Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.3, No.10, 2012

The Impact of the Quality of Transport Infrastructure on the Nigerian Economy

Ikpechukwu Njoku [1*] Urael Ikeji [2]
1. Transport Management Technology Department, Federal University of Technology, Akure, Nigeria
2. Stores Unit, Alvan Ikoku Federal College of Education, Owerri, Nigeria
*ikpechinjoku@yahoo.com

Abstract
This study investigates the effect of the quality of transport infrastructure on the Nigerian economy. The Budgetary Allocation to Transport and the Contribution of the Transport sector to the gross domestic product (GDP) were used for the computation of estimates. First, it was hypothesized that the contribution of the transport sector to the economy does not increase with investment in transport infrastructure. Pearson Correlation Coefficient r was used in testing this hypothesis and the result showed a positive r value of 0.63 which was statistically significant. Hence, the alternative hypothesis which states that the transport sector's contribution to the economy increases with investment in transport infrastructure was accepted. Second, it was also hypothesized that there was no significant contribution to the GDP by the transport sector. Analysis of Variance was used with Multiple Regressions for testing this hypothesis. The output showed a significant R value of 0.98 and R^2 of 0.97. Therefore, the alternative hypothesis which states that there was significant contribution to the GDP by the transport sector was equally accepted. Insufficient funding was identified as the bane of growth of the transport sector. The study finally suggests that policymakers should prioritize appropriate and adequate investment on transport infrastructure towards building a viable economy.
Keywords: infrastructure, transport, investment, economy

1. Introduction

Transport infrastructure is the fixed part of transport such as the road and rail, its environs, plus signs and signaling. It also includes transport terminals, depots and interchange, airports, seaports and canals (David, 2001). Transportation is the aspect of general business that deals with the movement of passengers and goods from points of origin to points of destination. It moves idle resources from points of low value to points of higher value and demand. Transportation therefore governs world trade, commerce and industry. It controls production or manufacturing. It is the pivot of any economy. It is the hub upon which the wheel of the economy revolves (Njoku, 2009). The elasticity of demand for transport depends on the elasticity of demand for the commodity being transported as well as on the proportion of transport costs in the value of the delivered product. Also, studies on Nigeria's economy suggest that transportation costs have a significant proportion of the final price of most goods – agricultural, manufactured and mining products. On the average, transport accounts for more than 30% of the value of the delivered product. The high cost is due to the inadequacy and inefficiency in Nigeria's transport infrastructure (Olanrewaju and Falola, 1986). Inadequate provision of transport infrastructure tends to increase the journey time of goods delivery of both industrial raw materials and finished goods. This is so, because poor road condition and port inefficiency increase travel time and reduce the reliability of transport services. The delays in the delivery of industrial goods could result in stoppage of the use of expensive machinery because the spare parts to be used arrived late, or have not arrived at all due to inefficient transport system. In order to avoid unplanned stoppage of production, occasioned by delayed deliveries of industrial raw materials, stocks pilling of these raw materials are embarked upon thereby increasing handling and inventory cost, including warehousing. Delayed deliveries increase the cost of industrial production since goods held up during delayed delivery is capital held up. Travel time saved on the shipments of freight is observed to be more valuable in developing countries like Nigeria than in more advanced countries (Njoku, 2009). Again, freight tied up during transit due to poor road and rail condition is, in fact, capital tied down. This capital becomes particularly important in a country like Nigeria where capital is in short supply. Also, production is not complete until the goods reach the final consumer. Delivery time/transit time is no longer predictable due to poor road condition and port inefficiency.

Table 1. Cost Items of Road Freight Transport in Nigeria

ROUTES	ITEMS	NATURE OF ROAD	
		GOOD	BAD/POOR
Lagos – Aba 650km	Fuel consumption (liters)	375	500
	Journey time (hours)	9	15
Lagos – Kaduna 825km	Fuel consumption (liters)	500	575
	Journey time (hours)	10	14
Lagos – Enugu 600km	Fuel consumption (liters)	325	375
	Journey time (hours)	8	12

Source: Dolf Madi Consulting (2005)

In addition to the increased journey time and cost of travel (as in Table 1); there is also an increase in the cost of maintaining the vehicles. Indeed, maintenance cost of vehicles tends to be very high due to poor condition of roads. This includes the material cost, labour cost and down time cost of the vehicle. Vehicles parts most frequently affected include clutch and clutch plate related problems, braking system, gas-related problems, suspension system and engine. The down time of vehicles in the workshop reduces availability and the utilization rate.

Poor road conditions in Nigeria impact negatively on users by increasing the cost of consumer goods since cost per ton of goods transported increases. Apparently, an average of ₦8 per ton/km is charged to transport goods in Nigeria by road (Okoroafor, 2004). The incidence of this is passed on to the final consumers since the industrial establishments must pass the incidence of high cost to the final consumers. In effect, unit cost is observed to increase thereby helping to sustain the high inflationary trend in the cost of goods produced in the country. There is also the case of increasing rate of accidents due to the deteriorating states of roads. For the industrial users, accidents rate can be viewed as a resource cost. In this way, accidents impact negatively on industrial users through loss of items of human and material resources. The cost of shipping is doubled due to inadequate transport infrastructure. This situation increases cost and reduces travelling activities by some 25% and impact negatively on the GDP by some 0.5% reduction (Okoroafor, 2004).

In addition, there is also the case of loss of man-hours due to poor road network. Again, this has a serious impact on the economy. A total of 370.35 hours were estimated to have been lost in 2003 while travelling due to the poor state of roads in Nigeria. This estimate was based on only 53, 250km out of 194, 000km of roads that have an average daily traffic (ADP) of more than 30 vehicles. In putting values to the man-hours lost using the marginal productivity of factor based on the then Federal Government, a total of ₦9,462, 620, 544 billion was lost in 2003 due to poor/inadequate road infrastructure provision (Ibe , 2003). Another impact of inadequate provision of transport infrastructure on the economy is the issue of low level of competitiveness of our goods and the consequent high cost of transportation. The unreliable and erratic transportation situation results in high cost of goods in Nigeria thereby making it difficult for Nigerian goods to be competitive both in the domestic and international markets (Buhari, 2000).

The contribution of the transport sector to the economy of Nigeria if considered via the GDP tends to stagnate or decline at about 3% of GDP (Table 2). Indeed, the sector's real contribution to GDP increased from 5.98% in 1981 to 6.71% in 1982. Thereafter, it declined to 4.12% in 1984 before it continuously declined to its lowest of 3.12% in 1991. It, however, increased marginally to 3.59% in 1996 and 3.9% in 2000. Specifically, road sub-sector's contribution declined from 5.17% in 1981 to 2.78% in 1991 and 2.15% in 2000. The rail sub-sector declined from 0.15% in 1981 to 0.02% in 1990. In 1991, it increased to 0.03% and declined further to 0.02% for the three consecutive years 1992, 1993, and 1994. Its contribution for 2000 was 0.13%.

Table 2. Transport Sector (%) Contribution to GDP at 1999 Factor Cost

YEAR	ROAD	RAIL	OCEAN	AIR	TOTAL
1981	5.17	0.15	0.46	0.20	5.98
1982	5.93	0.17	0.38	0.23	6.71
1983	3.26	0.16	0.61	0.26	4.29
1984	3.31	0.11	0.43	0.27	4.12
1985	3.38	0.12	0.34	0.25	4.09
1986	3.34	0.11	0.24	0.21	3.90
1987	3.39	0.08	0.23	0.21	3.91
1988	3.12	0.06	0.23	0.18	3.59
1989	2.97	0.04	0.18	0.16	3.35
1990	2.80	0.02	0.17	0.15	3.14
1991	2.97	0.03	0.17	0.14	3.12
1992	2.80	0.02	0.16	0.14	3.16
1993	2.93	0.02	0.15	0.11	3.21
1994	3.94	0.02	0.14	0.10	3.20
1995	2.91	0.03	0.14	0.10	3.18
1996	2.99	0.04	0.35	0.21	3.59
1997	3.30	0.12	0.236	0.23	4.01
1998	3.30	0.07	0.28	0.27	3.72
1999	2.92	0.05	0.22	0.17	3.36
2000	2.15	0.13	0.38	0.26	3.92
2001	2.77	0.001	0.19	0.04	3.08
2002	2.97	0.001	0.21	0.05	3.31
2003	2.96	0.001	0.24	0.04	3.23
2004	4.08	0.001	0.26	0.04	4.33
2005	5.29	0.001	0.20	0.05	5.54

Source: Federal Office of Statistics

Although planned investment in the transport sector witnessed a slight shift of emphasis to water and air transport in the Rolling Plans of 1991–1993, and 1994–1995, the road sub-sector still accounted for over half of the total investment (Table 3).

Table 3. Federal Allocation to Transport Sector (1991 - 1999) Rolling Plan Periods

PLAN PERIOD	ROAD (%)	RAIL (%)	WATER (%)	AIR (%)	TOTAL (MILLIONS)
1990-1992	70.14	14.03	7.24	8.60	2,210,000
1991-1993	52.42	12.95	19.41	15.22	2,695,428
1993-1994	59.65	6.23	15.91	18.21	8,379,446
1994-1995	56.67	1.33	22.92	19.09	6,017,250
1996-1997	40.23	42.16	15.98	1.62	28,491,420
1998-1999	32.03	32.93	26.19	8.86	52,310,162
AVERAGE	51.86	18.27	17.94	11.93	-

Source: extracted from Rolling Plans (1990 - 1999)

Table 4. Modal Distribution of Public Planned Capital Investment in Transport (%)

PLAN PERIOD	ROAD	RAIL	AIR	WATER
1962-1968	54	14	7	25
1970-1974	59	17	11	13
1975-1980	72	11	8	9
1981-1985	70	15	6	9
1992-1994	50	12	18	20
1994-1996	57	10	19	23

Source: Percentage calculated from the various plans (1962-1996)

The importance attached to the road subsector is reflected in Government's resource allocation to it in the last four decades. The road subsector, which accounted for 54% of the Federal Government's total public sector planned capital investment in transport in the 1962–1968 First National Development Plan, received more than 70% of the allocations during the Third (1975 - 1980) and Fourth (1981 - 1985) Development Plan periods.

Tables 3 and 4, show plan allocations and actual expenditure on transport sector. The fact remains that there has been a disproportionate share between the modes. The greatest allocation was given to the road mode and in

terms of the actual expenditure; the results of the huge differentials in the intermodal shares of total transport investment over the four National Development Plan Periods show that:

a) While railway *kilometerage* had remained more or less static since 1965 or so, the road network has more than doubled.
b) The railways had been treated with neglect as far as improvement and modernization of its infrastructural facilities are concerned.
c) The nation has been made to pay very high social costs arising from more wasteful use of energy by road transport and huge maintenance cost due to heavy trucks engaged in road haulage over long distances (Oni, 2004).

1.1 Objectives and Hypotheses

The objective of this paper is to investigate the effect of the quality of transport infrastructure on economy and to compare the performance of transport industry with respect to funding.

Hypothesis 1: The contribution of the transport sector to the economy does not increase with investment in infrastructure.

Hypothesis 2: Transport sector's contribution to the GDP is not insignificant.

2. Methodology

2.1 Sources of Data

The data employed in the course of this research work were mainly Secondary data. They were obtained from the National Bureau of Statistics (NBS), Federal Ministry of Transport Abuja, Dolf Madi Consulting, related literatures from the internet, journals, textbooks, dissertations, magazines and periodicals.

2.2 Analytical Techniques

Hypothesis I which states that the contribution of the transport sector to the economy does not increase with investment in infrastructure was tested by analyzing the data in Table 5 with Pearson Product Moment Correlation Coefficient. It is designated as:

$$r = \frac{n\sum xy - (\sum x)(\sum y)}{(\sum x^2 - (\sum x)^2(\sum y^2 - (\sum y))} \dots\dots\dots (1)$$

Where: *n = number of pair sample x, y*

Equally, Hypothesis II which states that transport sector's contribution to the GDP is not insignificant was tested by analyzing the data in Table 2 with ANOVA and Multiple Regression Statistic. The equation of the model is expressed as:

$$Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + e \dots\dots\dots (2)$$

Where:

$y = GDP\ at\ 2003\ current\ factor\ cost$

$x_1 = road\ transport\ mode\ contribution\ to\ the\ GDP$

$x_2 = rail\ transport\ mode\ contribution\ to\ the\ GDP$

$x_3 = ocean\ transport\ mode\ contribution\ to\ the\ GDP$

$x_4 = air\ transport\ mode\ contribution\ to\ the\ GDP$

Further to this investigation, the Trend Analysis was used in explaining hypothesis II. Data were analyzed using the method of least squares. The method is similarly applied in fitting a trend line. The equation of the trend line is defined as:

$$y_t = a + bt \dots\dots\dots (3)$$

Where:

$y_t = the\ estimated\ trend\ value\ for\ a\ given\ time\ period$

$a = the\ trend\ line\ value\ when\ t = 0; i.e.,\ a = \bar{y} - b\bar{t} \dots\dots\dots (4)$

$b = \text{the slope of the trend, } \frac{\Delta y_t}{\Delta t}$; $i.e.,$

$$b = \frac{n\sum ty - (\sum t)(\sum y)}{n\sum t^2 - (\sum t)^2} \dots\dots\dots (5)$$

$t = the\ time\ unit (where\ x = t)$

3. Results and Discussion

Data in Table 5 were used in running a correlation between transport sector funding and the sector's Contribution to the GDP with the view to testing Hypothesis I and the result and discussion is below the table.

Table 5. Data for Test of Hypothesis I*

Year	Allocation to Transport Sector (₦'000)	Transport Sector's Contribution to the GDP (₦'000)
1990	1,105,000	8,537.91
1991	1,105,000	9,405.09
1992	4,273,031	16,947.24
1993	4,273,031	22,089.19
1994	4,273,031	28,928.15
1995	4,273,031	61,527.63
1996	14,245,710	97,066.74
1997	14,245,710	112,359.10
1998	26,155,080	101,227.84
1999	26,155,080	111,335.72
2000	9,604,800	185,318.89
2001	53,176,100	165,529.51
2002	53,176,100	206,287.26
2003	29,309,400	195,792.91
2004	15,046,000	279,506.29

*Source: Tables 3 and 4

3.1 Coefficient

$r = 0.629$

$t = 2.915$

The summary output of the correlation coefficient shows that (r) has a positive value of 0.63 and the test of its significant (t) is 2.92. Since the calculated r is statistically significant the alternative hypothesis is accepted to conclude that the transport sector's contribution to the economy increases as investment in infrastructure increases.

3.2 Regression Results

In order to test the validity of Hypothesis II, the data in Table 2 were analyzed using the ANOVA and the dependent and independent variables were designated as stated in the methodology and the result is as follows:

Table 6. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.986	.973	.967	414800.186	1.533

a. Predictor (constant), X4, X1, X2, X3

b. Dependent Variable: Y

Table 7. ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	1.17E+14	4	2.917E+13	169.512	.000
Residual	3.27E+12	19	1.721E+11		
Total	1.20E+14	23			

a. Predictor (constant), X4, X1, X2, X3

b. Dependent Variable: Y

The Multiple R is the correlation between the dependent variable and independent variables and its value is 0.986 while R^2 with the value of 0.973 is the percentage of variance of the dependent variable that is explained by the independent variables. The calculated (F) is 169.51 while the table value of (F) is 2.90. Since the calculated (F) is greater than the tabulated (F) i.e. $F_{cal} = 169.51 > F_{0.95}(4, 19) = 2.90$; the null hypothesis is therefore rejected to conclude that the contribution of the transport sector to the GDP is significant.

3.3 Fitting a Trend Line to the Least Square Method

In this section, data collected (Transport Sector Contribution to the GDP against time in Table2) were analyzed using the Least Square Analysis Method in MS Excel and the discussion of the results followed thereafter.

From the computation,

$$a = 4.39 \text{ and } b = -0.0429$$

$$\text{Recall that } y_t = a + bt$$

$$\therefore y_t = 4.4 + 0.04t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

The origin corresponds to 1981 and t is in units of year. The intercept is the fitted trend value reflecting the percentage contribution of the transport sector to the GDP in the base year, 1981. The slope indicates that such contributions are decreasing at the rate of 0.04% per year. To fit the trend line to the observed years of the series, we substitute appropriate coded values of t into Equation (6). Figure 1 shows the scatter diagram and a straight line trend of this analysis.

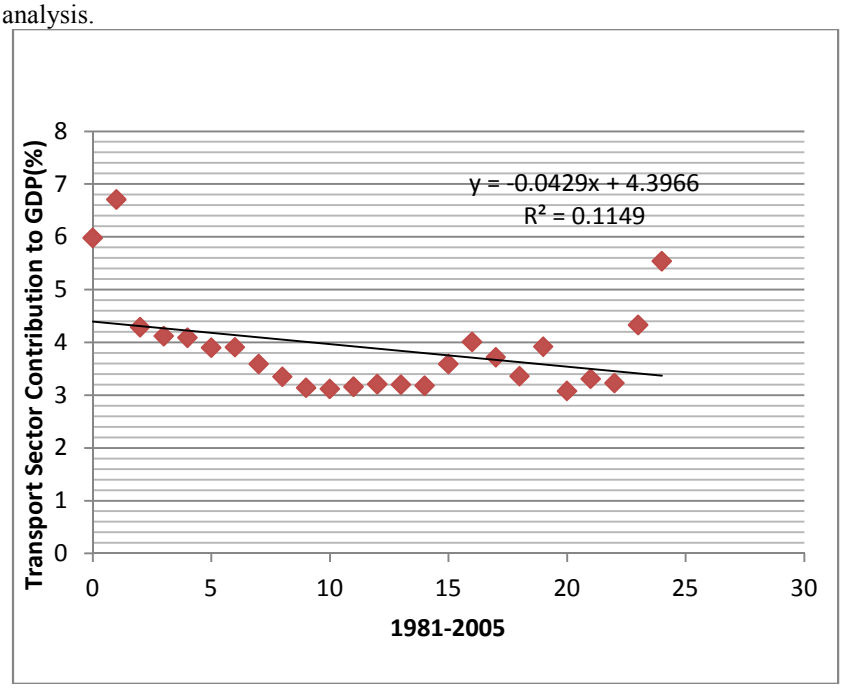

Fig 1. Scatter Diagram and Trend Line

It is observed that the figure 1 shows a negative or downward trend which is in conformity with the value of b calculated using the least square method. This implies that even though contribution of transport sector to economy has been significant, the trend has declined continuously.

3.4 Further Analysis of the Impact of the Quality of Transport Infrastructure on Economy

Between 1990 and 1992, a sum of ₦2, 210,000 was budgeted for the transport sector and the contribution of the sector to the GDP for the three years were 3.14%, 3.31% and 3.12% respectively. In the 1991–1993 Rolling Plan, the sum of ₦2, 695,428 was spent on the sector. It contributed only 3.21% to the GDP in 1993. Between 1993 and 1995; N8, 379,446 was earmarked for the sector and it contributed 4.2% of the GDP in 1994. Of course, the GDP of the sector appreciated, probably because of the slight increase in budgetary allocation. Significantly, the allocation increased to ₦28, 491,420 in the 1996–1998 Rolling Plan. The contribution of the sector to the GDP appreciated by 3.59%, 4.01% and 3.92% in 1996, 1997 and 1998, respectively (Tables 2). This is an indication that appropriate and adequate funding of the sector will enhance its contribution to the economy.

However, this does not mean that there have been adequate investments to the industry. This also reflects on the sector's contribution to the GDP. For most advanced economies, it contributes between 11% and 16% while for emerging economies like ours it is between 3 and 6%. The investment into the sector has been consistently inadequate. In the year 2000; ₦9, 604,800 of the budget was allocated to transport. But in the years 2001, 2002, 2003, 2004 and 2005; only 5.01%, 4.49%, 2.39%, 1.23% and 1.52% of the respective budgets was earmarked to the sector.

4. Conclusion

The result of Hypothesis I showed that the increased investment in the transport sector impact positively on the returns it made to the economy. This means that returns has a direct relationship with investment. In other words, improving the quality of transport infrastructure enhances the quality of the sector's services which has a multiplier effect on other aspects of the economy. It is also evident from the result of the test of Hypothesis II that the transport sector has contributed significantly to the GDP since the calculated F (169.51) is greater than the tabulated F (2.90).

Figure 1 showed a downward trend confirming the value of the slope b computed by the least square method. This indicates that the contribution of the transport sector to the GDP over the years has not been constant but declined steadily. This could be probably informed by the fact that government did not sustain her pace of transport infrastructural development in the years under review.

Based on these standpoints, a conclusion is drawn that appropriate and adequate investment in transport infrastructure is a catalyst to the economic growth of Nigeria. This is because the situation improved at some points on the graph (Fig. 1) where investment in transport infrastructure increased transport sector's contribution to GDP improved. This goes a long way to show that if substantial amount of fund is invested in transport infrastructure, the sector will contribute much to the economic growth of the nation. The pace of transport infrastructural development in Nigeria is low. Thus, it can be observed from figure1 a negative or downward trend which is in conformity with the value of b calculated using the least square method. This implies that even though contribution of transport sector to economy has been significant, the trend has declined continuously.

5. Recommendations

Public ownership and private sector operations of the transport infrastructure should be encouraged. The construction of transport infrastructures like roads, bridges, seaports, airports, railways, viaducts, tunnels and canals are capital intensive. So, government should provide such infrastructures and handover the management to private sector by lease, concession or partial privatization to ensure efficiency.

Private sector should hence-forth be involved in the transport infrastructure planning and development as a part of the present administration. Since ineptitude and other factors have adversely affected public transport infrastructure and business like the Nigerian National Shipping Line, Nigeria Airways, road maintenance, port operation etc in Nigeria and the private sector has proved to be capable of running this sector efficiently and as such should be involved in the planning and development transport infrastructure.

Government should take legislative, policy and fund intervention measures to develop our transport infrastructure. Government should ensure that most of international transport conventions are domesticated through the National Assembly. More so, government should ensure the establishment of specialized banks for the transport sector. This will enable those wishing to go into transport business to acquire loan and by so doing the transport sector grows rapidly.

Government should set up Transport Regulatory Commission which will provide regulatory roles while the private sector provides the operational requirement. Transport business should not be all comers' affairs. Thus, Transport Regulatory Commission should provide standards to ensure safety and the Road Safety Commission should be actively involved in enforcement of such standards.

Inadequate transportation network and transport infrastructure have long hindered Nigeria's internal economic development. Therefore, a holistic strategy involving the overall improvement of all the modes is required. Consequently, a Master/Blue Print should be evolved instead of uncoordinated approach for all the modes.

References

Buhari, M. (2000), " The Role of Infrastructural Development and Rehabilitation in Sustainable Economic Growth in Nigeria" , A paper presented at the All Peoples Party Economic Summit held at the Ladi Kwali Conference centre, Abuja, (www.buhari2003.org)

David, L (2001), "The Dictionary of Transport and Logistics", Kogan Page publishers, London

Dolf Madi Consulting (2005), "Final Copy of the Research on Road and Rail Infrastructure Projects in Nigeria"

Federal Ministry of Transport, Abuja (2003), Annual Statistics, 1993–2002

Ibe, C.C. (2003), "Railway Restructuring in Nigeria", unpublished PhD Thesis submitted to the Department of Transport Management Technology, Federal University of Technology, Owerri, Nigeria

National Bureau of Statistics (2005), National Accounts of Nigeria

Njoku, I. (2009), "Evaluation of Transport Infrastructural Development in Nigeria and its Effect on the National Economy", M.Sc. Thesis at the Federal University of Technology, Owerri, Nigeria

Olanrewaju, S.A. & Falola, T. (1986), "Introduction to Transport Systems in Nigeria", Syracus University

Oni, S.I. (2004a), "Development of Urban Transportation in Perspectives on Urban Transportation in Nigeria", Vandu-Chikolo *et al* (ed.), The Nigerian Institute of Transport Technology, Zaria, pp.53-69

_____ (2004b), "Urbanization and Transportation Development in Nigeria", 1950 – 1999, Adejugbe, M. (ed.), Lagos: Concept