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AN EVALUATION OF PUBLIC PROJECTS USING COST - BENEFIT ANALYSIS (CBA) – CASE STUDY OF YAKUBU GOWON DAM AND RWANG PAM STADIUM IN PLATEAU STATE

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ABSTRACT *This study is aimed at carrying out Cost-Benefit Analysis (CBA) of public projects, as a basis of development programmes in Nigeria. The objectives are to determine the costs and benefits of public projects and evaluate the benefit/cost ratios, and some social impacts. Two public projects in Jos (Yakubu Gowon Dam, Shen and Rwang Pam Stadium) were studied. Data were collected from Plateau Sate Water Board and Plateau State Sports Council as well as through structured questionnaires and interviews. The period of study is 1998 to 2027. The analytical tools used included simple percentage (in the case of the social impacts; including migration, employment generation and standard of living) and Net Present Value (NPV) and Internal Rate of Return (IRR) in the case of the economic costs and benefits of the projects*

. The results showed that Yakubu Gowon Dam has ₦1, 880,162,000.00, 1.68 and 8% NPV, Benefit/Cost ratio and IRR respectively and Rwang Pam Stadium has ₦86, 539,000.00, 1.71 and 17% NPV, Benefit/Cost ratio and IRR respectively. e. Also the results of the analysis of the questionnaires show that public projects influence migration, employment and standard of living positively.

INTRODUCTION

According to Thingan (1999), project evaluation is the most specialized planning process, which involves systematic, objective and comprehensive appraisal of development programmes for individual commodities and projects. This implies an appraisal or assessment of a project, as to its operational efficiency; technically, economically, financially and managerially. Hyman, et al (1962), refers to project evaluation as procedures of fact finding about the results of planned social action, which in turn move the spiral of planning over upward as the proper mythological accompaniment of rational action. Since the advent of democracy in 1999 in Nigeria, society has evolved; it has become more complex, seemingly at an increasing pace. This complexity affects aspects of society and has special relevance for environmental decision making. Not only are citizens re-evaluating the services they expect from the government, but concomitantly, increasing their willingness to the call to sacrifice other consumption in favour of enhanced environmental services. The character of environmental issues is also becoming more complex. According to Watkins (2003), incomplete information, uncertainty, system wide change, trans-frontier impacts, current cause that have far reaching future effects, irreversibilities, and possibilities of catastrophic change, all complicate the environmental decision making process. Public policies are often made without much reliance on economic reasoning. As a result, both the quality of public decision-making and the roles those economists play in it are less than optimal. The political era coupled with the complexity has brought about a situation where the social benefits of government activities are increasingly questioned. There is an increase in the unintended outcome and unexpected consequences resulting from public policy, thus there has been an increasing call from many quarters to subject all government programmes

to an examination by cost-benefit analysis. Cost-benefit analysis imposes an accounting framework that prescribes classes of benefits and costs, to consider means to measure them, and approaches for aggregating them. The technique of cost-benefit analysis is flexible and can be used to; choose among a range of alternatives, make comparison of projects of different lengths and identify instances where costs and benefits place identifiable groups at special advantage or disadvantage. Given the above attributes, the reasons to use the cost-benefit analysis technique to important decisions are growing (Bjornstad, 2003). Cost- Benefit Analysis (CBA) according to Watkins (2003). estimates and totals up the equivalent money value of the benefits and costs to the community of projects and helps to establish whether they are worthwhile. These projects may be dams, highways, school programmes, health care system, etc. According to Yeo and Qui (2003), traditionally, organizations use various types of quantitative analysis methods to estimate costs and values associated with a proposed project. The typical approaches to project evaluation are based on DCF (Discounted Cast Flows) analysis which provides measures like NPV (Net Present Value), IRR (Internal Rate of Return), pay back and maximum cash exposure. When all the criteria used for the evaluation are equal, more efficient projects should be chosen over less efficient ones. But that does not in itself make decisions. The most economical should not be chosen against the other important criteria that affect overall social desirability. The actual cost of constructing project and sometimes the environmental impact assessment seem to preoccupy government policy makers to the detriment of its real economic cost, the benefits that accrued from it (direct and indirect benefits) to the immediate community and the general public. This problem has limited the ability to rationally choose among alternative projects. This study is aimed at carrying out the Cost-Benefit Analysis (CBA) of some public projects. The objectives of which are; to determine the costs of the projects, to evaluate the benefits of the project after completion and when it is fully put into use; to evaluate the benefit/cost ratio of the projects, and to determine their comparative advantages using discount factors.

RESEARCH METHODOLOGY

Two public projects were studied; the Yakubu Gowon Dam at Shen, Jos South Local Government Area and the Rwang Pam Stadium in Jos North Local Government Area. The data included; firstly, the costs of the projects and the benefits accruing to the proprietors (or clients) of the projects (the Plateau State Water Board, PSWB and the Plateau State Sports Council, PSSC) and secondly, the responses from the structured questionnaires and interviews. The questionnaires were administered to the literate residents of the host communities where the projects are sited and interviews were conducted to the illiterate residents to gather data on the influence of the projects in respect of migration, employment and standard of living.

The costs of the projects include the cost of the construction and the estimated cost of running and maintenance over a period of thirty (30) years after completion. These were discounted for a period of thirty (30) years (1998-2027), during which revenue is also realized. The benefits include the estimated benefits in money value derived by the immediate communities at Yakubu Gowon Dam site and Rwang Pam Stadium and the revenue realized by the clients.

The analytical tools used to evaluate the cost-benefit ratios are simple percentage and discount factors (Net Present Value and Internal Rate of Return).

DATA PRESENTATION, ANALYSES AND DISCUSSION OF RESULTS

The results of data collected are presented in tables 1 and 2. Table 1 is the estimated costs of the two projects; Yakubu Gowon Dam and Rwang Pam Stadium, while Table 2 is the estimated benefits of the two projects respectively. Table 3 shows the responses to the structured questionnaire and interview.

Table 1 Projected estimate of cost

	Yakubu Gowon Dam	Rwang Pam Stadium
Year	Amount (₦'000)	Amount (₦'000)
1998	3,100	700
1999	3,400	800
2000	3,500	950
2001	3,980	1,000
2002	4,220	1,200
2003	5,010	1,750
2004	5,680	2,500
2005	6,123	3,300
2006	6,667	3,500
2007	7,012	6,200
2008	7,809	4,500
2009	8,214	4,900
2010	8,972	5,500
2011	9,421	6,000
2012	10,121	4,000
2013	10,972	7,600
2014	11,431	12,720
2015	12,012	6,000
2016	12,973	9,500
2017	13,721	10,340
2018	14,672	10,340
2019	15,521	11,270
2020	16,312	11,927
2021	17,512	12,730
2022	18,172	13,222
2023	18,568	14,021
2024	19,021	14,996
2025	20,216	15,751
2026	21,572	16,641
2027	22,961	17,812
Gross Total	**₦338,865**	**₦231,670**

Data source: Plateau State Football Association (PFA), questionnaire and interviews.

Table 2 Projected estimate of benefits

	Yakubu Gowon Dam			Rwang Pam Stadium		
Year	**Revenue as collected by PSWB (₦'000)**	**Other revenue collected (₦'000)**	**Total Benefit (₦'000)**	**Revenue as collected by PSSC (₦'000)**	**Other revenue collected (₦'000)**	**Total Benefit (₦'000)**
0	-	-	-	-	-	-
1998	52,790	1,720	54,510	5,002	781	5,783
1999	55,389	1,977	57,366	5,000	972	5,972
2000	64,051	2,312	66,363	4,459	1,340	5,799
2001	82,590	2,500	85,090	7,931	1,340	9,271
2002	94,107	3,001	97,108	9,181	1,572	10,753
2003	123,680	3,025	126,705	6,861	1,920	8,781
2004	136,048	3,802	139,850	8,667	1,412	10,079
2005	149,653	4,012	153,665	7,290	2,789	10,079
2006	164,618	4,234	168,852	8,294	2,993	11,287
2007	181,080	4,689	185,769	8,401	3,214	11,615
2008	199,188	5,021	204,209	8,399	3,678	12,077
2009	219,107	5,955	225,062	8,673	4,012	12,685
2010	241,017	6,921	247,938	8,922	4,531	13,453
2011	265,900	6,123	272,023	9,403	4,996	14,399
2012	291,631	6,344	297,975	9,218	5,321	14,539
2013	320,794	6,789	327,583	9,920	5,972	15,892
2014	352,873	7,012	359,885	10,000	6,482	16,482
2015	388,161	7,512	395,673	10,330	6,976	17,306
2016	426,977	7,998	434,975	11,000	7,463	18,463
2017	469,675	8,013	477,688	10,917	7,992	18,909
2018	516,642	8,681	525,323	11,199	8,501	19,700
2019	568,306	9,212	577,518	11,868	9,002	20,870
2020	625,127	9,701	634,828	11,670	9,781	21,451
2021	687,650	10,000	697,650	13,250	9,253	22,503
2022	756,416	10,532	766,948	13,256	9,797	23,053
2023	832,057	11,051	843,108	14,227	9,931	24,158
2024	915,263	11,971	927,234	15,753	10,121	25,874
2025	1,006,789	12,083	1,018,872	15,289	10,973	26,262
2026	1,107,468	12,083	1,119,551	15,767	11,621	27,388
2027	1,218,214	13,056	1,231,270	15,796	12,531	28,327
Gross Total			**₦12,720,591**	**Gross Total**		**₦483,210**

Data source: Plateau State Football Association (PFA), questionnaire and interviews.

Table 3. Responses on social benefits

Benefit	**% That accept in favour of the benefits**	
	Yakubu Gowon Dam	Rwang Pam Stadium
Migration	58	80
Employment	100	100
Standard of Living	83	86

The analyses of data presented in Tables 1, 2 and 3 are presented in Table 4 (for NPV) and table 5 (for IRR) using the following formulae:

(1) $NPV_B = \frac{B_1}{(1+r)} + \frac{B_2}{(1+r)^2} + \ldots + \frac{B_n}{(1+r)^n}$

(2) $NPV_C = \frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^1} + \ldots + \frac{C_n}{(1+r)^n}$

Where NPV_B = Net Present Value of Benefit
NPV_C = Net Present Value of Cost

B_1 = Benefit at 1st year.
C_1 = Cost at year of completion of project.
B_n = Benefit at n^{th} year.
C_n = Cost at n^{th} year.
r = rate of discount.
n = n^{th} year.

(3) $$IRR = \frac{B_1 - C_1}{(1+r)} + \frac{B_2 - C_2}{(1+r)^2} + \ldots + \frac{B_n - C_n}{(1+r)^n}$$

Where: $B_1 - C_1$ = difference between Benefit and Cost at 1st year.
$B_n - C_n$ = difference between Benefit and Cost at n^{th} year.
r = rate of return
B, C, and n as defined in (1) above

The IRR was carried out based on "trial and error" at 5%, 10%, and 15% for both projects.

Table 4 Projected estimate of Net Present Value

Yakubu Gowon Dam			Rwang Pam Stadium	
YEAR	NET PRESENT VALUE (NPV)		NET PRESENT VALUE (NPV)	
	Benefit (₦'000)	Cost (₦'000)	Benefit (₦'000)	Cost (₦'000)
0	-	2,628,348	-	35,000
1998	51,914	2,952	5,508	667
1999	52,033	3,084	5,417	726
2000	57,327	3,023	5,252	820
2001	70,004	3,274	7,627	823
2002	76,087	3,306	8,425	940
2003	94,549	3,739	6,553	1,306
2004	99,388	4,037	7,803	1,777
2005	104,006	4,144	6,822	2,234
2006	108,844	4,297	7,275	2,256
2007	114,046	4,304	7,130	3,806
2008	119,397	4,566	7,061	2,631
2009	125,098	4,574	7,063	2,728
2010	130,957	4,758	7,074	2,916
2011	136,996	4,758	7,272	2,778
2012	143,331	4,868	6,993	2,886
2013	150,070	5,026	7,280	3,206
2014	157,017	4,987	7,191	3,316
2015	164,410	4,991	7,191	5,285
2016	172,134	5,133	7,306	2,374
2017	180,036	5,171	7,127	3,580
2018	188,561	5,266	7,041	3,711
2019	197,424	5,306	7,134	3,852
2020	206,685	5,311	6,784	3,883
2021	216,319	5,058	9,977	3,947
2022	226,482	5,171	6,807	3,905
2023	237,116	5,110	6,794	3,944
2024	248,358	5,095	6,930	4,017
2025	259,900	5,157	6,699	4,018
2026	272,153	5,241	6,653	4,092
2027	284,888	5,313	6,554	4,121
TOTAL	**₦4,645,530**	**₦2,765,368**	**₦210,743**	**₦121,545**

Table 5 Projected Internal Rate of Return

Year	Yakubu Gowon Dam				Rwang Pam Stadium			
	B_n-C_n (₦'000)	IRR (₦'000)			B_n-C_n (₦'000)	IRR (₦'000)		
		5%	10%	15%		5%	10%	15%
	-	(2,628,348)	(2,628,348)	(2,628,348)	-	(35,000)	(35,000)	(35,000)
1998	51,410	48,962	46,736	44,704	5,083	4,840	4,621	4,420
1999	53,966	48,949	44,600	40,806	5,172	4,691	4,274	3,911
2000	62,863	54,303	47,230	41,333	4,849	4,431	3,854	3,373
2001	81,110	66,729	55,399	46,374	8,271	6,805	5,649	4,729
2002	92,888	72,780	57,676	46,181	9,553	7,485	5,932	4,950
2003	121,695	90,810	68,694	52,612	7,031	5,247	3,969	3,040
2004	134,170	95,352	68,850	50,439	7,579	6,027	4,352	3,188
2005	147,542	99,962	68,829	48,231	6,779	4,588	3,162	2,216
2006	162,185	104,546	68,782	46,103	7,787	4,826	3,175	2,128
2007	178,757	10,738	68,917	44,184	5,415	3,324	2,087	1,339
2008	196,400	135,878	81,455	49,952	7,577	4,430	2,656	1,629
2009	216,848	85,953	68,966	40,455	7,785	4,334	2,481	1,455
2010	238,966	126,198	68,930	38,676	7,953	4,218	2,303	1,293
2011	262,602	132,237	68,946	37,003	8,399	4,495	2,343	1,258
2012	287,854	138,463	68,910	35,376	10,539	4,107	2,044	1,049
2013	316,611	145,043	68,903	33,835	8,292	4,074	1,935	950
2014	348,454	152,029	68,940	32,380	3,762	3,875	1,757	825
2015	383,661	159,419	69,005	31,002	11,306	1,906	825	371
2016	422,002	167,000	69,000	29,652	8,963	4,932	2,038	876
2017	463,967	174,864	68,966	28,349	8,569	3,528	1,399	575
2018	510,651	183,294	69,005	27,131	9,360	3,360	1,265	497
2019	561,997	192,118	69,039	25,964	9,600	3,282	1,179	444
2020	618,516	201,374	69,076	24,849	9,524	3,315	1,137	409
2021	680,138	210,888	69,051	23,760	9,773	3,030	992	341
2022	748,776	220,999	69,072	22,734	9,831	2,903	907	299
2023	824,540	232,005	69,216	21,791	10,137	2,851	850	268
2024	908,213	243,263	69,276	20,862	10,878	2,914	830	250
2025	998,656	254,743	69,248	19,946	10,511	2,681	729	210
2026	1,097,979	266,912	69,258	19,082	10,747	2,611	677	187
2027	1,208,309	279,775	69,246	18,249	10,515	2,433	603	159
	0	1,865,938	(639,127)	(1,586,333)	0	86,544	35,025	11,437

Table 6. Project ranking based on result of Cost-Benefit

Project	Evaluation criteria	Result	Ranking
Yakubu Gowon Dam	NPV IRR	1.68 8%	2
Rwang Pam Stadium	NPV IRR	1.71 17%	1

The results of the analyses show that

1. (a) The Net Present Value (NPV) = $NPV_B - NPV_C$ of

(i) Yakubu Gowon Dam = ₦1, 880,162,000.00

(ii) Rwang Pam Stadium = ₦86, 539,000.00

(b) NPV_B / NPV_C of

(i) Yakubu Gowon Dam = 1.68.

(ii) Rwang Pam Stadium = 1.71.

2. (a) At 5%, Yakubu Gowon Dam and Rwang Pam Stadium have net positive values indicating high IRR.

(b) At 10%, Yakubu Gowon Dam has a net negative value (indicating low IRR) and Rwang Pam Stadium has a net positive value (indicating a high IRR).

(c) At 15%, Yakubu Gowon Dam has a net negative value (indicating low IRR) and Rwang Pam Stadium has a net positive value (indicating high IRR).

3. On migration for both projects, an average 69% of the respondents agree that the projects influenced their migration to the project sites. On employment generation for both projects, 100% of the respondents agree that the projects offered them employment. On standard of living for both projects, an average of 84.5% agree that their standard of living has been improved as a result of siting the projects.

SUMMARY AND CONCLUSION

The summary of the results is shown in Table 6. Thus, Yakubu Gowon Dam has a benefit/cost ratio and net NPV of 1.68 and ₦1, 880,162,000.00 respectively and Rwang Pam Stadium has a benefit/cost ratio and net NPV of 1.71 and ₦86, 539,000.00 respectively. The Internal Rate of Return (IRR) for Yakubu Gowon Dam is 8% and that of Rwang Pam Stadium is 17%.

The results imply that both projects have positive impacts and are worthwhile. However, Rwang Pam Stadium which has the highest benefit/cost ratio is rated higher than Yakubu Gowon Dam. Also, if environmental engineering factors do not indicate otherwise, Rwang Pam Stadium should have been chosen for procurement ahead of Yakubu Gowon Dam if they were put side-by-side for selection.

Thus, in the choice of the location of a project government should ensure that there are social and economic benefits derivable from the projects. This can be checked by the use of Cost – Benefit Analysis (CBA) tools.

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