35,750,000	353,000	15,632,000	51,382,000	124,189.16
1988	Public	4,196,000	25,117,000	326,000	13,206,000	38,323,000	92,625.84
1989	Public/ private	6,520,000	24,318,000	202,000	18,155,000	42,473,000	102,656.30
1990	Public/ private	6,345,000	31,403,000	198,000	35,911,000	67,314,000	162,696.45
1991	Public/ private	3,443,000	19,300,000	237,000	64,00,000	83,700,000	202,301.05
1992	Public/ private	1,747,000	17,013,000	204,000	49,732,000	66,745,000	161,321.19
1993	Public	1,502,000	14,627,000	106,000	25,841,000	40.468,000	97,810.26
1994	Public	784,491	36,809,000	106,000	121,911,902	158,712,786	383,605.31
1995	Public/ private	2,889,977	56,144,354	107,000	133,911,902	190,026,624	459,290.16
1996	Public/ private	2,626,026	112,907,824	137,000	161,348,796	274,256,624	662,872.22
1997	Public/ private	2,946,940	126,456,928	535,000	219,175,125	435,632,053	1,052,913.08
1998	Public/ private	1,070,424	74,457,194	1,513,077	438,779,607	513,236,801	1,240,482.05
1999	Public/ private	1,788,171	88,882,085	737,239	404,436,982	493,229,067	1.192,123.80
2000	Public	2,610,435	142,920,540	116,837	155,865,908	298,786,448	722,160.27
2001	Public	1,284,022	110,456,518	132,813	165,256,201	275,712,719	666,391.57
2002	Public	942,594	62,977,167	98,192	132,907,397	195,884,564	473,448.68
2003	Public	1,608,447	103,858,378	56,178	101,088,080	206,606,083	499,362.35
2004	Public	1,751,000	206,772,909	62,575	112,480,539	319,253,448	771,628.56
2005	Public	752	87,178	84	110,011	197,189	476.59
2006	Public	708	84,322	41	108,948	157,270	380.11
2007	Public	1,478	145,100	36	82,811	227,911	550.85
2008	Public	1,996	233,513	47	78,600	312,113	754.36
2009	Public	1,285	204,573	52	60,711	265,284	641.18
2010	Public	1,514	205,241	138	81,822	287,063	693.82

Source: Nigeria Railway Corporation Annual Reports
NB. Central Bank of Nigeria exchange of Naira to US Dollar ($1=₦409.97)

Table 3
Descriptive Performance

	N	Mean	Std. Deviation	Std Error	95% confidence interval for mean		minimum	maximum
					Lower bound	Upper bound		
Lagos	5	3E+007	22888697.44	1E+007	5266581.626	62106724.77	3208172	61066540
Western	5	9032911	14482642.72	6476835	-8949665.46	27015486.66	1739648	34922805
Northwest	5	4641142	2196133.491	982140.8	1914281.909	7368001.691	2487230	7429483
Northern	5	3E+008	727616643.6	3E+008	-565561445	1241349337	9691933	1.6E+009
Northeast	5	238420.4	247728.14477	110787.4	-69174.7187	546015.5187	.00	585236.0
Northcentral	5	655420.6	319856.35565	143044.1	258266.4786	1052574.721	321015.0	1021061
eastern	5	1832634	3219085.449	1439619	-2164388.11	5829656.910	104240.0	7569836
total	**35**	**6E+007**	**276014137.9**	**5E+007**	**-39388298.4**	**150240049.0**	**.00**	**1.6E+009**

Table 4
ANOVA Test

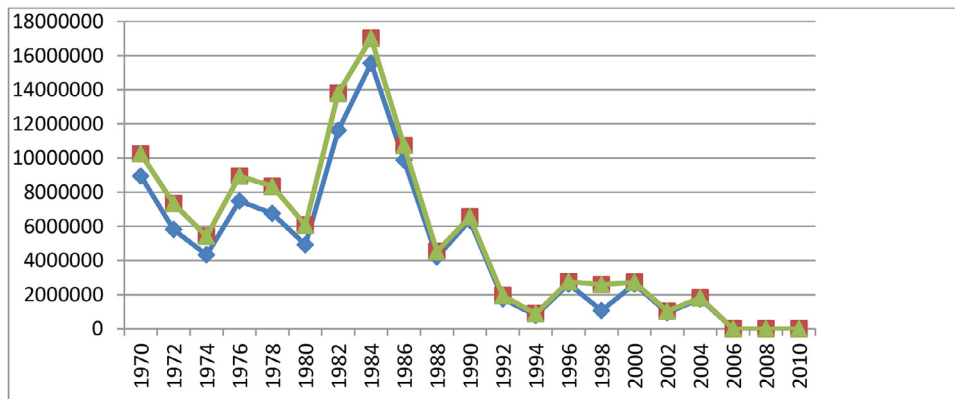|	Sum of squares	df	Mean square	F	Sig.
Between Groups	4.7E+017	6	7.826E+016	1.033	.425
Within Groups	2.1E+018	28	7.574E+016		
Total	2.6E+018	34			

Figure 3. Passenger and Freight Carriages (1970-2010)
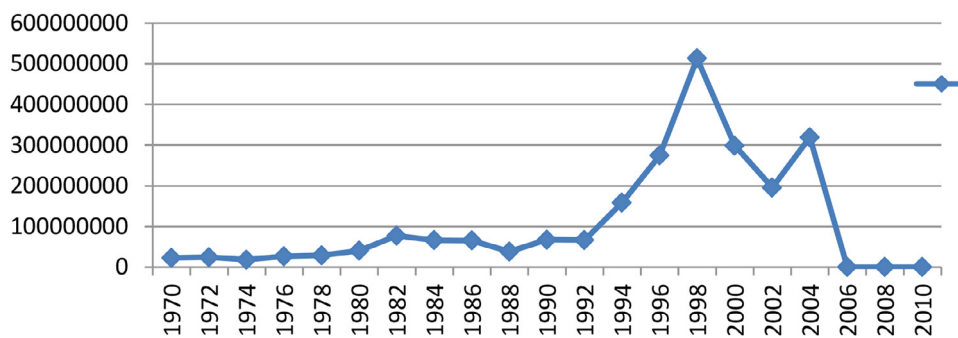Source: Nigeria Railway Corporation Annual Reports

Figure 4. Total Revenue Generated between 1970 and 2010
Source: Nigeria Railway Corporation Annual Reports

Generally, the data revealed a drastic decline in the performance of railway transportation during the management of NRC. This is evident by the total revenue generated from passenger and freight carriages. The figures had been fluctuating reaching all time high of ₦513,236,801 in 1998 and all-time lowest figure of ₦1,572,70 in 2006 (Table 2).

For the hypotheses, recall that Hypothesis 1 states that there is no significant difference in the performance of railway transportation (as measured by total revenue generated from number of passengers and freight carriages) across the two managerial eras of the industry in Nigeria. The ANOVA showed an F = 5.115 and P-value significant at 0.029. Since P <0.05 significant level the null hypothesis was rejected (see Table 4). The result suggests that there is a significant difference in the performance of railway transportation across the two managerial eras of the railway industry. The two managerial eras were during the management by NRC and during the period of concession of the railway industry under the public-private partnership (PPP) management. During the period of concession, the total revenue generated increased while during the management of the public sector (NRC) the revenue generated from carriages declined drastically (see Table 2).

Hypothesis 2 states that there is no significant difference in the performance of the railway transportation industry (as measured by the total revenue generated from the aggregate number of carriages from passengers and freight) among the geo-political zones.

The result showed F = 1.033, P-value = 0.425. Since P > 0.05 significant level, the null hypothesis was accepted. The small F value indicates group means are close together (low variability) relative to the variability within each group (see Table 3). This result confirms that the test of homogeneity of variance using Levene's Statistics of F = 1.033, with P > 0.05 significant level, met the requirements of ANOVA assumption. Therefore, there is no statistically significant difference in the performance of railway transportation across the geo-political zones in the country, thus ANOVA and Scheffe Test yielded the same result. These results are indications that the performance of railway transportation did not differ significantly among the geo-political zones in Nigeria.

Discussion

This study revealed a difference in the performance of railway transportation between the different managerial regimes of the railway industry in Nigeria between 1970 and 2010. This is evidently clear in the result of Hypothesis 1, which revealed that there was a significant difference in the performance of railway transportation between the two managerial eras.

The public-private management option also known as the period of concession, and the public management (by NRC). During the period of concession (1979-1982, 1989-1992, and 1995-1999) there was evidence of increase in the total revenue on a yearly basis. In the number of freight and passenger carriage, there was a marginal increase from 1994 to 1995 during the period of concession. The number of passengers carried increased from 784,491 to 2,889,977 representing a 360% increase in passenger traffic and 150% increase in revenue. These reflected a similar pattern in the total revenue generated within this period. The table 2 also revealed a drastic decline in the performance of railway transportation during the management of NRC. This is evident by the total revenue generated from passenger and freight carriages. In 1984 and 1977 the highest number of passenger carriage was 15.55 million and the highest volume of freight was 2.37 million under the management of NRC but it did not follow a similar pattern of increase in the total revenue generated. The study findings evident in tables and figures in result section of this paper shows the undulating nature in the performance of railway transportation; falls, rise, and drastic falls depicting the state of decrepit in the performance of railway transportation.

This finding suggests that poor administration could be one of the core factors that influence the performance of railway transportation and this is consistent with the previous submission by Odeleye [37] as previously highlighted. This was also corroborated by Ademiluyi and Dina [2] who also noted that maladministration by successive governments was a core factor that influenced railway transportation in the country. This poor management practices that could have affected performances of rail transportation in Nigeria are not different from those exhibited and experienced in other government establishment. These include; the long bureaucracy chain, inadequate staff strength, mismanagement of fund, lack of maintenance, lazy attitude of workers, conflict of interest of the political class, zero accountability, corruption, inconsistent and unsustainable policy etc [42]. This finding implies that the performance of railway transportation in the country has a strong link with management issues and it may continue to persist; hence, the need to transfer the management of NRC to private sector entities for enhanced efficiency and productivity. This study has recommended the transfer of the management of NRC to Private sector because of the obvious progress made in the few years of management of railway transportation sub sector. This progress may be attributed to the profit-oriented mindset of private investors and their quest to satisfy end users in order to survive in the business.

The results of Hypothesis 2 showed that there was no statistically significant difference in the performance of railway transportation across the geo-political zones. The implication of this result is that the performance of railway transportation was the same across the country. Presently, in Lagos (South West Zone), railway transportation is functioning and in Kafanchan (North Central zone) railway transportation is partially functioning only in terms of freight carriages. In Minna (North West Zone) railway transportation is functioning occasionally in terms of freight carriages while in Enugu (South East Zone) it has ceased to function for over a decade. This study also revealed that the performance of railway transportation has been on the decline since 1974. This agrees with [2,9,33] as previously highlighted in the review of literature. The poor performance of railway transportation has adversely affected the country economically and socially; and thus, there is an urgent need to revamp this sub- sector of the Nigerian economy.

Conclusion and Recommendations

The research investigated the performance of the railway transportation system in Nigeria between 1970 and 2010 using data extracted from the Nigeria Railway Corporation Annual Reports. The study revealed that there was a significant difference in performance of the railway transportation system in this country across the two managerial eras. Although a considerable improvement in performance was observed during the periods of public-private sector partnership, this could not be sustained after the periods. Therefore, in order to revive Nigeria railway, the Public Private Partnership model should be sustained. This should involve segmental concessions of routes to many concessionaires. Under this arrangement, railway infrastructure will remain the property of the Federal Government, while the concessionaires manage the rolling stock under lease and/or bring in additional rolling stock for their operations. The concessionaires should also carry out rehabilitation and maintenance of railway track structure and relevant infrastructure. This should be in line with the 25-Year Strategic Rail Development aimed at reviving the railway transportation sector in the country. This may bring about competition among the private sector operators and cause an effective change in the performance of the railway transportation sector.

In the short run, the financial situation of the NRC should be improved through better and sustained funding. Adequate funding for procurement of more locomotives and rolling stock, and improved condition of workshops should be provided. Indeed, the planned adoption of the PPP model does not mean that the government should totally abdicate its responsibilities to the private sector. There is a need to enact the railway act for the effective revival of railway transportation. The Railway Act that meets the current reality of the country is long overdue and the Railways Bill that was sent to the National Assembly for over five years has not been given the expeditious passage that it requires.

Inadequate locomotives are a major factor that affects the performance of railway transportation. It has therefore become imperative to develop and strengthen local capacity for the manufacture of locomotive and rolling stock spare parts. There were plans by the NRC to establish a rolling stock manufacturing plant in Kaduna, in conjunction with Daewoo Corporation of South Korea. This step would not only create job opportunities, but help in conserving foreign exchange used in procuring locomotives. In addition, the proposed Transport University in Daura, Katsina State that is expected to focus on manpower development and research and development in railway transportation is a welcomed development

In view of the fact that only 19 of the 36 States of the federation are connected by rail-lines, there is a need to extend the existing railway network to connect major town, seaports, and to the Inland Container Depots (ICDs) and Container

Freight Stations (CFS) and airports. Construction of the proposed East-West rail line connecting Lagos to Calabar should be given priority attention, while major cities in this country should begin to plan for the provision of intra-urban rail services partly to ease the problem of severe vehicular traffic congestion and to make them healthy and environmentally-friendly. Railway transportation can significantly contribute in minimizing urban GHG emission and to the transformation of the nation's economy.

Although this current study can be perceived to have realized its aim. It does however, suffer from the flaw that is common in archive research. Remarkably, the study's research design primarily depended on secondary data and sample cannot be representative. It was further limited by dearth of reliable data as from the year 2010. This implies that the findings are based solely on the biases of secondary data accumulated over four decades. Therefore, further research is required to incorporate recent years (from 2010 to date) in order to obtain more robust results that can be generalized for urban rail transportation system in Nigeria.

Declaration of Competing Interest

The authors declare no conflict of interest.

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