AN ANALYSIS OF THE PRIMARY AND SECONDARY BENEFITS OF THE BRT-SCHEME IN LAGOS STATE. NIGERIA (2008-2027)

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Abstract

The paper investigates the primary and secondary benefits/costs of the Bus Rapid Transit (BRT-lite) scheme in Lagos State within its corridor (Mile 12 in Lagos Mainland to CMS in Lagos Island). The data used for the study were extracted from the operator's documents. The data were decomposed into various categories: The initial cost, operating cost, maintenance cost, replacement cost, cash in-flow to the operators. etc. The borrowing rate of the operators was used as the discounting factor. The criteria used to measure the primary and secondary benefits/costs were the NPV and the B/C. The two investment criteria turned out to be positive and significant in terms of primary benefits. The secondary benefits also when isolated turned out to be very significant. The null hypotheses were rejected for the alternative hypotheses. The study shows that the scheme is a blessing to the people in Lagos State and also to the operators.
Jel Classification: D 61

Keywords: Infrastructure, Primary and Secondary benefits, Cost-Benefits, Transportation, BRT. PPP3

1.0 Introduction

No nation has reached or maintained a high level of economic development in the absence of a stable infrastructure, of which an important element is the transportation system. Transportation all over the world is a potent drive to economic growth. It enhances productivity and thereby promotes competitiveness. A thorough analysis of a system of transportation in order to promote economic growth is very necessary. Infrastructure is necessary for economic growth and sustainable development. Loto and Nkaogu (2011), pointed out that the economic growth of a nation is no doubt dependent on the availability of functioning infrastructures. There must be functional infrastructure in place. The infrastructure that we are talking about include: electricity, road network, water- supply, education, transportation, sea port, among others.

The main objective of good and functioning infrastructure is to promote free flow of economic activities. It also reduces cost of operations and promotes timely delivery of goods and services, which means it also promote efficiency and effectiveness. The type of infrastructure that the study is focusing on is the road transportation system. It is no surprise to learn that transportation affects every phase of our lives. Jonathan (2014) described

transportation as a way of life that no nation can do without. Inmaculada et al (2014) sees transportation as a variable that contributes enormously to the growth of total factor productivity. It positively affects private productive factors and the component of technical chance.

The Lagos State Bus-Rapid-Transit System" happens to be the first of its kind in Africa. It started operations March 17th, 2008. Lagos State especially is a highly congested area with a population of about 18 million. The means of transportation are very crude and local. Some of them are not supposed to be used in a relatively modern city like Lagos. Larger buses as a means of transportation have lots of advantages over the smaller fill-and run ones like the Danfoss Okada Keke Napep, etc. According to Dayo (2009), larger buses are neater; it reduces congestion and would convey many passengers at a time. They have been associated with efficiency in terms of delivering services (i.e. low cost, high frequency, high speed, high safety low emissions, protection of the environment, among others). Some benefits and costs have a mirror-image relationship in the sense that; benefit is being reduced by increase in the cost and vice versa. At the same time, reduction in road accidents can be related to increase in road safety, also a reduction in congestion, delay which could be associated with an increase in mobility.

The BRT in Lagos has its advantages and disadvantages. While it is a welcome policy to some set of people, it is a hindrance and a menace to some others. Since this policy is being regarded as a policy that is making some sets of people to be worse-off in terms of discomfort, some people are said to be better-off in terms of convenience.In order not to base our judgements on a normative reasoning, it is ideal to subject such policy to a testable fact, so that proper decisions and recommendations could be made. The Lagos State BRT system is a collaboration of the public and private sector provision of public goods and services. The focus of the study is on the analysis of the primary and secondary benefits/costs of the BRT-Lite system in Lagos State using the benefit/cost analysis approach.

1.1 Objective of the Study

The main objective of the study is to analyse the primary and the pecuniary benefits and the costs of the BRT-like system in Lagos within a 20-year period, using the method of cost/benefit analysis approach. (2008 –2027). That is, the benefit/cost to the operators and also to the users of the system.Following from the introduction and the objectives above, the rest of the paper is organized as follow: In section two , we have the literature review, section three contains the theoretical framework and methodology, interpretation and the discussion of the results are in section four and the final section contains the summary, recommendation and conclusion. .

2.0 Literature Review

The BRT system of transportation is a modern means of transportation in Lagos State. Before the introduction of the BRT system in Lagos State, commuters were travelling by the traditional transport system such as Danfo, Okada, Keke Marwa and Molue buses. These traditional means of transportation seem to be slow especially when in a hold-up, very unconducive and very risky in terms of accidents. They are also relatively expensive and

inadequate except for the Okadas... The BRT System may be new in Lagos State, but this means of transportation has been in use in other parts of the world. They are full of advantages over the traditional means according to Blonn et al (2006) who stress that BRT systems provide a higher level of service than the traditional bus transportation can provide. These includes operation on restricted use lanes, limited stops, quieter, smoother and more comfortable ride, speed, service and convenience. In the United States, several metropolitan areas have implemented the BRT systems. Also other cities of the world, such as Sydney, and Lima have implemented the BRT System (Blonn et al, 2006).

The Lagos State Bus Rapid Transit is said to be the first African BRT scheme (Dayo Mobereola 2009). Kumar (2009) congratulates Nigerians living in the city of Lagos for experiencing their first organized and efficient bus transport system which according to him, provides Lagos commuters with a clean, affordable and reliable means of getting around in the city; and also provides a cost-effective service. The BRT-Lite in Lagos State has been evaluated in different ways of which according to Dayo (2009), the benefits are enormous in the sense that, its users were saving travel time have fewer transfers, travel cheaper, and are safer. It improves accessibility in the sense that staff of various companies found it easier to get to work and to travel for company businesses. There is a positive and direct relationship between good transportation system and economic growth. Wright (2005) sees public transportation as the practical means of getting employment access to education, markets, public services and other businesses especially when all these activities are located outside the walking distance.

BRT system is regarded as a very flexible and very cost effective system of transportation which could be used by cities (Caides et al 2007). Studies from other parts of the world that are using the BRT system show that the system is a good one. (Kogdenko, 2011) confirmed that the BRT system in the Asian countries have contributed to the improvement of their transportation systems. Authors such as Eranleck et al (2008) believe that the transportation system in any nation is very crucial to economic growth and welfare. A positive relationship between public transportation investment and the economy was also identified. Several authors studied the Benefits/Costs of Public Transit services. They concluded that public transit services are crucial and very important in bringing about rapid economic growth of a nation. Such authors are Lee J Melton Jr (2014), Hee S, J (2007), Stephane R (2003), Jonathan H (2014), Inmaculada C et al (2014), Neil B.M (2014), Graeme A.H (2007) Robert B and Schafer J.M (1968) Martins J.B and Janes P.M (1969) and Olusina et al (2012). BRT-Lite System is very good and is beneficial to users of the services provided by the scheme. It encourages hard work. According to the authors, people living near public transit service tend to work more days each year than those who lack such access.

3.0 Theoretical Framework and Methodology

3.1 Theoretical Framework

The economic evaluation of a project in any sector entails the measurement and comparison of cost and benefit streams expected from alternative investments. Benefits are measured in terms of the concepts of consumers and producers surpluses. The benefits and costs from a road transport project in any year can simply be measured by the product of the project-

induced decrease in unit road user costs, and the normal volume of traffic and pollution, congestion, etc. Economic analyses are based on efficient decision-making. Championed by the OECD countries, one of the main sponsors of the early manuals as far back as late 1960s on project evaluation, was authored by Ian Little and James Mirrlees (1974). They used cost-benefit analysis and since then, it has been widely practiced, especially in the areas of environmental policy, transport planning and also health care. The theory of welfare economics was developed in line with the "marginalist' revolution in microeconomic theory that emerged in the late 19th century. This theory formalized the notion of the divergence of private and social cost and reconstructed welfare economics in line with the ordinal utility theory only. Costs and benefits of an investment need to be compared. Cost /benefit analysis has long been recognized as one of the main appraisal techniques for public investment and public policy.

The cost benefit analysis uses a net present value model. The theoretical basis of economic benefits and costs is to be found in the domain of welfare economics. In the literature (Dasgupta and Pearce, 1972) believe that there is a link between utility or welfare and benefits. This was done by considering the conditions for the equilibrium of the consumer, which is achieved for a consumer that is consuming only two goods when

$$\frac{MU_x}{P_x} = \frac{MU_y}{P_y} = \lambda \qquad (1)$$

Or

$MU_x = \lambda P_x$

$MU_y = \lambda P_y$

Dasgupta and Pearce made some certain assumptions which include

i. When marginal utility of income is equal to one, $MU_x = P_x$

ii. Price reflects the value of the satisfaction = utility to individual that consumed a particular commodity

iii. There must be willingness to pay (WTP) for a commodity that a person so desires

According to them, it is the WTP that defines the value of a benefit, which then gives the equivalence of:

Marginal Utility = Benefit = Willingness to pay = Price

They then generalized the above relationship as follows:

Let

m = total number of individuals in the society

i = the ith individual i.e. i will range from one to infinity

n = total number of goods and services

j = the jith goods and services such that j= one to n

th good or service such j = one to n

x = vector of goods and services such that $x = (x_1, x_2, \ldots X_n)$

x_{ij} = commodity j purchased by individual i.

If for example,

$U_i = U_i(X_{i1}, X_{i2}, X_{i3}, X_{ij}, \ldots X_{in})$ (2)

To generalize the equilibrium condition as shown above will give

$$\frac{\delta U_i}{\delta X_{ij}} = MU_{ij} = \lambda_i P_j \quad \text{.....3}$$

Where:

MU_{ij} = marginal utility of good j to individual i.
λ_i = marginal utility of money income to individual i
P_j = price of good j

If there is a change in money income to ith individual, there is every likelihood that it will bring about change in the amount of goods and services X_j purchases by this individual. That is, increase in X_j (ΔX_j) purchased by individual i will raise utility (U_i) for individual i by

$$\Delta U_i = \frac{\delta U_i}{\delta X_{ij}} . \Delta X_{ij} \quad \text{.....4}$$

If the good is a normal good

This will be an addition to total utility as a result of the increase in consumption of X_j by one unit (MU_{ij}) multiplied by the increase in the consumption of X_j

That is,

δX_{ij}

Then,

$$\Delta U_i = \frac{\delta U}{\delta X_{i1}} . \Delta X_{i1} + \frac{\delta U_i}{\delta X_{i2}} . \Delta X_{i2} + \frac{\delta U_i}{\delta X_{i3}} . \Delta X_{i3} + \dots\dots + \frac{\delta U_i}{\delta X_{in}} . \Delta X_{in} \quad \text{.....}$$

(5)

Substituting for $\frac{\delta U_i}{\delta X_{ij}} = \lambda_i P_j$ will give

$$\Delta U_i = \lambda_i P_1 . \Delta X_{i1} + \lambda_i P_2 . \Delta X_{i2} + \lambda_i P_3 . \Delta X_{i3} + \dots\dots + \lambda_i P_n . \Delta X_{in}$$

..... (6)

$$\Delta U_i = \sum_{j=1}^{n} \lambda_i P_j . \Delta X_{ij} \quad (7)$$

Assumption

If for example, λ which is the marginal utility of money income assumed that a change in the social welfare of a nation or state (ΔSW) as a result of a change in the national income is the sum of changes in the utilities of individuals in the society, then,

$$\Delta SW = \sum_{i=1}^{m} \Delta U_i \quad (8)$$

If we substitute for

$$\Delta U_i = \sum_{j=1}^{n} \lambda_i P_j . \Delta X_{ij}$$

This will give:

$$\Delta SW = \sum_{i=1}^{m}\left[\sum_{j=1}^{n}\lambda_i P_j \,.\Delta X_{ij}\right] \quad (9)$$

From the goods and services (X_{ij}) some of them will be outputs, while some will be inputs and if we treat the outputs to be physical benefits (b_j) and the inputs to be physical cost (C_j) then we can rewrite equation (9) as

$$\Delta SW = \sum_{i=1}^{m}\left[\sum_{j=1}^{n}\lambda_i P_j \,.\Delta b_{ij} - \sum_{j=k+1}^{n}\lambda_i P_j \,.\Delta C_{ij}\right] \quad (10)$$

If for example, λ (i.e. marginal utility) of money income is assumed to be the same for all individuals, and also the change in the national product is distributed across the community rather than individuals, then equation -- could be written as:

$$\Delta SW = \lambda\left[\sum_{j=1}^{k} P_j \,.\Delta b_{ij} - \sum_{j=k+1}^{n} P_j \,.\Delta C_{ij}\right] \quad (11)$$

What is relevant here is not the absolute magnitude of the SW that is needed, but the change in SW and also for the fact that social welfare function is an aggregation of individual utility function which are defined only up to a monotonic transformation, then equation -- could be written as:

$$\Delta SW = \sum_{j=1}^{k} P_j \,.\Delta b_{ij} - \sum_{j=k+1}^{n} P_j \,.\Delta C_j \quad (12)$$

Where B and C are the values of benefits and costs. After taking every revenue (benefits) and costs into consideration, the change in social welfare will be equal to benefits minus costs. If this outcome is positive, it means such project will add more to peoples' welfare and vice versa. Theoretically, in order to condemn a policy, it is important to compare the benefits and the costs of the policy through a project.In the case of the BRT-Lite in Lagos State, the benefits and the costs of the investment could be analyzed using cost/benefit analysis. The main focus of the study is to analyse whether the BRT-Lite is beneficial to the state government and also to the people as a whole. These could be ascertained through the techniques of cost/benefit analysis, which is based on NPV approach. It is possible to measure the benefits and the costs of the BRT Lite System in Lagos State. The whole essence is to test whether the BRT-Lite System increases the social wellbeing of the people. If not the investment will be condemned.. If there is increase in the social wellbeing of the people, there is every possibility that economic growth will increase (This is a measure of welfare).

3.2 Methodology

In the theory of cost-Benefit analysis of an investment, benefits are defined as increases in human wellbeing (utility) and costs are defined as the reductions in human wellbeing. Using these definitions, the social benefits of an investment must be greater than its costs for the investment to be able to improve human wellbeing. The decision rule under cost/benefit

analysis of an investment is : accept the investment if the benefit is greater than the cost. Cost/benefit analysis is very ideal for evaluating government projects.. Although, it could also be used for any other type of investment or policy. This study is focused on the BRT-Lite System in Lagos State. The whole essence is to analyze the cost and the benefit of the system to the society around the corridor of operation using investment evaluation technique that is adequate for a study of this type. In the light of the above, the NPV and the benefit/cost ratio are very appropriate for the study.

In an investment, there is usually an initial fixed expenditure.. For example, δK spent on e.g. machinery, equipment, trucks, new road construction for operation etc. and also an operating expense such as δC which is expended every year. There is also what we called yearly revenue i.e. streams of benefits e.g. δk over the years, depending on the life span of the investment. The yearly cost of operation is known as cash outlay and the yearly revenue or benefits received as the cash inflow.The present value is taken to be either the present value of revenue (or benefits) or the present value of costs. To arrive at the net present value (NPV) the value of benefits (revenue) and that of costs, must be discounted yearly throughout the year of operations using the appropriate discount rate. It is possible to bring all cash flows to the present value instead of compounding it into the future date. The value of ₦5000 received at some future date will be less than ₦5000 today. The future value is obtained through the process of discounting. In the calculation of NPV, the streams of benefits and all the streams of costs incurred during the operations of the investment must be discounted. The initial cost incurred will be the only type of cost that will not be discounted, but added to the discounted stream of cost, which will be netted out of the discounted stream of benefit, in order to arrive at the Net present value (NPV). The equations that explain these processes are as illustrated below.

$$NPV = \left(\frac{\beta_1}{(1+i)^1} + \frac{\beta_2}{(1+i)^2} + \frac{\beta_3}{(1+i)^3} + \frac{\beta_4}{(1+i)^4} + \cdots\cdots\cdots\cdots + \frac{\beta_n}{(1+I)^n}\right) - \left(K_0 + \frac{C_1}{(1+i)^1} + \frac{C_2}{(1+i)^2} + \frac{C_3}{(1+i)^3} + \frac{C_4}{(1+i)^4} + \cdots\cdots\cdots + \frac{C_n}{(1+i)^n}\right) \quad (1)$$

$$\sum_{t=0}^{n} \beta_t(1-i)^{-t} - C_t(1+i)^{-t} - K_0 \quad (2)$$

$$\sum_{t=0}^{n} (\beta_t - C_t)(1-i)^{-t} - K_0 \quad (3)$$

Where:

K_0 = initial cost incurred before the yearly operations begins

The decision rule for the NPV criterion is that the investment should be regarded as socially desirable, if the NPV obtained by using equations (2) or (3) is positive.

Test of Hypotheses:

Hypothesis 1: **Ho:** There is no significant benefits being derived from the BRT in Lagos State.

H_1: The benefit is significant

Hypothesis 2: Ho: There is no secondary benefit associated with the BRT scheme in Lagos State

H_1: The secondary benefits is significant

3.2.1 The Selection of the Discount Factor

In an attempt to guide policy makers on the choice of the discount rate to be chosen, some economists gave the suggestion that the market rate of interest could be used. But, Merewitz and Sosnick (1971) argued that market rate of interest performs too many functions and as a result, it might not be ideal to use it. The problem confronting the planners now is that which is the ideal interest rate to discount the streams of benefits and costs?.

The Suggested Ones are:

a. **Long-Term Rate of Interest on Government Bond**: The limitation of this is that it is affected by market considerations.
b. **Marginal Rate of Return on Investments in the Private Sector**. It has the same limitation with (a) i.e. it is affected by market considerations.
c. **Opportunity Cost of Rate of Interest**: The argument against this method was that it might cover specific risks and contingencies that are not explicitly allowed for in the estimates of the particular public project/investment.
d. **Social Time Preference (STP):** But the Marxists believed that this rate should be zero

The study is focused on the social contribution of the BRT-lite Buses introduced in Lagos State to the users. The aim is to estimate the benefits and the costs to the community and to individuals along the corridor of BRT-Lite operation over a period of 20 years from March 2008 to Dec. 2027). The area of analysis is from mile 12 in Lagos Mainland to CMS in Lagos Island (A 22 kilometers length corridor).

3.2.2 Sources of Data

The data used for analysis were sourced from the listed sources:

i. Lagos State BRT-Lite documents
ii. Lagos State Website
iii. Published data by the Lagos State BRT-Lite through Conferences.
iv. World Bank Reports and News articles.
v. LAMATA Socio-Economic baseline Survey.
vi. LAMATA Implementation Completion Reports.

3.2.3 Measurement Issues

To calculate the benefits and the cost of the BRT-Lite System and also the benefits and costs to the individual, the following information were extracted from the operators of the System

1. Initial Cost of the BRT-Lite Investment (Sunk Costs = N4.5b this includes:
    a. Elevated Segregation barriers
    b. Road Repairs on buses and service lanes.

c. Repairs on block drainage channels
d. Provision of bus stops.

2. Cost of BRT-Lite bus is ₦13.5m per one No. of BRT-lite buses available 260 Total Cost of 260 buses = ₦3.51b Life span of bus is approximately 10 years.
It means that in 20 years a bus will be replaced twice. Since the cost of 260 buses will be ₦3.51b. To replace them twice within 20 years will cost ₦3.51b x 2 ₦7b.

Maintenance and Operating Costs

Operating Cost is assumed to be as Follows. To Operate a BRT-Lite will require:

i. Cost of Fuel
ii. Pilot Salary
iii. Engine Oil
iv. Plug
v. Other Maintenance

Fuel Consumption

80 Litres of Fuel (diesel) per day at ₦150 per litre will give:

150 x 80 = ₦ 12,000 per bus/per
for 260 buses will cost per day
12,000 x 260 = 3,120,000

Cost of Engine Oil 3 (4 Litre container per six months per bus at the rate of ₦3500 per 4 litres

= 3500 x 3 = 10500 per six months.
For one year will give 10500 x 2 = 21 000 per bus
For 260 buses will give ₦21, 000 x 260 = 5, 460, 000 per year.

Cost of Plug

Plug is assumed to be changed once in one year. A bus will use and average of 8 plugs (in a set) set of 8 plugs will cost averagely ₦3500.
For 260 buses will give 3500 x 260 =910000 per year.
Taking all the above analysis into consideration lead to the tabulation in table (1) in the appendix

4.0 Result Interpretation and Discussion

After calculating the present value of the cost and benefit variables, the next step is to calculate the Net present value by subtracting the discounted costs plus the initial cost which will not be discounted from the discounted benefits to arrive at the Net present value, upon which decision will be based. The present value is calculated using a discount rate of 21% which is the average interest going rate as at the time of borrowing, and we assumed it will be constant over the twenty years of analysis. The present value of the stream of cash flows $a_1, a_2, a_3 \ldots\ldots\ldots a_n$, generated at yearly intervals for n years is given by:

$$PV = \frac{a_1}{(1+i)^1} + \frac{a_2}{(1+i)^2} + \frac{a_3}{(1+i)^3} + \ldots\ldots\ldots\ldots\ldots + \frac{a_n}{(1+i)^n}$$

A project is characterized by an initial fixed expenditure of e.g. θk_t in machinery, equipment, building, other costs incurred before the starting of the project and also operating expenditure of e.g. βC_t every year, with also a revenue or benefit of say e.g. $\phi\ \beta_t$ over the life of the project (in this case, 20 years). The cost incurred every year is referred to as cash outflows, and the annual revenue received is referred to as the cash inflows. Therefore

$$NPV = \left(\frac{\beta_1}{(1+i)^1} + \frac{\beta_2}{(1+i)^2} + \frac{\beta_3}{(1+i)^3} + \frac{\beta_4}{(1+i)^4} + \cdots\cdots\cdots\cdots + \frac{\beta_n}{(1+I)^n}\right) - \left(K_0 + \frac{C_1}{(1+i)^1} + \frac{C_2}{(1+i)^2} + \frac{C_3}{(1+i)^3} + \frac{C_4}{(1+i)^4} + \cdots\cdots\cdots + \frac{C_n}{(1+i)^n}\right)$$

$$\sum_{t=0}^{n} \beta_t(1-i)^{-t} - C_t(1+i)^{-t} - K_0$$

$$\sum_{t=0}^{n} (\beta_t - C_t)(1-i)^{-t} - K_0$$

Where:

K_0 = the initial investment expenditure which is having so many components.

Based on the calculation of present value in table(1) and the formula for presenting NPV in equation 17, net present value can now be estimated as follows:

NPV at 21% will give – 15.03b – 6.7214b + 30.2100

NPV = -21.7514 + 30.21500 =

₦8.4586b > 0

4.0 Interpretation and Discussion

The period of analysis is between 2008-2027. Data were collected for these periods. The figures extracted were subjected to the discounting method of analyzing the Net present value of the amount that extends into the future in order to know the net present value of the money today. The borrowing interest rate as at the time of analysis was used as the discount rate, which is the cost of borrowing money to finance the project. This rate is 21%.

This discount factor was used to discount streams of benefits and cost for twenty years.

The decision rules for NPV and benefits/cost ratio is given as:

If NPV > 0, Accept (which means the project is beneficial) If NPV < 0 Reject (which means the project is not beneficial) If NPV = 0 The project is neither good nor bad. You can remain indifferent.

Table 1 in the appendix shows the results of the discounted streams of benefits and cost, plus the initial cost. Based on the discount factor of 21% as shown on the table NPV at 21% will yield the following value.

- 15.03b – 6.7214b + 30.2100 =-21.7514+302100= ₦8.4586b > 0

The NPV shows that the BRT-Lite System from the point of view of the operators, it is a viable and money making venture. Using the benefit/cost ratio criterion we have:

302100/21.7514=1.3889>1

The benefit/cost ratio is greater than one. This means that the benefit realized is more than the costs incurred. The two outcomes of NPV and benefit/cost ratio show that the BRT-Lite project is a lucrative project for Lagos State and the Private partner. Now, what are the secondary benefits that could be realized from the BRT-Lite System in Lagos State?The secondary benefits/cost of the BRT-Lite System to the people could be monetized to know the true value of the benefits. Apart from the primary benefits/cost that the BRT-Lite System takes into consideration there are secondary benefits/costs that could be associated with the project. These are as elaborated below:

The Benefit to the People (Secondary Benefits) Qualitative

There are several other benefits that are associated with the project of BRT-Lite System which were not captured by the primary objective of the project. These other benefits to the users of the BRT-Lite are what we called secondary benefits; and value could be placed on them. How can the secondary benefits to the individual users of BRT-Lite be estimated? These could be done by taking into considerations what individuals used their personal cars to do and also find the difference between other modes of transportation.

Secondary Benefits to Individuals

The individuals are in three categories and they enjoy secondary benefits either directly or indirectly.

Category I

Those Individuals without a Car

This category formed 65% of the total passengers flying the BRT.

.: (65 x 200,000) persons per day=65x2000=130000 per day
100

In one year, we will have 130,000 x 260 = 33.8 million people

The secondary benefits to this category could be estimated by comparing what they pay flying BRT with what they pay using Mini Bus (Danfo).

From Mile 12 to CMS

Danfo

Per trip ₦200 Two Trips=N400

BRT per trip 120, Two Trips=N240

Gains = ₦400 – 240= N160 per day per person

Per year = (₦160 x 260 days) =41600

Note: In 20 years, individuals would have saved ₦41600 x 20 = N832000.

Category II

Those Individuals with a Car

This category formed 25% of the total passengers flying the BRT

.: 25 x 200,000 = 50, 0000 people per day
100 1

Per year will give = 50,000 x 260 =13 million people

Secondary Benefits to this Category (Car Owners)

Even though car owners find it comfortable to ride in their own cars boarded right in front of their door steps, they still fly the BRT buses. To them, there are some advantages being derived by flying the BRT-Lite.

These Advantages Include:

1. Money gained from parking

₦200 per day

Individuals work for 5 days in a week, there are 52 weeks in a year, which means individual will work for 52 x 5 = 260 days in a year, and 260 parking in a year

200x260days = 52000 in one year.

In 20 years will give 52000x20 = 1040000

Fuel Saved

Average cost of fuel ₦1000 per day,
For five days will give ₦5000
For 260 days will give 260000
In 20 years will give 260000 x 20 = N5.2 million.

Cost of Servicing the Car

Since during the weekends, the car of individual will still be on the road for other social or family engagements. The car will still be in use, but the wear and tear will reduce drastically. On the average, cars are serviced every three months. But because, with the advent of BRT, the car is less in use. The servicing with an average of once in one year.

The Cost of this will be:

Cost of Plug	₦3000
Engine Oil (2)	₦3500 x 2
Filter	₦1500
Total	₦11, 500 per year

These amount is compared with servicing the car four times in a year i.e. 11500 x 4 = ₦46, 000. The gains to a car owner is given as ₦46, 000 - ₦11500 = ₦34500 as gains per year.
In 20 years will give 690000
Total gains to a car owner in 20 years will be
Parking = N1040000, Fuel = N5200000, Servicing= N690000, Total= N6930000

Category III

This category, they are the supper rich. This category formed about 10% of the set of people that are interested in the BRT-Lite System. The super rich, who would not be BRT-Lite System users, but who would have a strong voice and so would be able to spread influence and might benefit from the decongestion effects of the new system. The benefit they earned is called option value.

Option Value Means: The Value that people placed on having a service available even if they do not currently use it. Value could also be placed on option value. This depends on the value judgment of the super rich

Social Benefits: (gains)

Reduction in air Emission from Automobiles: such as

- Hydrocarbons, Nitrogen oxides
- Carbon monoxide and carbon dioxides

The reduction in the degrees at which all these substances are released is a social gains to the society. It will also bring about a reduction in the green house effects. Other qualitative benefits for the users of BRT-Lite System that value could also be placed on are:

i. Reduction in travel time for the users of the system.
ii. It reduces vehicle accident costs.
iii. Reduction in air emissions – carbon dioxide, Carbon monoxide, hydro carbons and Nitrogen oxides.
iv. Reduction in road congestions.
v. Reduction in parking congestion.

vi. The BRT-Lite System, according to the users are: Smoother, quicker, safer and more comfortable as compared to other means of public transport.
vii. It will indirectly bring about economic development by increasing the productivity of workers who fly the BRT Value could also be placed on all these..

All the benefits enjoyed by the users of the BRT-LITE system are very substantial. The total value gained will also be subjected to the discounting factor, in order to know the true picture of the real value gained . The problem at this point is to find that discount factor that will be appropriate to discount streams of benefits of these individuals. Definitely, there is no sense in using the same discount factor used to discount the streams of benefits and costs of the operators of the BRT. Obviously, the appropriate discount factor should be the one that reflect social valuation. This discount factor should lie between 3% and 7%.What ever figures is being used at this range, will leave the users with a positive value**.**

5.0 Summary Recommendation and Conclusions

5.1 Summary

The study investigated the primary/secondary benefits and costs of the BRT-Lite System in Lagos State within the corridor of Mile 12 to CMS. A 22 kilometer corridor. The period of analysis is between 2008 and 2027 (a twenty year period). Data were sourced from the documents of SSATP publication website. (Sub-Saharan African Transport Policy Program website, www.worldbank.org/afr/ssatp. and LAMATA OFFICE) LAMATA and LASTMA. From these documents, the study was able to gather the needed data such as:

i. The Cost of each bus.
ii. The fare charged by the bus
iii. The number of average passengers that fly the bus on a daily basis, monthly and yearly.
iv. The initial costs incurred before operation begins.
v. The operating cost and maintenance costs.
vi. The Life span of each bus
vii. The replacement cost.

The data were discounted into the future and then finding the present value of the figures by making use of the discount factor formula to arrive at the NPV and the benefit/cost ratio. Based on the outcome of the two investment techniques used, the study was able to reach the following conclusion.NPV was positive and greater than zero. Benefit/cost ratio was greater than one. These two outcomes show that the BRT-Lite system is beneficial and a very lucrative venture to Lagos State and the private partner. The secondary benefits to the individual were also estimated. The outcome was also identified to be beneficial to the categories of users that fly the BRT-Lite System and those that earned the option value.

5.2 Recommendations

After investigating the performance of the BRT-Lite System in Lagos State using the widely used investment analysis techniques, the system was given a pass mark. However there are rooms for improvement as follow:

i. The fare charged could still be reduced e.g. to N80 and the NPV will still be positive and the benefit/cost /ratio will still be greater than one.

ii. There is need for more buses. This is because, the present demand is greater than the available buses.
iii. There is need for good maintenance. Some of the buses, the air conditioners are no longer functioning.
iv. More routes should be opened up to expand the corridor of the BRT-Lite System.
v. New roads could also be constructed rather than encroaching on the existing ones

5.3 Conclusion

This study evaluated benefits and the cost of BRT-Lite System in Lagos State. In as much as there are benefits associated with the system, especially to the users of the system, there are also some costs associated with it (i.e. the inconveniencies and the discomfort impacts on the people). These include reduction in the existing vehicle lanes from three to two in some places. This is expected to increase the traffic jam. This is about the major inconvenience caused by BRT. Apart from the identified negative effect from traffic jam, the BRT-Lite System shows that the scheme is beneficial to especially the low income earners that formed about 65% of the users of the scheme and also the middle income earners (i.e. the private car owners) that will prefer to park their vehicles at home and fly the BRT Bus. It enhanced their punctuality and also improves their productivity. In all, our research analysis, based on the techniques adopted to carry out the analysis (NPV, benefit/Cost ratio), pointed towards positive results to the Lagos State government and the private partners, and also to individuals that fly the BRT-Lite Systems, in terms of the primary and secondary benefits.

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Appendix

1 Year	2 Initial cost ₦b	3 D.F. 21%	4 NPV	5 Capital fixed cost ₦b	6 D.F. 21%	7 NPV.	8 Salaries & Wages	9 D.F. 21%	10 NPV	11 Operating cost ₦b
2008	4.5			3.51			.443	.83	.368	.692
2009							.560	.68	.381	.874
2010							.560	.57	.319	.874
2011							.560	.47	.263	.874
2012							.560	.39	.218	.874
2013							.560	.32	.179	.874
2014							.560	.26	.146	.874
2015							.560	.22	.123	.874
2016							.560	.18	.101	.874
2017				3.51			.560	.15	.084	.874
2018	4.5						.560	.12	.067	.874
2019							.560	.10	.056	.874
2020							.560	.09	.050	.874

2021							.560	.07	.039	.874
2022							.560	.06	.034	.874
2023							.560	.05	.028	.874
2024							.560	.04	.022	.874
2025							.560	.03	.017	.874
2026							.560	.03	.017	.874
2027				3.15			.560	.02	.011	.874
				10.53			**11.083**	**4.67**	**2.523 PV**	**17.298**

Year	12 D.F 21%	13 NPV	14 Bus. Maintenance / Servicing	15 D.F 21%	16 NPV	17 Road maintenance ₦b	18 D.F. 21%	19 NPV	20 Revenue for BRT	21 D.F. 21%	22 NPV
2008	.83	.574	0.018	.83	.015	-	-	-	5.32	.83	4.42
2009	.68	.594	0.018	.68	.012	.045	.68	.031	6.72	.68	4.57
2010	.57	.498	0.018	.57	.010	.045	.57	.026	6.72	.57	3.83
2011	.47	.411	0.018	.47	.009	.045	.47	.021	6.72	.47	3.16
2012	.39	.341	0.018	.39	007	.045	.39	.018	6.72	.39	2.62
2013	.32	.280	0.018	.32	.006	.045	.32	.014	6.72	.32	2.15
2014	.26	.227	0.018	.26	.005	.045	.26	.012	6.72	.26	1.75
2015	.22	.192	0.018	.22	.004	.045	.22	.010	6.72	.22	1.48
2016	.18	.157	0.018	.18	.003	.045	.18	.008	6.72	.18	1.21
2017	.15	.131	0.018	.15	.003	.045	.15	.007	6.72	.15	1.01
2018	.12	.105	0.018	.12	.002	.045	.12	.005	6.72	.12	.81
2019	.10	.087	0.018	.10	.002	.045	.10	.005	6.72	.10	.67
2020	.09	.079	0.018	.09	.002	.045	.08	.004	6.72	.09	.54
2021	.07	.061	0.018	.07	.001	.045	.07	.003	6.72	.07	.47
2022	.06	.052	0.018	.06	.001	.045	.06	.003	6.72	.06	.40
2023	.05	.044	0.018	.05	.001	.045	.05	.002	6.72	.05	.34
2024	.04	.035	0.018	.04	.001	.045	.04	.002	6.72	.04	.27
2025	.03	.026	0.018	.03	.001	.045	.03	.001	6.72	.03	.19
2026	.03	.026	0.018	.03	.001	.045	.03	.001	6.72	.03	.19
2027	.02	.018	0.018	.02	.0004	.045	.02	.001	6.72	.02	.13
	4.68	3.938 PV	0.36	4.67	.0864 PV	.855	4.67	0.174 PV	133.00	4.67	30.21 PV

Source: Author's calculation

Abbreviations

BRT----------BUS RAPID TRANSIT
LAMATA--------LAGOS METROPOLITAN AREA TRANSPORT AUTHORITY
LASTMA---------LAGOS STATE TRAFFIC MANAGEMENT AUTHORITY
SSATP----------SUB- SAHARAN AFRICAN TRANSPORT POLICY PROGRAM