Accuracy of *in Medias RES and EX-Post* Cost-Benefit Analyses: A Case of National Special Programme for Food Security, Nigeria

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Abstract: The current global financial situation and low public expenditures on food and nutrition security in sub-Saharan Africa (SSA) makes the accuracy of the Cost-Benefit Analysis (CBA) technique imperative for project decision making. The study compared the *in medias res* and *ex-post* Cost-Benefit Analyses with the aim of determining the accuracy of the estimated Cost-Benefit Analyses. Data for the study were generated from secondary information obtained from the FAO Assisted National Special Programme for Food Security implemented in 109 sites across Nigeria. The study employed the Percentage Error (PE), Mean Percentage Error (MPE), Percentage Point Error (PPE) and Mean Absolute Percentage Error (MAPE) to compare the *in medias res* and *ex-post* CBA conducted under the Programme. Generally, the results under both CBAs differed under the three financial indices considered. For the incremental benefits, inflation adjusted percentage errors ranged from - 87% for aquaculture to as high as 1,139% for groundnut processing, with an MPE of 161%. The comparison of the Net Present Values showed overestimation of the *in medias res* for six of the analysed projects with MPE of -27%. With respect to the Internal Rate of Return, the *in medias res* of all the enterprises analysed were over-estimated except for the sorghum-based enterprise, while the MAPE stood at 15% across the enterprises analysed. The study concluded that there were considerable discrepancies between the *in medias res* and *ex-post* CBA values, with obvious implications for decisions taken by project implementers and policy makers. Arising from this outcome, there is need for Country-based CBA results' review framework and guidelines to guide Analysts and Policy Makers in their decision-making process.

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INTRODUCTION

Several food security interventions have been implemented in Sub-Saharan Africa (SSA), and in particular Nigeria. However, due largely to weak project preparation and implementation, most of these projects and programmes have yielded little results, with minimal impact on the populace (Coker *et al*., (2018). Gittinger (1984) noted that poor project preparation is a critical challenge bedevilling developing countries in implementing development projects. Recent occurrences, particularly, the dwindling public expenditures in key sectors of the economy across Africa, especially spending on agriculture and food security (International Food Policy Research Institute, 2018) make reliance on the CBA technique imperative for informed decision among alternative projects, aside efficient allocation of resources. The CBA serves as a decision-making tool informing the choice and type of investments. Amongst other benefits, the CBA helps justify project investment and inform decision about project resource allocation; informs the decision as to whether project is producing expected financial and economic results; help to improve project design and implementation; while serving as an important tool for assessing project impact, efficiency and documenting lessons learned, which is useful for formulation of future projects. However, stakeholders are at conflicts over the accuracy, utility, monetization and trade-offs between the present and the future, using the CBA technique (Boardman *et al*., 2018).

This study therefore determined the predictive ability and accuracy of the CBA, with a view to ascertaining the practical value and enhancing its effective deployment in Africa. Aside the novelty, the study will serve as a learning guide to Project Appraisal Teams, Consultants, Planning Officers in Government Ministries and the Academia in the effective application of

the CBA and Financial and Economic Analysis (FEA) techniques and support policy makers in their decision-making process. The study will in addition contribute to the development of tool for effective deployment within the agricultural development project cycle.

THEORETICAL AND CONCEPTUAL DISCOURSE

The CBA technique is based on the theories of opportunity cost, the Kaldor-Hicks Economic Welfare Criterion and farm budgeting. The theory of opportunity cost is premised on the fact that factors of production are scarce and multipurpose, while wants are unlimited but the means of satisfying them are limited and are deployable to alternative uses, thus giving rise to choice. According to Ponnusamy (2020), the axiom of opportunity cost stipulates that opportunity cost of anything is the alternative that is forgone. In the context of CBA therefore, it thus implies that the selection of a project or programme is only at the expense of the other, especially in a mutually exclusive project selection scenario. Opportunity cost is the value of the best alternative foregone when a choice is made. The benefits of the concept relate to the support for efficient allocation of resources, determination of relative prices of goods and fixation of enumeration. However, the concept is limited by the specific nature of cost, as to limit alternative uses; reluctance of cost to move to alternative locations; its premise on assumption of perfect competition, which is infeasible; discrepancy between private and social costs, while alternatives may not be evident.

The Kaldor-Hicks Criterion is a measure of economic welfare change which stipulates that projects are assumed to confer net benefits in as much as gainers from such interventions are able to compensate the losers. Campbell and Brown (2016) noted that a project may not necessarily attain Pareto Improvement (a scenario in which some are better off but no one is worse off) to complement economic welfare, but merely a Potential Pareto Improvement. The logic is premised on the fact that even when the distributional consequences of the project are

unfavourable, government could use other policy instruments such as transfer payments, including taxes, subsidies to achieve the desired distributional equality.

A farm budget is an instrument for coordinating the inflows and outflows of resources towards the attainment of farming household objectives (Brown, 1982). Farm budgets comprises farm income analysis on one hand and agricultural project analysis, to which this study relates. Farm budget is basically used to estimate the expected income, expenses, and profit of a given farm plan; compare the profitability of alternative farm plans, and often to evaluate the effect of a change in farm size and estimate the availability of farm resources. In agricultural project analysis specifically, it supports evaluation and comparison of relative profitability of alternative investments.

According to Food and Agriculture Organization (2020), CBA or Cost Effectiveness Analysis houses the Financial and Economic Analysis. A CBA is considered to be the most comprehensive approach and a standard for FEA. The CBA relies on key indicators such as the benefit-coat ratio, incremental benefit, net present value and the internal rate of return.

Meanwhile, in his contribution on the persistence of appraisal optimism in Benefit-Cost Analysis, Abelson (2020) noted the tendency of project analysts to be too optimistic and affirmed that many appraisals have recorded overruns as well as over-estimation of project benefits. The author argued that optimism is either borne out of cognitive push where issues are viewed from the positive angle or as a result of political pressure, in which analysts dance to the tune of policy makers or client for future or other benefits. The piece affirmed the seriousness of optimism and the challenge of reaching a technical solution.

METHODOLOGY

The study utilised the FAO Assisted National Special Programme for Food Security (NSPFS) implemented in Nigeria as a case study. The NSPFS was a follow-up on the Pilot Special

Programme for Food Security implemented in Kano State, Nigeria in 1998. The total programme cost was US$ 45.2M fully funded by the Federal Government of Nigeria plus US$ 22.25M for the South-South Cooperation. The Programme comprises five components, namely; Food Security, Aquaculture and Inland Fisheries, Animal Diseases and Transboundary Pest Control, Marketing of Agricultural Commodities and Food Stock Management, Soil Fertility Initiative and a South-South Cooperation intervention. The Programme was implemented between 2002 and 2006 in 109 sites across the 36 States of Nigeria and the Federal Capital Territory (Food and Agriculture Organization (FAO), (2008). The implementation strategy was premised on three sites per state, comprising one urban/peri-urban and two rural sites, involving 23,000 farming families. The broad objective of the Programme was to sustainably improve national food security through increases in food productivity and production on an economically and environmentally sustainable basis, reduce year to year variability in agricultural production and improve people's access to food.

Method of Data Collection and Data Requirements

The study relied on secondary data obtained from the National Programme for Food Security. Data employed for this analysis were those of the ex-ante CBAs conducted for the second phase of the Programme undertaken using the 2004 constant data, which doubled as the *in medias res* for the NSPFS and those of the Implementation Completion Report conducted in 2006. Specific data and information were sourced from the Project Document, Economic Appraisal of NPFS modules and Implementation Completion Report of the National Special Programme for Food Security. Data elicited included enterprise farm budgets and cashflows, enterprises incremental benefits, financial Net Present Values and Internal Rate of Return percentages.

Analytical Techniques

The study employed the Percentage Error (PE) techniques used by Odeck and Kjerkreit, 2019; Nicolaisen and Driscoll, 2014and Gomez *et al*., 2015 to measure the inaccuracy of the *in medias res* and *ex-post* CBAs (Equations 1 and 2).

$$\text{PE } \beta = \frac{(\beta \ ex-post \ - \beta \ in \ medias \ res)}{\beta \ in \ medias \ res} * 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.1$$

Where:

β - Represents either of Incremental Benefit (IB) or Net Present Value (NPV).

$$MPE/MPPE = 1/n \sum_{i=1}^{n} PE \ /PPE \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.2$$

Where:

MPE - Mean Percentage Error

MPPE - Mean Percentage Point Error

If the $PE_{\beta} < 0$, the ex-ante CBA was overestimated and if otherwise, it is underestimated. To achieve the objective of the study, comparison of the two CBAs covered 10 agriculture-based enterprises. The comparison was based on the incremental benefits (IB), net present value (NPV) and internal rate of returns generated under both milestone CBAs.

FINDINGS AND DISCUSSIONS

Percentage Errors of Annual Incremental Benefits

The results under both CBAs were generally mixed. For the incremental benefits, the PE ranged from - 83% for aquaculture to 1,486% for groundnut processing. The pattern was similar for the inflation adjusted values, however values were lower, with -87% and 1,139% under both enterprises respectively. Expectedly, while the unadjusted MPE and MAPE stood at 234% and 292% respectively, the consumer price index (CPI) adjusted values were lower, put at 161% and 132% respectively. The implication of the results is that the *in medias res* for

six of the 10 enterprises considered were overestimated, while four were underestimated (Table 1). In their review of 19 bridges in China, Liu *et al.* (2018) affirmed 84% of the bridges were over -budgeted for while 16% were under budgeted.

Table 1: Percentage errors of the Incremental Benefits (Naira)

S/N	Enterprises/Modules	Annual Incremental Benefits			Percentage Error	Inflation Adjusted Percentage Error
		***in medias re* (2004)**	***Inflation Adjusted in medias re (2006 values)***	***ex-post(2006)***		
1	Yam/maize/cassava	15,203	19,460	9,260	-39	-52
2	Sorghum/millet/maize/cowpea	20,135	25,773	17,470	-13	-32
3	Ram fattening	175,940	225,203	36,750	-79	-84
4	Goat and Sheep upgrading	39,598	50,685	30,680	-23	-39
5	Layer production	203,482	260,457	96,040	-53	-63
6	Aquaculture	75,408	96,522	12,600	-83	-87
7	Palm fruit processing	86,500	110,720	428,910	396	287
8	Groundnut processing	19,154	24,517	303,800	1486	1139
9	Garri processing	136,250	174,400	320,360	135	84
10	Rice processing	94,500	120,960	669,700	609	454
	Project	**866,170**	**1,108,698**	**1,925,570**	**122**	**74**
	MPE				**234**	**161**
	MAPE				**292**	**232**

Source:1.Federal Republic of Nigeria, (2006). National Programme for Food Security Main Document
2. Federal Republic of Nigeria, (2006). National Special Programme for Food Security Implementation Completion Review
3. Percentage errors were derivations of the author
4. Adjustment for inflation was undertaken using CPI values from National Bureau of Statistics

Percentage Errors of the NPV

The results under the financial net present value (NPV) is similar to the outcome of the incremental benefit analysis. However, for the NPV, the range of PEs spans -98 under

aquaculture to 112% for garri processing, with an MAPE of 68% (Table 2). For the adjusted values however, the range were also similar, but while aquaculture enterprise maintained same value of -98%, garri processing witnessed a decrease to 65%, reflecting the actual price influence. Expectedly, the MPE and MAPE were lower under the inflation adjusted analysis, put at -27% and 59% respectively compared to the unadjusted values of -6% and 68%.

Table 2: Percentage errors of the financial Net Present Value (Naira)

S/N	Enterprises/Modules	Net Present Value @ 12%			Percentage Error	Inflation Adjusted Percentage Error
		in medias re (2004)	Inflation Adjusted in medias re (2006 values)	*ex-post(2006)*		
1	Yam/maize/cassava	22,615	28,947	16,360	-28	-43
2	Sorghum/millet/maize/cowpea	64,479	82,533	75,660	17	-8
3	Ram fattening	634,818	812,567	119,440	-81	-85
4	Goat and Sheep upgrading	80,805	103,430	42,000	-48	-59
5	Layer production	1,701,517	2,177,942	83,360	-95	-96
6	Aquaculture	201,368	257,751	4,540	-98	-98
7	Palm fruit processing	141,281	180,840	267,480	89	48
8	Groundnut processing	213,219	272,920	405,800	90	49
9	Garri processing	245,573	314,333	519,750	112	65
10	Rice processing	333,997	427,516	260,480	-22	-39
	Project	**3,639,672**	**4,658,780**	**1,794,870**	**-51**	**-61**
	MPE				**-6**	**-27**
	MAPE				**68**	**59**

Source:1.Federal Republic of Nigeria, (2006). National Programme for Food Security Main Document
2. Federal Republic of Nigeria, (2006). National Special Programme for Food Security Implementation Completion Review
3. Percentage errors were derivations of the author
4. Adjustment for inflation was undertaken using CPI values from National Bureau of Statistics

Percentage Errors of the Financial Internal Rate of Return

As for the financial IRR, the *in medias res* of all the enterprises analysed were over-estimated except for the sorghum-based enterprise (Table 3). The MAPE for the percentage error and

percentage point error stood at 42% and 15% respectively. The results tend to suggest that decisions were made believing that most enterprises would yield better than their actual potentials. The emerging development may not be unconnected to weak forecast and assumptions, the volatile economic situation in the country, limited consideration of risk factors in the analysis, data challenge and probably human error.

Table 3: Percentage errors of financial Internal Rate of Returns

S/N	Enterprises	Financial Internal Rate of Return @ 12%		Percentage Error	Percentage Point Error
		in medias re (2004)	*ex- post(2006)*		
1	Yam/maize/cassava	20	18	-10	-2
2	Sorghum/millet/maize/cowpea	39	43	10	4
3	Ram fattening	39	24	-38	-15
4	Goat and Sheep upgrading	35	16	-54	-19
5	Layer production	43	14	-67	-29
6	Aquaculture	28	13	-54	-15
7	Palm fruit processing	20	13	-35	-7
8	Groundnut processing	42	15	-64	-27
9	Garri processing	20	16	-20	-4
10	Rice processing	43	13	-70	-30
	MPE	**33**	**19**	**-40**	**-14**
	MAPE			**42**	**15**

Source:1.Federal Republic of Nigeria, (2006). National Programme for Food Security Main Document
2. Federal Republic of Nigeria, (2006). National Special Programme for Food Security Implementation Completion Review
3. Percentage errors were derivations of the author
4. Adjustment for inflation was undertaken using CPI values from National Bureau of Statistics

The large chunk of these results is contrary to the work of Odeck and Kjerkreit (2019) which established that the ex-post results are always greater, largely due to higher benefits and investment costs, though under the transportation intervention. In a related development, Boardman (2018) affirmed that the ex-post CBAs are the most accurate, given the obvious advantage of actual statistics rather than forecast.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Arising from the aforementioned findings, this study concluded that there were considerable discrepancies between the values of *in media res* and ex-post CBAs, with obvious implications for decisions taken by programme implementers and policy makers. This development thus raises concern on the efficacy and consistency of the existing procedure.

Recommendations

To enhance the predictive ability and usefulness of the CBAs for future milestone assessments and evaluations, there is need for improvement in data forecasts, management of appraisal optimism and data banking culture for future CBAs. It is also imperative to align and standardize CBA analytical framework, while supporting increased professionalism through continuous training of Analysts. There is also the need for the Federal Ministry of Budget and National Planning and the Nigerian Evaluation Association to come up with holistic Country CBA results' review framework and guidelines.

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