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AN ASSESSMENT OF COST AND BENEFIT OF UHOLOR/OGBA RIVER LINK ROAD CONSTRUCTION PROJECT IN BENIN CITY, EDO STATE

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ABSTRACT

Cost Benefit Analysis (CBA) is the best appraisal approach in determining the profitability of a public project, enumerates the impact of the project on all stakeholders. The impacts of the project or decision on all stakeholders are calculated and compared to examine whether the benefits of the proposal outweigh the costs. The Main Report includes a description of cost-benefit analysis in which in order to make a sound decision in a policy context it is important to take into account the full range of costs and benefits. Methodology presented in this study can be used to complement the more easily available elements of CBA and inform decision-makers on known elements, uncertainties and gaps of such analyses. It will also serve to make the underlying choices of political decisions more easily understandable and transparent. Data retrieved from the interview session also physical observation and field inventory on an alternative route frequency of service was made and both used for analyzing cost and benefits. Benefit which is restricted to Travel Time Savings and Travel cost saving was gotten using Load Management theory to get the Frequency Determination. Both Cost and Benefits were discounted and weighted using the Benefit cost ratio. The result of the study revealed Project created a by-pass road for the community inhabitants, which has led to a reduction in travel time and reduction in travel cost; pointing to one fact that the project is of more benefit to the host community than the Government. It was recommended that professionals in the built environment especially Estate Surveyors and Valuers and Urban Planners should be involved in preparation of Cost and Benefit Analysis of Government Projects so as to determine onset whether the project is cost effective or the benefit of the project will outweigh the cost.

KEYWORDS: *Road Construction Project, CBA, Assessment, Benin City*

INTRODUCTION

A cost- benefit analysis is a systematic evaluation of the economic advantages (benefits) and disadvantages (costs) of a set of investment alternatives. Cost Benefit analysis is a framework that identifies, quantifies and compares the costs and benefits of a proposed policy or mode of action. The formal foundation of a CBA is that benefits increase human well-being and cost reduces it. For a project to qualify as a net benefit, the social benefits, be it job creation, improved health, etc must outweigh the social cost (i.e. compensation for increased air pollution), The objective of a cost-benefit analysis is to translate the effect of an investment into monetary terms and to account for the fact that benefits generally accrue over a long period of time while capital costs are incurred primarily in the initial years. The primary transportation related

elements that can be monetized are travel time cost, vehicle operating costs, safety costs, ongoing maintenance costs, and remaining capital value (residual value). Cost Benefit analysis have been used as a tool by project managers to help evaluate preliminary concepts during early planning studies, to evaluate alternatives and select a Preferred Alternative as part of project environmental documentation, and to evaluate potential design and construction staging options as part of detailed design and/or construction.

Cost Benefit analysis provides monetary measures of the relative economic desirability of project alternatives, but decision makers often weigh the results against other non-monetized effects and impacts of the project. In short term, Cost-benefit analysis is a way of assessing the consequences of public projects and reforms, in which the estimated benefits are weighed against the costs. For this purpose, all consequences must be measured in the same unit, and the traditional choice of unit is money. To be explicitly included in a cost-benefit analysis, then, environmental changes must be valued in monetary terms. However, in applied cost-benefit analysis, however, one is usually concerned with the maximisation of some concept of aggregate income or well-being, disregarding its distribution entirely.

The major problem of cost and benefit technique of appraisal is how to assess the implications of the qualitative costs and benefits to the investment (Ogbuefi, 2002). These problems have even been extended to the interpretation of those un-quantifiable cost and benefits often referred to as intangible costs and benefits. The appraisal process is simple when the elements of cost and benefit are quantitative.

In practice, it is however almost always problematic to obtain the full range of impacts, especially since all impacts ideally need to be fully quantified in monetary values. In many cases all impacts are not fully quantified but are limited to those areas for which the monetary value gives value-added information (i.e. where an approximate value is better than no value at all). In these cases care should be taken to interpret the quantitative results of a CBA and the results should be weighed against the data material. In any case, all impacts should be mentioned in an analysis irrespective of quantification or not. This means that it is still better to give a description of the impacts than having no valuation and not mentioning the impact at all.

Lichfield (1956) classifies costs and benefits into private and social. In his context he describe private costs and benefits are those that can be measured in money terms and are often referred to as tangibles, while social costs and benefits are those that cannot be measured in money terms. Umeh (1977) see social cost as cost of public project borne by the community in which the project is sited or to be sited. While social benefits are benefits received by the community from the project. However, social costs and benefits are commonly seen as those cost and benefit that cannot be quantified in terms of money.

Most often the hosted community usually inquisitive of what will be the benefit of the proposed project having known that there is no gain without loss. Likewise the public authorities are of the opinion of embarking on a project that will be cost effective and at the same time achieve their goal. As identified by Cameron (2011), the following are the likely cost usually borne by the government in executing such project; Investment costs e.g. construction costs, materials etc, Equipment, Overheads, Operating costs and Maintenance costs, while the identify benefits are Reduction in health care costs, Accident savings, Travel time savings, Reduced environmental emissions, Lower operating and maintenance costs and Job creation.

The study is to identify the impact of cost and benefit on the cost-benefit of Uholor/Ogba River Link Road Construction Project in Benin-City, Edo State with a view to translate the effect of a public investment into monetary terms by weighing the cost of construction against the benefits of travel time savings and travel cost saving only which is a gap that this study intends to solve.

LITERATURE REVIEW

Cost Benefit Analysis and Road Construction Project

During road selection/ prioritization, it is possible to consider both the economic impacts of a road as well as the distributional impacts of the project. Understanding both of these and trade-offs between prioritizing one over the other can improve decision-making in a project.

Cost Benefit analysis is a tool for assisting project managers when they are evaluating and comparing different alternatives. Alternative comparisons are different points in the project development process, including: concept development, environmental documentation, design, and construction. Results from a Cost Benefit analysis, along with public input and environment documentation, can be used to evaluate both the monetized and non-monetized effects and impacts of alternatives when a decision needs to be made.

Although, the Cost Benefit analysis always tries to answer the question "From the economic perspectives, are the benefit worth the investment?" This question is posed in different ways at different points in the project development process. Project Planning: From an economic perspective, are the benefits of building a road worth the project costs? Design and Environmental Study From an economic perspective, are the benefits of location "A" worth the project costs?

According to Boardman (2006), the steps that comprise a generic cost-benefit analysis are: List a Project or alternative projects; List Stakeholders; Select measurement(s) and measure all cost/benefits elements; Predict outcome of cost and benefits over relevant time period; Convert all costs and benefits into a common currency; Apply Discount Rate; Calculate Net Present Value of project options; Weigh cost against benefit; Recommendation based on result

Identifying Cost

In economic terms, the cost of a transportation investment is the value of the resources that must be consumed to bring the project about. The total value of construction and any additional maintenance costs must be estimated. It is important to note that the analysis does emphasis who incur the cost which include all cost involved in bringing about the project. Capital cost make up the total investment required to prepare a road construction for services, from engineering through landscaping. When possible, capital costs should be grouped into similar life-cycle categories. These include: engineering, right of way, major structures, grading, sub-base and base, surfacing, and miscellaneous items. These life cycle grouping make it easier to calculate remaining capital value. Estimates of capital cost, ranging from detailed engineer's estimate to planning-level cost estimates, should be as refined as appropriate for the project stage in the project development process.

Aside from the capital cost, others cost include major rehabilitation cost, routine annual maintenance costs, remaining capital value. The period of time for which the project benefits and related cost are compared is 30 years. This is because the analysis period for transportation improvement projects, because traffic and demographic information is generally available for this timeframe (European Commission, 2014).

Identifying Benefit

The benefits of a project can be more difficult to identify because these are often not obvious cash flows but are outcomes relating to the objectives of the CBA. In identifying benefits, the analyst should have due regard to the direct and indirect effects of the interventions. Benefits go majorly to three stakeholders who are: to the immediate community, to the road users and to the project undertakers

Benefits of a transportation investment are the direct, positive effects of that project; that is to say, the desirable things we obtain by the directly investing in the project. For example, the improvement may reduce the number or severity of crashes, eliminate long delays during peak hours, or reduce circuitry of travel (provide a shorter route). Typical benefits may also include: Reduction in loss of life; Reduction in health care costs; Accident savings; Travel time savings; Reduced environmental emissions; Lower operating and maintenance costs; Job creation; Increased water quality. Travel time is one of the largest transport costs and travel time savings are often the greatest potential benefit of transport improvements (Heggie and Thomas, 1982). Travel time costs and the benefits of travel time savings vary widely depending on factors such as type of trip, traveler and travel condition. Although some travel time has zero or negative costs (people want to spend time traveling), most travel time represents a cost (Mokhtarian and Salomon, 2001). Under some circumstances, travel time costs can be very high, for example, when traveling to an emergency, rushing to catch an flight or delivering urgently-needed products. Travelers sometimes place a high value on travel time reliability (Liu, Recker and Chen, 2004).

Personal travel time is usually estimated at one-quarter to one-half of prevailing wage rates. According to Furth and Wilson (1981), in determining a reasonable frequency of service on a route the Load management theory is one of the most common methods. The frequencies in Load management theory are based on managing load at the peak load point along the route. The peak load point is that point along the route that experiences the largest number of passengers per hour. For instance, if X is the largest allowable ratio of demand to supply (Volume to Capacity), with values between 0 & 1(with 1 when volume= capacity) Then:

$$\frac{P}{f.\text{Nbu}\ .\text{Cbus}} \leq X \text{ or } f \geq \frac{P}{X.\text{Nbus}.\text{Cbus}} \qquad \text{……..……..……Esq.(i)}$$

- Where P = volume at peak hour (passenger/hour)
- X = maximum available volume to capacity ratio, $0 \leq x \leq 1$.
- N_{bus} = number of Bus in a train.
- C_{bus} = number of passengers per Bus.

Transport is a classic example of the application of Cost Benefit Analysis. The analysis of road projects to date have been lacking in incorporating the full costs and benefits to society (Boadway, 1974). They have tended to examine costs and benefits which are easily examined such as travel time savings and accident savings. In more recent years the ability to calculate the total social benefit of a project has become more important. A method of valuing these costs and benefits are Net Present Value Method, Benefit Cost Ratio.

The Study Area

The study was carried out in Oredo Ward II, within Benin City, Edo state and in particular in Uholor/Ogba axis. Edo state in southern Nigeria is boarded with four states which include Ondo, Delta, Kogi and Anambra state. Oredo Local government is located between the geographical coordinates 6.235809N and 5.551135E in Benin City, which is the State

capital boarderd by four other local governments which includes: Ikpoba Okhia, Egor, Ovia North East, Ovia South West. Benin City is situated approximately 40 kilometers North of Benin River.

METHODOLOGY

Qualitative research method was adopted in carrying out the study in arriving at result and conclusion. Primary and secondary sources of data engaged to examine the Cost and Benefit of the Uholor/Ogba Road construction Project. The primary data sources include a formal interview with the Site Engineer/Contractor and personal contacts and oral interview of appropriates stakeholders the use of direct observation via traffic volumetric count was conducted to determine the level of traffic volume using a base (hypothetical) study area to Ekenhuan from the city centre. The hypothetical route used was that from Ring-road to Ekenhuan direct. The exercise run through the period of three days which include Monday, Thursday and Saturday in which observation were taken at different point in time both during peak and off-peak hours.The secondary data were gathered from record books and Town Planning Department, Oredo Local Government, Benin City, Edo State. The financial analysis methodology used in this research is the Discounted Cash Flow (DCF) method.

ANALYSIS AND DISCUSSION

Calculations and analysis for the Uholor/Ogba road construction project from both the major stakeholders involved in the project. These stakeholders are the project undertakers and the immediate beneficiaries which is the host community. The analysis is based on the information retrieved from the Site Engineer on site and other research made from the observations on the road. Below analysis shows the cost from the project undertaker, the benefit to the host community in form of travel time saving and travel cost saving and the viability of the project using the Benefit Cost Ratio (BCR).

Table 1: Cost Analysis of the Road Project From the Site Engineer

S/N	Cost Componentsphase 1,2 & 3	Description	Year 0-1	Cost Year 2-31
1	Planning/design fees, technical Assistance		₦10,000,000	0
2	Building and construction, of which:Earthworks		₦ 869,248,601	0
	Drainage	500m-1500m		0
	Reinforcement	10mm		0
	Stone Base	10cm		0
	Asphalting	5cm		0
	Junctions Motorway	22 x 2 Lanes, Width:27.5m, Length 6km		0
3	Plant and machinery		₦ 10,500,000	0
4	Publicity		₦200,000	0
5	Supervision		₦10,051,399	0
6	Total cost excl. contingencies		₦900,000,000	0
7	Contingencies		₦38,596,491.0	0
8	Total Cost incl contingencies(discounted)		₦938,596,491	0
9	Operation/Maintenance Cost(discounted)		0	₦565,868,910.26
	Total Investment cost		**₦1,504,465,4019**	

Source*:* Interview With The Site Engineer, 2017

Table 1 shows the composition of the project cost; cost estimate for works and supervision of the selected option is based on a detailed design estimate (broken down transparently into quantities and unit costs per components). The works have commenced and in the second phase. The construction cost is made at constant prices yielding a sum of ₦900million(excluding contingencies) for the period of two years to complete all the three phases of project while the Operation/Maintenance cost on a discounted rate over a period of 25 year amounts to ₦565,868,910.26 the total investment cost amounts to ₦1,504,465,401.49.

Table 2: Investment Cost Analysis

Year	Construction Cost Phase 1	Construction Cost Phase 2	Construction Cost Phase 3	Total Cost	Present Value (Construction Cost)	Maintenance Cost	Present Value (Maintenance Cost)
0	NGN 300,000,000.00	NGN 200,000,000.00	NGN 0.00	NGN 500,000,000.00	NGN 500,000,000.00	NGN 0.00	NGN 0.00
1	NGN 0.00		NGN 500,000,000.00	NGN 500,000,000.00	NGN 438,596,491.23	NGN 0.00	NGN 0.00
2	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 72,221,952.23
3	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 63,352,589.68
4	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 55,572,447.08
5	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 48,747,760.60
6	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 42,761,193.51
7	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 37,509,818.87
8	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 32,903,349.88
9	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 28,862,587.62
10	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 25,318,059.31
11	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 22,208,823.96
12	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 19,481,424.53
13	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 17,088,968.88

14	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 14,990,323.58
15	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 13,149,406.65
16	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 11,534,567.24
17	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 10,118,041.44
18	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 8,875,474.94
19	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 7,785,504.34
20	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 6,829,389.77
21	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 5,990,692.78
22	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 5,254,993.67
23	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 4,609,643.57
24	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 4,043,546.99
25	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 3,546,971.04
26	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 0.00	NGN 93,859,649.12	NGN 3,111,378.11
				NPV OF CONSTRUCTION COST	NGN 938,596,491.23	NPV OF MAINTENANCE COST	NGN 565,868,910.26
					SUM TOTAL COST	NGN 1,504,465,401.49	

From the table 2 is the investment cost analysis. The cost of construction was discounted in the second year of construction which amounts to a total of ₦900 million with the yearly maintenance cost 10% of the initial cost of construction over a period of 25years and discounting rate at 14%. The total financial cost of the project resulted to a sum of ₦1, 504,465,401.49

Table: 3 Traffic Volumetric Count on Ekenhuan Road

Average Vehicle	Peak Period	Off-Peak Period	Total
Hour	23	13	
Day	253	169	
Total			**422**

Source: Field Survey, 2017.

Table: 4 Frequency Characteristics of Ekenhuan Road Users

	FREQUENCY	PASSENGER	TOTAL
COMMERCIAL: Bus Taxi	211 23	13 1	2743 23
PRIVATE CAR	168	2	336
HEAVY DUTY VEHICLE	20	2	40
Total			**3142**

Source: Field survey, 2017.

Presented in table 4 is the frequency of commercial and private vehicles plying the route to Ekenhuan giving a resultant sum of 3142 road users per day?

Table: 5 The Impact on Travel Time, and Fares of Road Users

	TRAVEL TIME			TRAVEL FARE			
	Without project (min)	With project (min)	Savings (users x consumer surplus ₦1.875)/yr	Without project (₦)	With project (₦)		Savings (₦) (users x consumer surplus x 1yr)
BUS	50	24	48,808,256	150	70		80,095,600
TAXI CAB	45	24	330,553.25	1500	700		6,716,000
PRIVATE CAR	45	24	3,541,230	593	290		37,159,920
HEAVY DUTY VEHICLE	80	30	1,471,406.25	1160	593		8,278,200
Yearly Total	**₦54,151,445**						**₦ 132,249,720**

Source: Field survey, 2017.

Table 5 above gives Information on the travel time and travel fare for users without and with the project. It is therefore possible to calculate the consumer surplus as the difference in generalized costs of the trip (including time savings and fares) to the destination. As a consequence of the project, average Bus using the full length new road route will save 26 minutes per day, Taxi Cab and Private Vehicle both save 21 minutes each while heavy duty/ goods vehicles will save fifteen minutes. Using a shadow wage (for labor costs) ₦1.875/minutes value of time, the total annual time cost savings were estimated to be ₦54, 151,445. The table also reveals the travel fare savings of an estimated sum of ₦132, 249,720per annum as a result of ₦80 saved per each passenger in Bus, ₦800 saved from Taxi cab, ₦303 saved from private vehicle and ₦567 saved from heavy duty vehicle.

Table 6 shows the Benefit of Travel Cost and Fare Saving discounted at the rate of 14%. The overall revenue generated comprises of 70.9% travel fares saving while the other 29.1% is from the time savings.

Table 7: Residual Value

S/N	Benefit Component			
1	Total Cash Inflow	₦1,123,790,948.49		
3	Total Cash Outflow	₦565,868,910.26		
	Residual Value			**₦557,922,038.23**

Source: Field Survey, 2017.

Table 7 revealed that the residual value of the project at the end of the 25th year of operation will

Remain at ₦557, 922,038.23, which is as a result of the net cash flows throughout the reference period of project.

Table: 8 Total Benefit Analysis (Discounted)

S/N	Benefit Component			
1	**Travel Time Saving and Fare Cost Saving**	**₦1,123,790,948.49**		
3	**Residual Value**	**₦557,922,038.23**		
	Total Economic Benefit			**₦1,681,712,986.70**

Source: Field Survey, 2017.

From the table above, we have benefits of the project is listed above as travel time saving and travel cost saving together with the Residual value. All in all, the results of the benefit analysis (discount rate of 14 % and economic life of Benefit NPV: ₦1, 681,712,986.70million)

Table: 9 Benefit Cost Ratio (Bcr)

	COST	BENEFIT		BCR
	NGN 1,504,465,401.49	₦1,681,712,986.70		1.12

Table Source*:* Field Survey, 2017.

Table 9 revealed that the project is viable since the Benefit cost ratio is greater than 1. The total investment cost which comprises of the initial cost and the annual operational/maintenance cost is weighted against the total benefits that comprises of the travel time and fares and residual value. The table shows that the project generates a positive welfare change and is thus worthy of undertaking.

SUMMARY OF FINDINGS

- The major cost incurred by the project undertaker (NDDC) during the project life span was the cost of construction and maintenance cost.
- The elements of cost of the project are the construction cost and the operational/ maintenance cost which was borne by the Federal Government cost while the elements of benefit quantifiable include the Travel fare savings, travel cost savings and the residual value at the end of the reference period. The benefit of the project is more to host community than the undertakers as there was no identifiable benefit to the Federal Government other than the benefits of Travel time saving and Travel fares savings.

- From the result, travel fares saving benefit generates over 70% of the total benefit of the project. The viability of the project largely depends on the residual value to some extent as mere travel time savings and fare savings will not yield a BCR that is greater than 1. Hence, the result revealed that the longer the economic life of the project, the greater the Benefit Cost Ratio since the cash inflow is always greater than the net inflow and hence the greater the viability potential of the project.

CONCLUSIONS

The research illustrated the contribution of the principles of environmental economics to environmental regulations by providing a better foundation for decision-making through the facts and figures presented. Federal Government should seek to invest more qualitatively to the construction of road project as the longer the economic life of the road, the higher its viability potential.

RECOMMENDATION

- The details of Uholor / Ogba Road Project, has been taken into consideration. Cost-Benefit analysis (CBA) has examined the circumstances of the project, taken into consideration the streams of cost and benefits associated with the project and having on this basis analyzed the Cost and Benefit of the said project. In view of this therefore, it was recommended that;
- Professionals in the built environment especially Estate Surveyors and Valuers who is capable of translating effect of public investment into monetary should be involved in preparation of Cost and Benefit Analysis of Government Projects so as to determine unset whether the project is cost effective or the benefit of the project will outweigh the cost.
- The Federal Government should be willing to give up sum of money that will be sufficient to construct a quality road that will be durable for many years to come leading to longer economic life of the road.
- Federal Government should do follow up and check by professionals in the field of road construction while the construction is on-going in order to ensure the project is up to taste and standard.

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