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Evaluation of the Installed Passenger Capacity Utilization Performance of the Nigerian Railway Services

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ABSTRACT

The annual volume of passengers carried by the Nigerian Railway Corporation (NRC) has been on progressive decline. This paper evaluates the performance of selected train stations in Nigeria in utilization of installed capacity for passenger carriage. The data for the study were sourced using structured questionnaires. Secondary data were obtained from online sources. Spearman's Rank Order Correlation technique was used to establish the strength of the relationship between active Installed Passenger Capacity (IPC) and the Actual Capacity Utilization (ACU). The analysis revealed significant ($P<0.05$) relationship with correlation coefficient (rho) of 0.892. Simple regression analysis was used to develop model for the relationships. The R Square was 0.840. A deterministic model for the relationship was developed and the study concludes that high downtime regimes and infrastructural inadequacy impact capacity utilization negatively. The study recommended scheduled preventive maintenance of trains and rolling stock, linking of high economic activity centres.

Keywords: Volume, Capacity Utilization, Traffic, Rolling-Stock, Downtime.

1. Introduction

The Nigerian Railway Corporation (NRC) as it is known today, started as the Government Department of Railways in 1898. It was created by an Act of the parliament of 1955 (amended in 1990) and renamed the Nigerian Railway Corporation (NRC).

The rail transport system was quite useful in the past years, before and after the nation's independence, so much so that it enhanced the operations of the colonial government, by linking the rural areas and hinterlands to the central seat of government. Then, it constituted approximately one-third of the national freight traffic (Adesanya, 2002).

Dina and Raji (2016) observed that industrialized nations of the world such as the United States of America, Japan, Australia, Britain, China, etc, have consistently developed their railways, improving speed, managerial expertise and coverage. For example, Rodrigue and Slack (2009) noted that portions of the French high speed rail system, can engage in a speed of up to 515km/hr. This also applies to the Chinese railway system.

Today in Nigeria, studies have shown that the rail system can no longer sustain itself, as the service operators are currently bedeviled with myriads of operational issues (Adesanya, 2010; Agunloye, 2008). Researchers lament persistent rot in the railway transport sub-sector in Nigeria, resulting to the loss of capacity to act as a vehicle for mass transit (Agunloye and Oduwaye, 2011; Odeleye, 2015; Ayoola, 2008; Faajir and Zidan, 2016).

2. Literature Review

The Theory of Performance

The Theory of Performance (ToP) as propounded by Don Elger in 2007, gives a good theoretical underpinning to this study as it identifies the components that holistically interact to establish levels of performance in various organisations.

According to Elger (2007), performance is a concept that is defined by set results or goals. To perform therefore, is to bring about prized results. McNamara (2005) observed that performance as a concept supposes that being busy is not the same as being productive. Folan, Browne & Jagdev (2008) outlined three priorities that govern performances in an organization:

a. RELEVANCE: Performance is construed with the mind of the supposed relevance of an entity to a given situation. In this instance, an organization may be assessed in line with its impact in a given area.

b. VISION/OBJECTIVE: Performance in this case is construed with specific objectives in mind. In this case, a company may be appraised in line with its vision as to what it wants to achieve in the future, not based on the vision or objectives of extraneous forces.

c. RECOGNISABLE CHARACTERISTICS: Performance may be reduced to recognizable characteristics that are of absolute relevance to the organization. One may assess an organization on the basis of such parameters as timeliness, cost, quality of products/services, etc.

3. Materials and Methods

Research Design: The study is basically quantitative. Correlation Research design was used, as it analyses the relationship between two or more variables.

The population for this study: All the active train stations as at the period of the study. Total of ten (10) active stations out of 27 identified major stations/terminals across the study area.

Sampling Technique: Stratified sampling technique used to classify the two railway districts in Nigeria (Eastern and Western rail lines) into various strata, based on the current level of functionality of stations/terminals. Stations were selected in order of functionality.

Purposive sampling technique: The purposive or judgmental sampling technique was employed to choose the functional stations/terminuses for data collection.

Sample size: Since the size is low, all 10 active stations formed the sample size for this study. 12 members of staff drawn from 7 designations on the basis of relevance of duties to the study were sampled. That gave a sample size of 120 members of staff.

Nature of Data: Ordinal data as the options available were ordered or ranked (<5, 6-10, 11-15, 16-20, >20). Where applicable, Likert scaling was introduced and scaled thus: Strongly agreed (1), Agreed (2), Neutral (3), Strongly Disagreed (4), Disagree (5).

Sources of Data: Primary: Structured questionnaires. Secondary: NRC as annual reports, interviews, journal articles, internet/online sources, releases from the National Bureau of Statistics; etc.

Method of Data Analysis: Spearman’s Rank Order Correlation technique was used to test the hypothesis and establish the strength of the relationships. Furthermore, a simple regression analysis was used to develop a model for the relationship.

4. Results and Discussion

Fleet Size

From the table above, it is observed that 13 respondents, representing 11.5% of total sample size observed that the estimated number of trains were about 5 or less. Following this, 23 respondents, accounting for 20.4% of respondents sample observed between 6 to 10 trains in the fleet. 11 to 15 trains were observed by 20 respondents who represented 17.7% of total sample size. 48 respondents, constituting 42.5% of total sample size estimated between16 to 20 trains, while 9 respondents estimated above 20 trains in the fleet. Overall, the study shows that the highest estimates points to the presence of 6 to 20 trains in the fleet.

Table 5.2: Estimate of the total number of active trains in the fleet.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5 trains or less	86	76.1	76.1	76.1
	6 - 10 trains	11	9.7	9.7	85.8
	11 - 15 trains	8	7.1	7.1	92.9
	16 - 20 trains	5	4.4	4.4	97.3
	Over 20 trains	3	2.7	2.7	100.0
	Total	113	100.0	100.0	

The table above shows that 86 respondents, representing 76.1% of total sample size observed that the estimated number of active trains was about 5 or less. 11 respondents, accounting for 9.7% of respondents sample observed number of active trains to be between 6 to 10 trains in the fleet. 11 to 15 trains were observed by 8 respondents who represented 7.1% of total sample size. 5 respondents, constituting 4.4%% of total sample size estimated between16 to 20 active trains in the fleet, while 3 respondents estimated above twenty active trains in the fleet. Overall, the study shows that majority of respondents point to the possibility of active trains being between 5 to 10 trains.

- **Installed Passenger Carrying Capacity**

Table 5.3: Least train passenger carrying capacity.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	100 passengers or less	24	21.2	21.2	21.2
	101 - 200 passengers	41	36.3	36.3	57.5
	201 - 300 passengers	21	18.6	18.6	76.1
	301 - 400 passengers	16	14.2	14.2	90.3
	Above 400 passengers	11	9.7	9.7	100.0
	Total	113	100.0	100.0	

Table above shows that 24 respondents, representing 21.2% of sample size observed that the estimated least passenger capacity of trains is about 100 passengers or less. Following this, 41 respondents, accounting for 36.3% of respondents sample observed that the least passenger carrying capacity is between101 to 200 passengers. 201 to 300passengers were observed by 21 respondents who represented 18.6% of total sample size as the least carrying capacity of the train. 16 respondents, constituting 14.2% of total sample size estimated the least passenger carrying capacity to be between 301 to 400 trains, while 11 respondents estimated a minimum carrying capacity of above 400 passengers. Overall, the study shows that an estimated minimum carrying capacity by respondents pointed to between 100 passengers to 400 passengers.

Table 5.4: Estimate of the total active passenger capacity of the fleet.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	500 passengers or less	48	42.5	42.5	42.5
	501 - 1000 passengers	29	25.7	25.7	68.1
	1001 - 1500 passengers	13	11.5	11.5	79.6
	1501 - 2000 passengers	15	13.3	13.3	92.9
	Above 2000 passengers	8	7.1	7.1	100.0
	Total	113	100.0	100.0	

The table shows that 48 respondents, representing 42.5% of total sample size observed that the estimated total active passenger capacity of train was about 500 passengers or less. Following this, 29 respondents, accounting for 25.7% of respondents observed that it is between 501 to 1000 passengers. 1001 to 1500 passengers were observed by 13 respondents who represented 11.5% of total sample size. 15 respondents, constituting 13.3% of total sample size estimated the total active passenger carrying capacity to be between 1501 to 2000 trains, while 8 respondents estimated a total active carrying capacity of above 2000 passengers. Overall, the study shows that the total active carrying capacity of trains as observed by respondents is between500 passengers to 2000 passengers.

Table 5.5: Estimate of the daily volume of passengers carried by the fleet.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	200 passengers or less	28	24.8	24.8	24.8
	201 - 400 passengers	49	43.4	43.4	68.1
	401 - 600 passengers	23	20.4	20.4	88.5
	601 - 800 passengers	8	7.1	7.1	95.6
	Above 800 passengers	5	4.4	4.4	100.0
	Total	113	100.0	100.0	

The table indicates that 28 respondents, representing 24.8% of total sample size observed that the estimated daily volume of passengers carried by the fleet was about 200 passengers or less. Following this, 49 respondents, accounting for 43.4% of respondents observed that to be between 201 to 400 passengers. 401 to 600passengers were observed by 23 respondents who represented 20.4% of total sample. 8 respondents, constituting 7.1% of total sample size estimated it to be between 601 to 800 trains, while 5 respondents estimated a total daily volume of passengers carried by the fleet of above 800 passengers. Overall, the study shows that the daily volume of passengers carried by the fleet is between 200 passengers to 600 passengers.

Table 5.6: Relationship between active installed passenger capacity (IPC) and the actual passenger-capacity utilization (ACU) of train.

			APU					Total
			< 200	201-400	401-600	601-800	>800	
IPC	< 500	Count	28	20	0	0	0	48
		% of Total	24.8%	17.7%	0.0%	0.0%	0.0%	42.5%

501-1000	Count	0	29	0	0	0	29
	% of Total	0.0%	25.7%	0.0%	0.0%	0.0%	25.7%
1001-1500	Count	0	0	13	0	0	13
	% of Total	0.0%	0.0%	11.5%	0.0%	0.0%	11.5%
1501-2000	Count	0	0	10	5	0	15
	% of Total	0.0%	0.0%	8.8%	4.4%	0.0%	13.3%
> 2000	Count	0	0	0	3	5	8
	% of Total	0.0%	0.0%	0.0%	2.7%	4.4%	7.1%
Total	Count	28	49	23	8	5	113
	% of Total	24.8%	43.4%	20.4%	7.1%	4.4%	100.0%

Source: Researcher's Field data 2020.Analysis from SPSS v. 25 software.

Table 5.7: Correlation analysis of the relationship between active installed passenger capacity (IPC) and the actual passenger-capacity utilization (ACU) of train in Nigeria.

			IPC	APU
Spearman's rho	IPC	Correlation Coefficient	1.000	.892**
		Sig. (2-tailed)	.	.000
		N	113	113
	APU	Correlation Coefficient	.892**	1.000
		Sig. (2-tailed)	.000	.
		N	113	113

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Researcher's Field data 2020.Analysis from SPSS v. 25 software.

The strength of the relationship already established between active installed passenger capacity (IPC) and the actual passenger-capacity utilization (ACU) of train in Nigeria was tested using correlation analysis. From the table above, the outcome of the Spearman's Rank Order correlation analysis of the responses of respondents on the relationship between active installed passenger capacity (IPC) and the actual passenger-capacity utilization (ACU) of train in Nigeria revealed a significant ($P<0.05$) relationship with a correlation coefficient (rho) of 0.892. As a result, it is established that active installed passenger capacity (IPC) and the actual passenger-capacity utilization (ACU) of train in Nigeria do have a significant relationship.

Table 5.8: The regression analysis model summary of the relationship between active installed passenger capacity (IPC) and the actual passenger-capacity utilization (ACU) of train.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.918[a]	.842	.840	.520

a. Predictors: (Constant), Estimate the daily volume of passengers carried by the fleet

Source: Researcher's Field data 2020.Analysis from SPSS v. 25 software.

From Table, the proposed model has an Adjusted R Square of 0.840 which implies that the installed passenger capacity (IPC) is a good predictor of the actual capacity utilization (ACU).

Table 5.9: The regression analysis coefficients on the relationship between active installed passenger capacity (IPC) and the actual passenger-capacity utilization (ACU) of train.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.384	.116		-3.313	.001
	ACU	1.144	.047	.918	24.304	.000

a. Dependent Variable: IPC

Source: Researcher's Field data 2020.Analysis from SPSS v. 25 software.

Having established a relationship between active installed passenger capacity (IPC) and the actual passenger-capacity utilization (ACU) of train in Nigeria, we proceed to obtain a deterministic model for this relationship using regression analysis as shown in Tables 5.8 and 5.9 respectively. From the preceding results in Table 5.9, a deterministic model was developed as follows:

Model:

$$IPC = -0.384 + 1.144\, ACU$$

The model implies that for every additional actual passenger-capacity utilization, the overall installed passenger capacity increases by 1.144.

5. Discussion of findings

a. Positive significant relationship between active installed passenger capacity (IPC) and the actual passenger-capacity utilization (ACU) of train in Nigeria?

It is established that where there is improvement of the passenger carrying capacities of the trains, there would be corresponding improvement on the actual passenger carriage. This means that for a unit addition in capacity, there would be a unit additional increase in utilization of capacity.

b. High Train Downtime Regime:

Trains, according to the NRC operators sometimes spend more than one year in the workshop; depending on the fault to be fixed. This goes to show that the stock of spare parts is a challenge, despite the huge profit.

c. Installed passenger capacity of the fleet of Nigerian Railway Corporation is grossly underutilized:

Owing to frequent breakdowns and high downtime regime, the average daily utilization of overall fleet size capacity of an average station or terminus is very low. Consequently, the frequencies of operations, maintenance of departure and arrival timelines are not guaranteed.

6. Recommendations

Preventive Maintenance of Trains and Rolling Stock

The management of NRC and ARMT should ensure scheduled train and rolling stock maintenance. Scheduled preventive maintenance would help reduce incidences of breakdowns in transit and attendant high downtime regime, and make for increase in capital gains.

Total Rehabilitation of Existing Rail Infrastructure

Government must devote more efforts at the gradual replacement of the sleepers of the narrow gauge lines that have become obsolete and dangerous, with standard gauge tracks. Currently, most of the segments of the Nigerian rail network, especially the eastern district have been cut off intermittently from their origin or destination.

Breaking of Government sole right over Rail Transport Industry

The Nigerian Railway Act of 1955 (amended in 1990) which grants government the exclusive right over railway transport should be amended to allow private investors to operate. Competition brings about high service quality.

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