Contributing Paper

Resettlement Costs

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Cost-benefit analysis (CBA), (also called economic analysis or economic assessment) purports to provide information on the overall contribution of a project to the economic welfare of the population of a country, a region (or even the world at large). The original idea of CBA is over two hundred years old, and was put forward to understand what were the benefits of public works such as roads and bridges. The theoretical framework for current CBA was developed in the late nineteenth century with welfare economics efforts to understand how people benefits from trade. Practical methods were developed mostly in the 1950s' and actually out of an interest to better asses the benefits of water projects.

In the last two decades CBA has come under increased criticism among many development stakeholders, regarding: (a) claims of poor estimations of costs and benefits (b) challenges to assumptions and technical criteria embedded in CBA, like the rate of discount used to compare cost and benefits accruing at different time, (c) demands to broaden CBA framework to account for cost and benefits in areas far away from traditional economic valuation, like health, education, the environment (some times labeled project's externalities), and others; (d) demands to incorporate social concerns or ethical criteria, (e) demands to make the analysis more transparent and open to the public; (f) challenges to its relevance: the private developer don't care about it, and the public at large don't trust it. National and international development agencies and CBA practitioners have been trying to address these challenges, and progress has been made. Yet divergent opinions persist.

Even then CBA is among the few existing economic yardsticks and is widely used as one of the criteria to assess large public development projects, including dams. Then, it is important to realize that as late as the 50's and even 60s' most countries lacked specific rules or guidelines regarding how development projects should be assessed and decisions be made. And even after CBA was enshrined as an important decision rule by many countries and agencies, its actual bearing has been at best modest. Usually the overall decision to go for a development project is taken on political, social and financial grounds and the CBA is kicked in to justify the project or at best to fine tune its design.

Estimating of costs and benefits

Performing good CBA of large projects is complicated, costly, and time consuming, and the current demands for a more comprehensive CBA is adding to all three hurdles. CBA of dams that usually are large and may have unique characteristics are plagued with uncertainties, having to come up with predictions regarding people and events far away in time and space or for which there is very little comparable experience. Furthermore, since the CBA will put prices to a large list of project inputs and outputs estimated by the technical and engineer teems it will carry over all errors and uncertainties built in these previous steps.

Below we have used the available information and recent studies of some 80 dams around the world, plus the WCD country case studies to explore the following questions:

- How well CBA of dams estimated costs at project appraisal? Note that the question refers only to the costs actually paid by the project design and do not address the broader issue of indirect and unaccounted costs (social, environmental, etc.)
- How well CBA of dams estimated benefits at project appraisal? Again this refer to the project direct benefits identified at appraisal.
- If instead of the original estimates of cost and benefits more updated estimates were used –for example post-construction costs and benefits estimates- would the project still have looked economically attractive?

- What would happen if we factor in indirect environmental and social costs and benefits?
- What would happen if different rates of discount were used to appraise dams?

Cost estimates

Dam projects seem to be prone to cost overruns. In a sample of some 70 hydropower projects commissioned between 1965 and 1986, costs at completion were on average 28% higher than estimated in the pre-project CBA. For 10 multipurpose dams average cost overruns were even higher. Comparatively, average cost overruns in a sample of 64 thermal power projects was only 6% higher, and in a sample of over 2,000 development projects of all type it was only 11% higher. On the other hand schedule slips were smaller in hydropower than in other type of projects (see table 1).

Table 1. Cost overruns and schedule slip in a sample of World Bank financed projects

Project Group	**Cost Overruns (in %)**		**Schedule Slips (in %)**	
	Mean	SD	Mean	SD
Over 2,000 development projects	11	45	117	80
59 Thermal power projects	6	23	30	30
67 Hydroelectric projects	27	38	28	28
10 Multipurpose dams	39	54		

SD: standard deviation

Source: Three first lines reproduced from table 5.4. of Bacon R. et al (1996); last line based on OED (1996) [1]

Regarding causes the same study (Bacon et al, 1996) found that about half the hydropower cost variations could be explained by (a) the dam technical characteristics, (b) the size of the project, curiously the larger the project, the smaller was the percentage of cost overruns, and (c) economic factors (like price inflation). The other half of the cost variations could not be systematically explained and is therefore attributed to risk and uncertainty. Regarding how to reduce under-valuation at project appraisal, the study suggests that, because the cost overruns vary widely, the simple solution of multiplying the costs by an adjustment factor will not work (the adjustment factor would have to be too large to make the exercise meaningful), and more sophisticated method of estimation are called for. Even then the fact remains that the cost of large dam projects have a significant level of uncertainty and risk.

Benefit estimates

If assessing costs is difficult, it is nothing compared with trying to assess benefits, that in the case of dams requires guessing production and prices over 50 years or more. Furthermore, while comparing pre-project cost estimates with costs at project completion is a meaningful exercise, in that the latter are the true costs, benefit estimates after the project has been built are as much as a guess as the pre-project estimates.

Benefits of irrigation and multipurpose dams are particularly difficult to estimate, entailing layer over layer of assumptions regarding irrigated areas, crops, crops yields, crop prices, land and properties values and much more. Expected benefits for hydropower or urban water supply dams are more simple to estimate, but still are prone to many mistakes, in that they are usually assessed as the savings of not going for the next more expensive alternative (e.g. a thermal power plant).

[1] Bacon R.W. et al (1996) "Estimating construction Costs and Schedules. Experience with Power Generation Projects in Developing Countries" World Bank Technical Paper No.325, WB, Washington D.C; and OED (1996) "The World Bank Experience with Large Dams. A Preliminary Review of Impacts" World Bank, Washington D.C.

Then the cost of that alternative may vary widely during the dam's life. For example the cost of power provide by thermal power plants is heavily dependant on oil prices that have a tendency to swing widely, so that many hydropower dams commissioned in the 80s' when oil prices were high, deliver poor or no benefits in the 90s' when oil prices where low, but bounced back in the late 90s' when oil prices went up again.

Besides true risk and uncertainty involved in benefit estimates there are good reasons to expect that project developers will tend to overestimate benefits, since that would play to the favor of the project. For instance in USA, the Army Corp of Engineer (on of the two federal water development agencies) estimated a traffic of 15,000 barges a year to justify a 2 billion dollar project of dams and dikes constructions in the Red River, in Louisiana State. Five years after completion the actual traffic was below 200 barges a year[2].

While there are many examples of overvaluation of short-term gains, there are also examples where in the log run dams delivered more than was originally envisaged. A review of the WCD country case studies shows both cases:

- Thailand's Pack Mun hydropower CBA grossly overstated the project benefits, presenting all the dam energy output as peaking load (that commands a much higher price) and using as a comparison a gas-turbine plant twice the dependable capacity of the dam.
- After more than 30 years of operation the South Africa's Orange River project has not deliver the originally expected irrigation benefits (the irrigated area and the value of production is lower than originally envisaged) on the other hand power, flood protection and recreation benefits are higher than estimated at appraisal.
- In 1996-98, ten years after project completion, the net irrigated area in Turkey's Aslantas Dam command area was a remarkable 95% of the CBA estimates made 20 years early. But the production value was 30% below the original estimates.
- Similarly Pakistan's Tarbela current irrigated area is slightly higher than the originally estimated, but crop yields lag 30% below the projected ones.
- In the Grand Coulee Dam Columbia Basin project only half of the originally irrigated area was finally developed, but more valuable crops and higher yields deliver a value per acre that almost double the original predictions.

Reassessing cost-benefit comparisons

What would happen if instead of the original estimates of cost and benefits more updated estimates were used –for example post-construction costs and benefits estimates. Would the projects still have looked economically attractive? There are few exercises to answer this question.

- In a recent post-construction reassessment of cost and benefits of 50 dam projects, a recent study (OED,1996) find that 5 of them 10% would be economically unjustified by the new figures (at a 10% discount rate)
- Other study of 32 hydropower projects completed between 1884 and 1992 found that after construction cost overruns have lowered the rate of return below 8% in one third of them.(Gutman, 1993)[3]

[2] The Washington Post, January 9, 2000.
[3] Gutman (19934) "Involuntary Resettlement in Hydropower Projects". World Bank, Washington D.C

Factoring in indirect social and environmental costs and benefits

Besides complaints that CBA underestimate costs and overestimate benefits, there is the issue of non-accounted social and environmental costs and benefits. Environmentalists have it that if all the environmental damages of large water development projects where factored in costs would surpass benefits. Same with the social costs falling upon the local population threatened with resettlement or lost of livelihood, cultural values, etc. On the other hand there could also be unaccounted environmental and social benefits, from reduction in greenhouse gases emissions to new tourism and economic activities.

So what would happen to CBA if these social and environmental costs and benefits would be duly assessed? The truth is that nobody knows for sure, because it has not been done systematically. And besides the available estimations are highly contested with many stakeholders insisting that environmental and social goals are priceless (a statement that can be strictly true, in the case of non replicable resources or loss of biodiversity).

For example, regarding resettlement costs, a study of hydropower projects build in the 80s' found, that resettlement costs were usually larger than estimated during project design. Cost overruns were large, averaging 40%, and were considerably larger than overall cost overruns. Then, since these costs were usually a minor proportion of the total costs --below 10%-- the projects usually could withstand these cost increases and still be profitable (one more reason to make the project pay fare compensations). On the other hand when resettlement costs where high at the beginning of the project (over 10% of the estimated costs) significant costs overruns may jeopardize the project rate of return, and a more careful cost estimation at the assessment stage would be granted.

Probably the best way to go would be a combination of (a) economic valuation of social and environmental costs and benefits that can duly be mitigated or replicated, and (b) a set of thresholds (acceptable/ unacceptable) for environmental and social values where we lack a consensus on its economic value. Except in extreme cases the latter will be the stricter yardstick. For instance in the 50 dam project study mentioned above (OED, 1996) doubling resettlement expenditures would not change the economic assessment of any project. On the other hand if a threshold is established whereby "a major negative impact in the environment or the local population is considered unacceptable" a good 25% of the projects would fail it

The rate of discount

CBA and most economic analysis use a positive rate of discount to compare cost or benefits accruing at different times. This practice penalizes the future and favors the present (or the short range over the long range). The theoretical and practical reasons for this procedure are discussed at length in the economic literature and are reviewed in several reports of the FEDA thematic.

The issue we want to address here is a misunderstanding that seems common among some dam stakeholders namely that: "other things equal, a lower rate of discount will make dam project less attractive". Actually exactly the opposite is true: "other things equal, the lower the rate of discount the more attractive dams would be". The reason should be straightforward. Dams, as mot large infrastructure projects have large construction costs crammed in the first 5-10 years, while the expected benefits, will come by over 50 years or more. Therefore a high discount rate since it reduce the present value of distant benefits vis a vis the present value of short term costs will make the dam project less attractive than a lower discount rate that acts in the opposite direction.

Just as an example we reproduce below the CBA figures of the Pak Mun Dam hydropower for a 150 MW configuration. During the first five years of construction cost outweigh benefits, represented here by a negative number, while benefits outweigh costs from year 5 through year 54 (with the exception of the year 28 when a replacement of machinery is required).

Here when the discount rate falls from 10% to 0% the project net present value (NPV) rocket from 1,983 million Baht to 30,549 million Baht. This outcome does not depend on Pack Mun particular cost and benefits or how well were they estimated, it will happen in any case where the bulk of the costs are incurred at the beginning of the period and benefits are spread through the project life.

Table 2. Cash Flow (CF) of the Pak Mun Dam hydropower for a 150 MW configuration, based in the CBA estimates (in millions of 1991 Baht)

Year	CF	Year	CF	Year	CF	Year	CF	Year	CF	Year	CF
1990	-296	**2000**	604	**2010**	614	**2020**	457	**2030**	598	**2040**	614
1991	-770	**2001**	609	**2011**	614	**2021**	614	**2031**	607	**2041**	614
1992	-875	**2002**	614	**2012**	819	**2022**	614	**2032**	647	**2042**	614
1993	-301	**2003**	614	**2013**	1931	**2023**	614	**2033**	1867	**2043**	614
1994	-104	**2004**	614	**2014**	894	**2024**	615	**2034**	894	**2044**	677
1995	531	**2005**	614	**2015**	614	**2025**	630	**2035**	614		
1996	582	**2006**	614	**2016**	614	**2026**	758	**2036**	614		
1997	588	**2007**	614	**2017**	527	**2027**	808	**2037**	614		
1998	593	**2008**	614	**2018**	-245	**2028**	614	**2038**	614		
1999	598	**2009**	614	**2019**	342	**2029**	614	**2039**	614		

Source: From WCD, Pak Mun Dam, Mekong River Basin, Thailand, table A-1

Table 3. Net Present Value (in millions of 1991 Baht)

Discount rate	Net Present Value	Discount rate	Net Present Value
10%	1,983	4%	9,208
8%	3,293	2%	16,265
6%	5,447	No discount rate (0%)	30,549

Source: Based in table 2

Conclusions

The limited experience auditing CBA shows that it is a very imprecise instrument, but so are all other assessing techniques, and any decision making process needs criteria to analyze trade-offs. that ideally should be coherent, transparent and acceptable to the parties. We submit that:

- CBA should be used as part of a multi-criteria decision making process, together with Distributional Analysis, financial analysis and other non-economic tools that are required to assess dimensions like culture, ecology, governance, macroeconomic impact etc.
- The literature, and the FEDA reports illustrate many alternatives to improve current CBA practices.
- Regarding environmental and social impacts the best way to go would be a combination of (a) economic valuation of social and environmental costs and benefits that can duly be

mitigated or replicated, and (b) a set of thresholds (acceptable/ unacceptable) for environmental and social values where we lack a consensus on its economic value.

A related question is how CBA could be used to foster a wider and better informed participation in the decision making process, when actually they (and other technical analysis) are mostly used either to limit participation: the "this is a highly technical issue" approach; to deny legitimacy: the "you just don't understand" approach: and in doing so they foster over-the-board rejection: the "we don't believe on it" approach. In this line some important suggestions include:

- Do not address the project assessment only as technical exercises to be presented key in hand. At least the main stakeholders that will be directly participating, or whose interest need to be acknowledge, in the decision making should also participate in understanding and defining the scope of the CBA and the distributional analysis: what alternatives will be considered, what cost and benefits will be considered, and how. To allow for such a participatory scoping face (a) the participants may need some initial learning, but, (b) the technical staff will need some learning too so as to present issues in a non technical language, yet fully fledged and non patronizing, and be willing to spent time answering questions and discussing issues. The bottom line here is that while doing the actual analysis may be a technical task, deciding what it is going to addressed and how, is part of the decision making process.

- All this is costly and therefore there would be time and moneys constraint, and the WCD could want to underline that (a) not all dam projects are equally problematic and ask for the same level of screening; and that (b) doing analysis by stages(e.g. in CBA, identification, pre-appraisal, appraisal, design) may take more time but would have the benefit of allowing for discussions at each stage and stopping short of not needed stages. In some countries the process would be better served if the project by project approach is supplemented by the existence of a focal point that regularly undertakes sectoral analysis and reviews (in some cases the sectoral Ministry has this role)

- At the final stage when it comes to understanding and weighting the outcomes of the CBA as well as the outcomes of other analysis (distributional, ecological, macroeconomic, political etc.) it is important that participation in the decision making process not be preempted by the technical approach. The CBA documents and/or speakers should be able to answer stakeholders questions regarding why? how sure could we be? and most important, what if?

- A measure of the final contribution of CBA to the decision making process should be not that is succeed in imposing one decision making criteria over another but that it inform the decision making process with (a) a better understanding of the trade-off involved, and (b) clear indications of how can agreed upon thresholds -ecological, social, economic or others- be better attained.