Journal of Pol Dev Studies
DOI: 10.12816/0045328

An Open Access Journal
Vol. 11 (4), 2018

ARABIAN GROUP OF JOURNALS

Journal of Policy and Development Studies

JPDS Journal Pol Dev Studies

Research Article | Homepage: www.arabianjbmr.com | Arabian Group of Journals

ECONOMIC COSTS AND BENEFITS OF ROAD REHABILITATION: EVIDENCE FROM AKURE-ILESA ROAD IN ONDO AND OSUN STATE, NIGERIA

Simon-Oke, O.Olayemi & Umokoro, E. Blessing
Department of Economics, Federal University of Technology, Akure, Ondo State, Nigeria
Corresponding E mails: oosimon-oke@futa.edu.ng;yempej@yahoo.com

Abstract

Apart from the usual financial estimates set up for all manner of construction projects in Nigeria, there seems to be dearth of information on the economic costs and benefits of most public projects to end users. Hence, the preoccupation of this study with special reference to Akure-Ilesa road rehabilitation project in Ondo and Osun State, Nigeria. The study employed some non-parametric statistics such as Benefit-Cost Ratio (BCR), Chi Square and correlation method of analysis. The result showed that benefits outweigh costs, with the positive value of Benefit-Cost ratio estimated at 1.67. The Correlation result also showed positive association between the measures of real costs of the road (travel time: r=0.783; armed robbery cases: r =0.813; accident scenes witnessed: r=0.958 and breakdown of vehicles=0.952) before and after rehabilitation. The study also discovered no significant difference between accident scenes witnessed (χ^2= 1.617, p > 0.05); breakdown of vehicles (χ^2= 0.668, p > 0.05) before and after road rehabilitation; while a significant difference exists between time travel (χ^2= 169.035, p < 0.05) and armed robbery cases (χ^2= 82.107, p < 0.05) respectively before and after road rehabilitation. The study concludes that, the rehabilitation of Akure-Ilesa road has reduced armed robbery cases and vehicle operating costs, ensures prompt arrival to destination. Therefore, it is expected that the culture of new road constructions and rehabilitation of the existing ones would be imbibed by government at all levels; while public partnership with government on road constructions should also be encouraged.

Keywords: Costs and Benefits Evaluation, Road Rehabilitation, Akure-Ilesa, Ondo and Osun, Nigeria.

Introduction

Cost–benefit analysis (CBA), sometimes called benefit–cost analysis (BCA), is a systematic approach to estimating the strengths and weaknesses of alternatives (for example in transactions, activities, and functional business requirements); it is used to determine options that provide the best approach to achieve benefits while preserving savings (3). (3) further defined CBA as a systematic process for calculating and comparing benefits and costs of a decision, policy (with particular regard to government policy) or (in general) project; and also estimates the strengths and weaknesses of project or activity by calculating and comparing its costs and benefits in order to justify the project. Depending on when the analysis is undertaken (before, during or after an activity), Cost-Benefit Analysis can provide information to help assess whether a project or activity will be or is worthwhile. It initially considers two to three alternatives to find the best net gain for the society. However, a particular project giving the highest net gain may not be the one chosen, as the sectors of society who gain and those who lose may not be distributed fairly (2).The growing world population and its inherent need for increased road transportation is straining the existing transportation infrastructure and creating the need for mega-projects. The

transport sector provides an example of a non-traditional channel to promote social, economic, and gender equity. Access to transportation on safe roads has a direct impact on the economic standing and quality of life in affected communities. Communities are affected through increased opportunities for buying and selling, availability of emergency health care, and stronger familiar links (8).

Nigeria has a total land area of about 925,000 sq. Km with a total road network estimated at 200,000 km shared among the three tiers of government, out of which 65,000 km are paved. Also, 90% of all inland transportation is by road. Integrated road infrastructure development in Nigeria dates back to 1925, when the Road Board was established by the then colonial administration (5). The Board had the responsibility to evolve blueprints for trunk road network, connecting major administrative centers in the colonial time. As at 1951, 1,782km out of the total of 44,414km of road built in Nigeria was surfaced (5). The roads were however lacking in standard designs and were in single lane, with sharp bends and poor drainage system. The growth of economic activities prompted the need for improvement in roads. Consequent upon this, the quality of road construction was improved as the length and network continued to increase such that by 1952, 15,785km of bituminous surface and 75,200km of earth/gravel surface roads were already in place in Nigeria (5). Meanwhile, the Federal Ministry of Works classified Nigerian road system into four broad categories namely:

The Federal Trunk 'A' Roads

These are under Federal Government ownership which are developed and maintained by the Federal Government. Akure-Ilesa road belongs to this category;

The Federal Trunk 'F' Roads

These were formerly under state ownership, but were taken over by the Federal Government, with a view to upgrade them to Federal highway standards;

The State Trunk 'B' Roads

These are under the ownership and management of the component states; and

The Local Government Trunk 'C' Roads

These are under Local Government ownership and management.

Each tier of government has the responsibility for planning, construction and maintenance of the network of roads under its jurisdiction. Meanwhile, the Federal Government embarked on Akure-Ilesa road rehabilitation, with the major source of funding being the annual budgetary provision (5). The Akure – Ilesha Road passes through Ondo and Osun States in Nigeria. The road rehabilitation project commenced on the 25th of November 2013, with a completion date of 26th August 2015. The 66.354km long Akure - Ilesha road starting from the Akure/Ado-Ekiti junction road at the outskirt of Akure also forms part of the Ilesa – Akure – Owo – Benin Road, Federal Trunk Road, Route No. 35, which links to the South – West and South - South zones of the country as well as the Federal Capital Territory, Abuja. The road has a single two-lane carriageway of width 7.3m with 2.75m wide shoulder on either side of the carriageway.

The existing pavement structure consists of laterite sub-base and crushed stone base courses overlaid with one lay of asphaltic concrete binder and two layers of asphaltic concrete wearing courses. The road was first constructed according to the Federal Ministry of Works in the late seventies and part of it (Akure- Owo stretch) was last rehabilitated in 1998 by the defunct Petroleum (Special) Trust Fund (12). Before rehabilitation began on Akure-Ilesa road, several sections of the road had already failed and were in a deplorable condition with potholes in the pavement and breakaway of the edges of the carriageway. There were deposits of sand on the carriageway due to erosion along the road at some locations, which has reduced the carriageway width of the road in such places. Vegetation had also covered the verges and shoulders at some locations thus reducing the effective capacity of the road. Similarly, reduction of the width of the carriageway occurred as a result of sand accumulation through flooding at some sections of the road. This had a negative impact on the road users. Now that the road had been rehabilitated, the magnitude of such infrastructure investment creates a thoughtful idea to assess the real costs and benefits of the project cut across the two states. This study further considers the Benefit- Cost ratio of Akure-Ilesa road before and after rehabilitation as well as the real costs of the road to users before and after rehabilitation.

The paper is made up of five sections. Section one is essentially an introduction, providing a broad perspective of the paper as well as its motivation. Section two provides theoretical and empirical review. Section three discusses methodology issues, while results and discussion were presented in section four. The paper was finally concluded in section five.

Literature Review

Theoretical Review

To understand the imperatives of infrastructure provision in socio-economic development, Brett Frischmann's Economic Theory of Infrastructure and Commons Management is adopted. His theory states that certain important resources should be equitably used for the benefits of all members of a society. This theory explains the importance of public accessibility to infrastructure. A major thrust of the theory is the fact that open access to infrastructure would generate significantly positive results for a society (6). A key part of Frischmann's argument is that infrastructure has important spillover effects that accrue to third parties in accidental, incidental and unexpected ways. In considering roads, telecom and other types of infrastructure, Frischmann repeatedly exposed how conventional economic theory overlooks the actual economic and social benefits that infrastructure has when managed as commons (openly accessible to all within a community regardless of their identity or intended use).

He takes to task, for example, the habit of regulatory economies to discount the importance of market externalities, both positive and negative, because they often cannot be easily identified or measured or because their benefits accrue to third parties (not buyers and sellers). Frischmann derides this habit, noting that it ignores the importance of "non-market goods" such as environmental benefits, social capital and quality of life intangibles. This is in line with the Infrastructure resources such as the resources employed for the rehabilitation of Akure-Ilesa road, which are intermediate capital resources that serve as critical foundations for productive behaviour within economic and social systems. Infrastructure resources effectively structure in-system behaviour at the micro-level by providing and shaping the available opportunities of many actors.

Another theoretical school of thought which was also central to this study is the Welfarists school. Welfare economics is concerned with the evaluation of alternative economic situation from the point of view of the society's well-being. For example, if the present position of the society stood at P, and a new policy is propounded in the form of a new project, such that the outcome of the policy can improve on P to P* whereby P*>P, then it is socially desirable. To evaluate this point, Cost-Benefit Analysis could be used adequately. That is, by subjecting the whole situations into costs and benefits and to see whether benefits outweigh the costs. This type of evaluation is precisely the subject matter of welfare economics. The objective of welfare economics is the evaluation of the social desirability of alternative economic state. Where benefits outweigh costs, it will be that point of B>C which will be the preferred state, and will have that ability to give satisfaction or utility. Thus, this means that gains could also be defined as utility or welfare. The objective of a nation is to move the society to a state of economy that promises the maximum utility or welfare (9).

Welfare economics also concentrates on changes in resource use. It is a tool for evaluating the economic consequences of changes in patterns of resource allocation. Although CBA can be broadly applied to any choice which is constrained by limited resources or opportunity, it finds particular application in areas of public sector, where the market does not provide adequate or complete signals to guide resource allocation. An Example of such is a public road project like the rehabilitation of Akure-Ilesa road in Ondo and Osun state of Nigeria.

Empirical Evidence

Several studies have also used Cost-Benefit Analysis for selecting and justifying preferred alternative investment projects. One of such studies was carried out by (7) on ex-post Cost-Benefit Analysis of Bolu Mountain Tunnel project in Ankara, Turkey. The project was one of the most costly highway projects in Turkey. From the research findings, the benefit cost ratio showed 0.29 at 12% discount rate. When it was recalculated using an alternative scenario the BCR value showed 0.51 at 12% discount rate. Based on the outcome, it was concluded that since the values of BCR were less than 1 in both cases, Bolu Mountain Tunnel project was not worth embarking on. Another study was also conducted by the Washington Department of Transportation in the United States to compare the economic benefits of implementing the proposed Cross Base Highway (State Route 704) with the widening of current roads or transit enhancement (13). Three different

construction alternatives were proposed for the project. Alternative-1 was named as the Build alternative, which indicated the construction of a 6 mile limited access highway to connect I-5 in the west and State Route 7 in the east across Ft. Lewis and Mc Chord Air force base. Alternative-2 was the widening of State Route 7 which included addition of another general purpose traffic lane in both directions of State Route 7, between State Route 512 in the north and State Route 507 in the south. Alternative-3 was the transit enhancement which involved the building of a light rail system from Spanaway in the east to Lakewood in the west. CBA of these projects showed that Alternative-2 had the highest benefit-cost ratio compare to the other alternatives (10).

The literature also concludes with other studies like(3) where Cost-Benefit Analysis was carried out in the Light Rail Transit project in Tel-Aviv Israel and with the cost- benefit ratio greater than 1, thereby making the project worth embarking on. (9) also study the Cost- Benefit Analysis of Lekki- Epe expressway in Lagos state, Nigeria, and found the cost- benefit ratio to be greater than 1, which also make the project worthwhile to the project executors. However, to a large extent the CBA approach was not carried out on Akure- Ilesa road rehabilitation project to ascertain if the project was worthwhile and positively affects the road users in terms of real costs and benefits. Hence, justifies the study.

Methodology

Research Design and Study Area

Survey design approach was used, with primary data sourced through the administration of questionnaire on the road users (both private and commercial) to elicit information on the real costs and benefits of Akure-Ilesa road before and after its rehabilitation. Akure and Ilesa axis of the road in both Ondo and Osun State, Nigeria were located as the study area. Ondo State lies between latitude 5^{o} 45$^{'}$ and 8^{o} 15$^{'}$ North and longitude 4^{o} 45$^{'}$ and 6^{o} East. Akure is known to be the capital city of Ondo state, located in the South-West Geopolitical zone of Nigeria. Ondo state was created on the 3rd of February 1976 during the military regime of late General Murtala Mohammed; and presently governs by a democratically elected governor. Akure has a population of 588,000 based on 2006 population census.

Ilesa on the other hand, is a town located in Osun State South-West Nigeria and also adjudged to be one of the largest towns in the state. The state was also created by the military regime of General Ibrahim Badamosi Babangida on the 27th of August 1991; and presently governs by a democratically elected governor. Ilesa is of Latitude 8.92°N and Longitude 3.42°E. It is located on approximately 70^{o}N, 50^{o}E.The total population of Ilesa also known as Ijesa land according to the 2006 Population Census is put at 620,109. Meanwhile, the 66.354km long Akure - Ilesha road rehabilitation project starts from the Oke Ijebu Street intersection in Akure, Ondo State and terminates at the Iloko-Ijesa junction in Ilesa, Osun state. It links the South-West, South-South and South-East geopolitical zones of the country as well as the Federal Capital Territory, Abuja.

Plate 3.1 Map of Akure-Ilesa Road
Source: Road Sector Development Team, 2014

Population and Sample Size

The population of the study consists of both known and unknown, which involves road users, classified into commercial and private drivers respectively. The known population is made up of the total registered commercial vehicle drivers from the National Union of Road Transport Workers (NURTW) offices within Akure and Ilesa summed up to be 240drivers. The unknown population comprises road users along the route for private purposes. For the known population, non-probability sampling technique was used. The sample size was obtained using Yamane's formula. The mathematically derived (14) is given by:

$$n = \frac{N}{[1 + N(e)^2]}$$

Where:

n = required responses
N = total population gotten from NURTW Akure and Ilesa branches
e = level of significance at 5% is also the error margin.
Adding N = 240, e = 5% = 0.05 to the formula gives:

$$n = \frac{240}{[1 + 240(0.05)^2]} = 150$$

Therefore, the sample size obtained for the known population was 150.

For the unknown population, Purposive Sampling Technique was used. A sample size of 20 was obtained. Respondents were sourced at filling stations and junctions along Akure-Ilesa road. In all, the total sample size for the known and unknown population summed up to be 170.

Measurement of Study Variables

The variables for this study were costs and benefits, measured based on the stated objectives of the study as follows; A calculated Benefit-Cost ratio (BCR) was used as a yardstick to measure the benefits and costs of Akure-Ilesa road rehabilitation to commercial and private road users. Also, to identify the real costs of Akure-Ilesa road to users before and after rehabilitation, the measurement variables include Travel time, Accident Scene witnessed, Armed Robbery Attack and Breakdown of Vehicles. These were analyzed using Chi- square test. Similarly, in evaluating the real costs of Akure-Ilesa road to end users before and after rehabilitation, the measurement variables also include Accident Scene witnessed, Armed Robbery Attack, Travel time and Breakdown of Vehicles. These variables were analyzed using Pearson Correlation coefficient

Method of Data Analysis

Benefit-Cost ratio (BCR) was used to analyze the data collected to ascertain if the costs outweighed the benefits from the rehabilitation of Akure-Ilesa road. Descriptive and inferential statistics were also used for data analysis. While the descriptive analysis involving simple percentage and graphical representation of data using pie charts was employed, the inferential statistics used were Chi-Square and Pearson correlation coefficient, with the aid of Statistical Package for Social Sciences (SPSS) version 17; a Windows operating system software used for statistical analysis. Meanwhile, the model expressions of various methods of Data Analyses employed for the study were stated as follows: the Model for Benefit-Cost (B/C) ratio is specified thus;

$$\textbf{Benefit} - \textbf{Cost Ratio} = \frac{\boldsymbol{B}}{\boldsymbol{C}} = \frac{\text{PVB}}{\text{PVC}} = \sum_{t=1}^{n=1} \frac{\dfrac{\boldsymbol{B_t}}{(\boldsymbol{1+r})^t}}{\dfrac{\boldsymbol{C_t}}{(\boldsymbol{1+r})^t}}$$

Where PVB = present value of future benefits; PVC = present value of future costs; r = discount rate; n = number of years or analysis period (years); t = time of incurrence in year (1, 2, 3..., n), B_t = benefit in each year; C_t = cost in each year; Σ = total sum

a) Chi-square Model is expressed as $\chi^2 = \sum \frac{(obs - \exp t)^2}{\exp t}$ where obs is the observed frequency and expt is the expected frequency. This was used to test the difference of the variables before and after the rehabilitation of Akure-Ilesa road; while the

b) Pearson Correlation Coefficient model is given as:

$$\textbf{Pearson Correlation Coefficient } (\mathbf{r}) = \frac{N \Sigma x y - \Sigma (x)(y)}{\sqrt{[N\Sigma x^2 - (\Sigma x)2\,][N \Sigma y^2 - (\Sigma y)^2]}}$$

Where N is number of pairs of scores, Σxy is the sum of the products of paired scores, Σx is the sum of x scores, Σy is the sum of y scores, Σx^2 is the sum of squared x scores,Σy^2 is the sum of squared y scores Correlation coefficient ' r' is used to describe the strength and direction of the linear relationship between two variables. It can only take on values from –1 to +1. The sign at the front indicates whether there is a positive correlation (as one variable increases, so does the other) or a negative correlation (as one variable increases, the other decreases). In this study, it describes the relationship between the variables of real costs before and after rehabilitation of the road.

Results and Discussion

Out of a total of 170target respondents only 140 responded to distributed questionnaire and return as well. This represents 82.35% retrieval rate of the administered copies of questionnaire used for the study as shown in Table 4.1.

Table 4.1: Response Rate of Distributed Questionnaire

Categories	Population
Administered	170
Retrieved/Valid	140
Non Retrieved/Non-valid	30
% Retrieved/Valid	82.35%

Source: Field Report, 2016

Demographic analysis of the Respondents

Table 4.2a: Demographic Characteristics of Respondent

Characteristics	Frequency	Percent
Age (years)		
18 – 29	3	2.1
30 – 39	14	10.0
40 – 49	63	45.0
50 – 59 60 and above	55 5	39.3 3.6
Total	140	100.0
Gender		
Male	130	92.9
Female	10	7.1
Total	140	100.0
Academic Qualification		
Primary School Certificate	21	15.0
SSCE	52	37.14
OND	36	25.7
Bachelors Degree Others	21 10	15.0 7.1
Total	140	100.0

Source: Field Report, 2016

Table 4.2a shows that 2.1% of the respondents were between 18 – 29 years old, 10.0% were between 30 – 39 years old, 45.3% were between 40-49 years old, 39.3% were between 50-59 years old while only 3.6% were above 60 years old. This shows that respondents between 40-49 years old had the highest percentage while respondents between 18-39 years old had the least percentage. This could be because drivers within the age of 40 years and above are more likely to have better experience in driving and can handle any challenge associated with using or owning a vehicle. It also suggests that all the respondents were within the eligible age for driving according to the law of Federal Republic of Nigeria. For the gender, 92.9% of the respondents were male, while 7.1% of the respondents were female. This implies that not many female drivers ply the route and out of the respondents who are commercial drivers, there is no female representation. The reason is because highways in Nigeria are largely dominated by the male drivers and the number of female available for driving is relatively few compared with the male counterpart.

Table 4.2a also shows that respondents with Senior School Certificate Examination (SSCE) have the highest percentage of 37.1 percent and followed by respondents with Ordinary National Diploma (OND) having 25.7%. Respondents with Bachelor's degree and Primary School Certificate have the same percentage of 15.0. Respondents with educational status in the category of others have a percentage of 7.1. Some respondents in this category may have a Master's degree, Doctorate degree, any other type of degree or qualification. The results indicate that majority of the respondents possess at least a minimum educational requirement that could enable them read, understand the content of the questionnaire and tick appropriate options in the questionnaire.

Table 4.2b: Demographic Characteristics of Respondents

Characteristics	Frequency	Percent
Driving Experience Years		
0– 5	13	9.30
6–10	29	20.70
11–15	36	25.70
16–20	47	33.60
21 and Above	15	10.70
Total	140	100.0
Type of Commuter		
Private	20	14.29
Commercial	120	85.71
Total	140	100.0
Type of Vehicle		
Sedan (Car)	35	25.0
SUV(Jeep)	6	4.28
Bus	95	67.86
Heavy Duty	4	2.86
Total	140	100.0

Source: Field Report, 2016

Table 4.2b presents the respondents' years of experience in driving, from the table it shows that respondents with16 to 20 years of driving experience had the highest percentage of 33.6%, while those with 11 to 15 years of experience was next with 25.70%, followed by those with 6 to 10 years of driving experience. Also, respondents with 20 years driving experience and more recorded a percentage of 10.70, while respondents with 0-5 years driving experience had the least percentage of 9.30.The implication of this percentile distribution is that Respondents with 16-20 years driving experience and with the highest percentage of 33.60% are most likely to have good driving skills and are very much familiar with the route. The table also shows respondents plying the route for private purposes with a low percentage of 14.29 while the respondents that commute the route for commercial purposes had a high percentage of 85.71. This implies that commercial drivers engage the route more than the private drivers in the study area.

This is because commercial drivers need to make frequent trips on the road since the primary reason for driving is to earn a living which is a major source of their livelihood. Also show in the table was the respondents' opinion on the percentage distribution of vehicles plying the road. The distribution identified buses with the highest percentage of 67.86. This may be as a result of the need for bus drivers to ply the route regularly for commercial purposes. Sedan (car) was ranked next to bus with 25%, followed by SUV (Sport Utility Vehicle) with 12%. Heavy duty vehicles ranked the least with 2.86%.

Test of Hypotheses

Cost-Benefit ratio was used to test for hypothesis One to determine if the benefits of Akure-Ilesa road rehabilitation outweigh costs; while the Chi-square test of non-parametric distribution was used to test for Hypothesis Two to determine whether there is a significant difference between the real costs before and after the rehabilitation of Akure-Ilesa road to users.ThePearson correlation coefficient was also used to test Hypothesis Three; to measure the degree of association between the real costs before and after the rehabilitation of the road.

Hypothesis One

H_0: The benefits of Akure-Ilesa road rehabilitation do not outweigh costs
H_1: The benefits of Akure-Ilesa road rehabilitation outweigh costs

Decision Rule

Reject the null hypothesis H_0 if the Benefit-Cost ratio is greater than 1. This means that the alternative hypothesis H_1should be accepted. Accept the null hypothesis H_0 if the Benefit-Cost ratio is less than 1. This means that the alternative hypothesis H_1, should be rejected.

Test Statistic

$$\text{Benefit} - \text{Cost Ratio} = \frac{\text{B}}{\text{C}} = \frac{\text{PVB}}{\text{PVC}} = \sum_{t=1}^{n=1} \frac{\frac{\mathbf{B_t}}{\mathbf{(1+r)^t}}}{\frac{\mathbf{C_t}}{\mathbf{(1+r)^t}}}$$

Where PVB = present value of future benefits, PVC = present value of future costs, r = discount rate, n = number of years or Analysis period (years), t = time in years (1, 2, 3..., n), B_t = benefit in each year C_t = cost in each year and Σ = total summation To carry out this analysis, two different cases were examined. Emphasis was placed on commercial drivers/owners because they ply the route more often than other road users since their major source of livelihood comes from transportation business. The impact of the rehabilitation project is more evident on them.

Analysis of Costs and Benefits Before and After Akure-Ilesa Road Rehabilitation

Before road rehabilitation, the average litre of fuel consumed by a commercial bus was gotten to be 30 litres for a round trip (to and fro); with the prevailing price of fuel at N87 per litre in Nigeria as at the time of this study. This amounted to a total of (30litres × N87=N2, 610/day × 365days) N952, 650/year; while other monetary costs to the commercial road users before rehabilitation were also sourced as follows;

1) NURTW dues and tax: N2,000/day × 365days=N730,000/year
2) Vehicle Maintenance (Servicing):Occurring at an interval of 10 days for N2,500,which amounted to(365/10x2500) N91,250 per year
3) Tyre Cost: N18, 000/year (As at the time of data gathering)

Total average Cost/year: N952, 650 + N730, 000 + N91, 250 + N18, 000 **=N1, 791,900** Note: Since the benefit to private users is measured in terms of comfort and safety only, the Cost-Benefit Analysis was applied to commercial drivers as road users because the benefit to them is not only in terms of comfort and safety but also in monetary terms because their major aim of plying the road is to make profit. Meanwhile, the average revenue generated per day from a round-trip by the commercial road users before rehabilitation (to and fro) and based on data gathering is N11,200.Thereforegiven that; Benefit=Profit=Revenue–Cost.Revenue=N11, 200×365days=N4, 088,000/year

Benefit=Profit=N4, 088,000 – N1, 791,900
Benefit/year=**N2, 296,100**
The values for the estimation of Benefit-Cost Ratio were given as follows; r = 12% = 0.12, n=1,
t = 1, B=2,454,875, C = 1,791,900

$$\text{Benefit} - \text{Cost Ratio} = \frac{\text{B}}{\text{C}} = \frac{\text{Present Value of Benefit}}{\text{Present Value of Cost}} = \frac{\frac{\mathbf{2,296,100}}{\mathbf{(1+0.12)^1}}}{\frac{\mathbf{1,791,900}}{\mathbf{(1+0.12)^1}}}$$

$$\text{BCR} = \frac{2050089.29}{1599910.71} = 1.28$$

Therefore, Benefit-Cost ratio (BCR) = 1.28.This implies that the state of the road before rehabilitation was still able to benefit the road users since BCR is greater than 1. Although before rehabilitation scenario, the existing levels of service and

safety on the road would have been worsened with the increasing pressure from the number of automobile and truck plying the road. This development would have had a negative impact on the economy of the two states involved in the study. Also in another development that is, after rehabilitation of the road the average litre of fuel consumed by a commercial bus was gotten to be 20litres at the prevailing price of N87 per litre. This was estimated to a total of (20litres × N87=N1,740 per day × 365days) N635,100/year; while other incurring costs include:

1) NURTW dues and tax: N2,000 per day × 365days=N730,000/year
2) Vehicle Maintenance (Servicing): Occurring at an interval of 10 days for N2,500 = N91,250/year
3) Tyre Cost: N18,000/year
Total average Cost/year: N635, 100 + N730, 000 + N91, 250 + N18, 000 **=N1, 474350.** Also, on the other side of the coin the benefit to the commercial bus drivers/owners is taken to be the profit made. The average revenue generated per day from a round-trip (to and fro) was also sourced to be N11, 200.Therefore, given that:

Benefit=Profit=Revenue – Cost
Revenue=N11, 200×365days=N4, 088,000/year
Benefit=Profit=N4, 088,000 – N1, 633,125
Benefit=**N2, 454,875**

The values for the estimation of Benefit-Cost Ratio were given as follows; r = 12% = 0.12, n=1, t = 1, B=2,454,875, C= 1,474350

$$\text{Benefit} - \text{Cost Ratio} = \frac{\text{B}}{\text{C}} = \frac{\text{Present Value of Benefit}}{\text{Present Value of Cost}} = \frac{\frac{\mathbf{2,454,875}}{\mathbf{(1+0.12)^1}}}{\frac{\mathbf{1,474350}}{\mathbf{(1+0.12)^1}}}$$

$$\text{BCR} = \frac{2191852.68}{1316383.93} = 1.67$$

Therefore, Benefit-Cost ratio (BCR) = 1.67. Since BCR is greater than 1, H_0 is rejected. Although the BCR values before and after road rehabilitation were high and positive with 1.28 and 1.67 respectively. However, the BCR value of 1.67 associated with after road rehabilitation should be accepted because of its higher BCR value. This implies that the rehabilitation project is worthwhile and has a positive effect on commercial drivers. Therefore, the benefits of Akure-Ilesa road rehabilitation outweigh costs; which was in agreement with the study of (3).

Hypothesis Two

H_0: There is no significant difference between the real costs before and after road rehabilitation to users.
H_1: There is a significant difference between the real costs before and after road rehabilitation to users.

Decision Rule

Reject the null hypothesis H_0 if p-value is less than 0.05. This means that the alternative hypothesis H_1 should be accepted. Accept the null hypothesis H_0 if p-value is greater than 0.05. This means that the alternative hypothesis H_1should be rejected.

Test statistic: Chi square test: $\chi^2 = \sum \frac{(obs - \exp t)^2}{\exp t}$where obs. is observed frequency and expt. is expected frequency respectively.

Chi-square Analysis

Table 4.3 Chi-Square Test on the Real Costs Before and After Road Rehabilitation

Measure of Real Costs Before/After Road Rehabilitation	Chi-Square, χ^2	Df	P-value	Remark at 5% Sig. Level
Travel Time	169.035	3	0.000	Sig. Difference
Accident Scene Witnessed	1.617	3	0.655	No Sig. Difference
Armed Robbery Cases	82.107	3	0.000	Sig. Difference
Breakdown of Vehicles	0.668	3	0.881	No Sig. Difference

Source: Field Report, 2016

From Table 4.3, the p-value of the travel time is 0.000. According to the decision rule which states that reject H_0 if p-value is less than 0.05 and accept H_0 if p-value is greater than 0.05,since p-value is 0.000 and is less than 0.05,H_1 is accepted that is, there is a significant difference between the travel time before and after rehabilitation of Akure-Ilesa road to users. This implies that users get to their destinations on time after the rehabilitation than before rehabilitation and has lowered the risks associated with travelling. Also, traffic congestion has reduced due to faster movements of vehicles. In this case, the time spent in discomfort (waiting period due to traffic congestion or at the side of a busy roadway) has higher unit costs than time spent in comfort (9).

On the number of accident scenes witnessed on the road before and after rehabilitation, the p-value is 0.655 which is greater than 0.05. Therefore H_0 is accepted, that is there is no significant difference between the number of accident scenes witnessed by users before and after rehabilitation. Before rehabilitation, the deplorable condition of the road made vehicles and road users susceptible to accidents. Some other reasons why accidents occur on Akure-Ilesa road like any other road are due to over speeding, reckless driving, driving under the influence of alcohol, vehicle break failure and tyre burst, poor vision at night due to the absence of street light for proper illumination. These reasons were also supported by (1) on a very large extent that it is not entirely the poor deplorable condition of Nigerian roads that causes incessant road accidents but a large proportion can be attributed to the carelessness and negligence of the road users.

Also from Table 4.3, on the measurement of real costs in terms of the rate of armed robbery before and after road rehabilitation, the p-value shows 0.000 implying that H_0 should be rejected since the p-value is less than 0.05. Therefore the alternate hypothesis H_1 should be accepted, which signifies a significant difference between the number of armed robbery cases encountered by users before and after the rehabilitation of Akure-Ilesa road. This explains a reduction in the rate of armed robbery attack which is a benefit to users. It is a social benefit to them since they feel more secured when plying the route after rehabilitation. The findings of (11) also supported the intents of road rehabilitation as a good measure of curbing crime on the highway in Nigeria.

The frequency in the breakdown of vehicles also measure costs to users before and after road rehabilitation. The p-value associated with this variable in Table 4.3 is 0.881 which also greater than 0.05. This follows that H_0 should be accepted and H_1 rejected. This also implies a no significant difference between the frequency in the breakdown of vehicles before and after the rehabilitation of the road. Meanwhile, before the road rehabilitation exercise, it was erroneously believed that the bad condition of the road had often times led to incessant breakdown of vehicles. But the findings show that the frequency in the breakdown of vehicles is not significantly different before and after rehabilitation of Akure-Ilesa road. The incessant breakdown of vehicles on the road may also be a function of vehicle maintenance. It can also occur as a result of negligence by drivers to carry out routing check on vehicles before embarking on trips, in order to ensure its fitness for use and prevent breakdown of vehicles along the road.

Hypothesis Three

H_0: There is no significant association between the real cost before and after Akure-Ilesa road rehabilitation

H_1: There is a significant association between the real cost before and after Akure-Ilesa road rehabilitation

Decision Rule

Reject the null hypothesis H_0 if the probability of asymptotic significance p, is less than 0.05. This means that the alternative hypothesis H_1should be accepted.

Accept the null hypothesis H_0 if the probability of asymptotic significance p, is greater than 0.05. This means that the alternative hypothesis H_1should be rejected.

Test statistic: Pearson Correlation Coefficient (r) is:

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[\, n\Sigma x^2 - (\Sigma x)^2 \,][\, n\Sigma y^2 - (\Sigma y)^2 \,]}}$$

where n is number of pairs of scores, Σxy is the sum of the products of paired scores, Σx is the sum of x scores, Σy is the sum of y scores, Σx^2 is the sum of squared x scores,Σy^2 is the sum of squared y scores

Correlation Analysis

Table 4.4 Correlation Test on Real Costs Before and After Road Rehabilitation

Measure of Real Costs Before/After Road Rehabilitation	Correlation, r	P-value	Remark at 5% Sig. Level
Travel Time	0.783	0.000	Positive/Sig. Association
Accident Scenes Witnessed	0.958	0.655	Positive/Insig. Association
Armed Robbery Encountered	0.813	0.000	Positive/Sig. Association
Breakdown of Vehicles	0.952	0.000	Positive/Sig. Association

Source: Field Report, 2016

Table 4.4 shows the correlation tests on the real costs of Akure-Ilesa road before and after rehabilitation, with correlation coefficient(r) between travel time before and after rehabilitation as 0.783. This implies a positive and direct association between travel time before and after rehabilitation, which also culminated into time saving benefit to users travelling along the road. After rehabilitation there seems to be free flow of traffic unlike before rehabilitation when users spent more time on the road due to the bad condition of the road, which most times causes congestion at some locations along the road.

Table 4.4 also shows a positive correlation coefficient (r) of 0.958 between the numbers of accident scenes witnessed before and after rehabilitation. This also implies a positive and direct association between accident occurrences before and after rehabilitation. Before rehabilitation, accident mainly occurred due to staggered pot holes on the road, reckless and alcohol induced driving; while over speeding, reckless driving and alcohol induced driving were accounted reasons for accident after rehabilitation of the road. It was also revealed that the correlation coefficient(r) between rate of armed robbery attack before and after rehabilitation is 0.813. This implies that there is a positive and direct association between them. This is due to the fact that before rehabilitation, users were susceptible to attacks by armed robbers because of the bad condition

of the road thereby making vehicular movement easily disrupted by robbers. After rehabilitation, cases of armed robbery attack seem to have been reduced since vehicular movements cannot easily be disrupted due to the good condition of the road. Similarly in Table 4.4, the correlation coefficient (r) between frequency in the breakdown of vehicles before and after rehabilitation of Akure-Ilesa road is as high as 0.952. This value shows a positive and direct correlation. This implies that frequency in the breakdown of vehicles is largely due to negligence on the part of drivers/vehicle owners in paying attention to the maintenance of vehicles before embarking on their trips. In other words, the state of the road before rehabilitation couldn't have been largely responsible for the incessant breakdown of vehicles along the road.

Conclusion

The study evaluated the Cost-Benefit of Akure-Ilesa road rehabilitation with the specific objectives of considering the Benefit- Cost ratio of Akure-Ilesa road as well as the real costs of the road to users before and after rehabilitation. The study also considers some parametric statistics like Benefit-Cost Ratio (BCR), Chi Square and correlation as method of analyses. The study found the Cost-Benefit ratio before and after the rehabilitation to be 1.28 and 1.67 respectively, which also confirm that the road rehabilitation project is worthy of execution especially with the higher value of BCR (1.67) after the rehabilitation exercise. Also in evaluating the real costs, the study revealed that there is a significant difference between the real costs in terms of almost all the measured variables before and after the rehabilitation of the road. Positive correlations were also discovered between real costs before and after road rehabilitation.

From the analysis carried out, the comparison of the real costs before and after rehabilitation gave rise to certain benefits. The benefits include savings on travel time, fuel savings, and reduced cases of armed robbery attack, reduce the frequency in breakdown of vehicles (ceteris paribus). This study concludes that, the rehabilitation of Akure-Ilesa road has reduced armed robbery cases, lowered vehicle operating costs and there is on time arrival to destination. The most significant benefit to road users is time savings. Road users now spend less time on the road, thereby lower the risks associated with travelling. Therefore the culture of new Road constructions and rehabilitation of the existing ones should be imbibed by all level of government to provide linkage across the geo-political zones of the country. Nigeria citizens are also expected to enjoy their right to good roads devoid of every impediment and make them safer for the people to have confidence in government; while public partnership with government on road projects is highly encouraged.

References

Agbonkhese, O., Yisa, G.L., Agbonkhese, E.G.,Akanbi, D.O. Aka, E.O., & Mondigha, E.B. (2013). Road Traffic Accidents in Nigeria: Causes and Preventive Measures. *Civil and Environmental Research Journal, 3*(13), 2224-5790

Agbonkhese, O., Yisa, G.L., Agbonkhese, E.G.,Akanbi, D.O. Aka, E.O., & Mondigha, E.B. (2013). Road Traffic Accidents in Nigeria: Causes and Preventive Measures. *Civil and Environmental Research Journal, 3*(13), 2224-5790

Arshad, A. A. (2005). Cost Benefit Analysis for Construction Projects. *IEP-SAC Journal*,*4*(5), 85-90.

Daniel, S., & Aviram, H. (2005). Incorporating Agglomeration Economics In Transport Cost- Benefit Analysis: The Case of a Proposed Light-Rail Transit In Tel-Aviv Metrpolitan Area. *Regional Science,*84(2), 487-508.

David, R., Ngulube, P. & Dube, A (2013). "A cost-benefit analysis of document management strategies used at a financial institution in Zimbabwe: A case study". S A Journal of Information Management. 15 (2). doi:10.4102/sajim.v15i2.540. October 16, 2008, at the Way back Machine.

Federal Government of Nigeria (2016). *Road and the Environment.* Washington D. C.: World Bank Publishing.

Frischmann, B. M. (2005). An Economic Theory of Infrastructure and Commons Management. *Minnesota Law Review*. *89*, 917-1030

Gaye, K., Baris, S. (2010). An Ex-Post Cost-Benefit Analysis of Bolu Mountain Tunnel Project. *EGE Academic Review,10*(4), 1279-1287

Gregory, G., Miho, I., & Francesco, T. (2007). *Socially Inclusive and Gender-Resposive Transport Projects: A Case Study of Timor-Leste Road Sector Improvement Project.* Philippines: Asian Development Bank Publication.

Loto, M. A., & Nkaogu, C. V. (2013). Infrastructural Development: A Study of the Lekki-Epe Expressway: (The Cost Benefit Analysis Between 2010-2040). A 30 Year Period Analysis. *American Journal of Economics*,*3*(1), 32-42.

Nusrat, J. (2010). *Economic Impact of Highway Investment Projects.* New Jersey: New Brunswick Rotgers Press.

Omidiji, A. A.,& Ibitoye, S. A. (2010). *Crime and Road Crashes Prevention in Public Transportation System in Nigeria: The Case Study of Kwara, Kogi and Ekiti States*. 24th ARRB Conference. Melbourne

Road Sector Development Team (2014).*Consultancy Services for Engineering Supervision of the Rehabilitation of Akure-Ilesa Road Abuja.* Abuja: Cypress Consult Limited.

Washington State Department ofTransportation (2007). *Benefit-Cost Analysis of the Cross-Base Highway Project.* Washington D. C.: Washington State Department Publishing.

Yomane, T. (1967). *Statistics: An Introductory Analysis* (2nd ed.). New York: Harper and Row.