Volume : 4 | Issue : 4 | April 2015 • ISSN No 2277 - 8179

Research Paper

Economic Appraisal And Evaluation Proce¬Dure of Water Resources Projects in India : A Critical Review

STATISTICS

KEYWORDS : Benefit-Cost Analysis, Social Benefit Cost Analysis, Water Resources Project, Project Appraisal ,

Vidya Purandare — Associate Professor, Water and Land Management Institute, Aurangabad,Maharashtra INDIA

Dr. V.H.Bajaj — Prof. & Head, Department of Statistics Dr. Babasab Ambedkar Marathawad University Aurangabad, Maharashtra INDIA

ABSTRACT

This paper discusses the need for developing realistic procedure for Economic Appraisal & Evaluation of Water Resources Projects in India. The existing criteria the " Benefit-Cost Ratio " as per Second Irrigation Irrigation Commission 1972, Govt. of India. In view of number of limitations of criteria suggested by the Commission, it is high time that we need to adopt the Social Benefit Cost Analysis (SBCA) for the WRPs . This technique can be used to economically evaluate projects & also evaluate in terms of the explicit National objectives such as employment generation, redistribution of income & development of backward regions, etc. Pecuniary costs and benefits need not be considered in SBCA. The classification & estimation of costs & benefits, into direct tangible; direct intangible ; indirect tangible; indirect intangible needs to be carried out.

1.INTRODUCTION:

Water is life! Water is essential in the lives of all flora and fauna on earth. Development of Water Resources Projects (either Gravity flow or Lift Irrigation projects) is a complex task & needs huge investments. This makes it imperative to take a conscious, judicious and sound decision for investment and construction of projects. Any casual approach can lead to a variety of problems right from water availability through execution, time and cost overruns offsetting the economics of the project. It is therefore necessary that projects are planned based on adequate surveys and investigations, well engineered, soundly designed & evaluated based on reliable statistical techniques & appropriate economic analysis.

Water availability is the main & the most important parameter for the success of any water Resources Project. By means of analysis of hydrologic data through statistical techniques one can arrive at appropriate value of water availability in the reservoir. Unless there is satisfactory expected yield in the reservoir, the water resources project cannot prove to be economically feasible. Water availability is the crux of economic viability.

The process of formulation and Economic Appraisal of WRPs are of paramount importance for their clearance. The Central Water Commission (CWC) in India has laid down detailed guidelines for preparation of project estimates of WRPs

The preliminary reports are scrutinized in the office where they are submitted. Once a report is found acceptable, "In Principle", consent from CWC for Detailed Project Report(DPR) preparation is communicated after examination and clearance by a Screening Committee from the office of the Chief Engineer, Project Apprisal organization(PAO), CWC. The time schedule for according consent of CWC for preparation of DPR is given in the guidelines issued. Investment approval by Planning Commission also needs to be sought .(CWC, 2010)

2.The Background:

- During colonial rule – Irrigation systems were looked upon as commercial ventures.
- In 1880 unproductive irrigation projects were introduced as famine relief measures and in subsequent years protective schemes were undertaken.
- After independence irrigation projects were viewed as instruments of development especially for augmenting food production, employment and income.
- Abandonment of commercial approach has lead to dwindling the financial return from irrigation systems. Hence showing increasing losses and growing burden on general revenue of the State.
- The Second Irrigation Commission, Government of India, 1972 recommended B-C Ratio estimation.
- World Bank recognized that Nitin Desai Committee constituted by planning commission recommended Economic Rate of Return of 9% as acceptable rate with 7% for drought prone areas, chronically flood – prone & hilly areas.(Nitin Deai, 1983)
- For Economic feasibility of the WRPs, in addition to B-C Ratio calculations the CWC also introduced estimation of Internal Rate of Return based on market prices. The CWC has issued revised guidelines as and when required. The format suggested by Second Irrigation Commission, Govt. of India, 1972 has been revised and the latest being followed is given as Annex-I.

"Annex-I-Format for calculation of benefit cost ratio"-pp 9-10

3.TECHNIQUES OF SELECTING A PROJECT[1]:

3.1. Present Methodology

Second Irrigation Commission, Government of India 1972, endorsed the use of benefit cost ratio for judging the economic soundness of irrigation projects. (Irrigation Commission GoI, 1972)

- Minimum B-C. Ratio value is 1.5 in general.

- But minimum B-C ratio for irrigation projects in drought prone or tribal areas is 1.0

- B / C. = $\frac{\text{Net annual benefits}}{\text{Annual Costs}}$

3.2. Discounted cash flow techniques :

The B-C. Ratio mentioned above ignores time value of money therefore discounting techniques is suggested for economic analysis of project. The techniques are :

Net present method
Benefit cost ratio method
Internal Rate of Return / Economic Rate of Return method

- Discounted B - C Ratio =

$$\frac{\text{Present worth of total benefits}}{\text{Present worth of total costs}}$$

- Net Present Worth = Present worth of total Benefits - Present worth of total cost.
- IRR is the discount rate at which discounted benefit cost ratio is = 1 & market prices are considered for estimation. Norm suggested is IRR has to be >=12% in general & 10% for drought prone /tribal areas.

Volume : 4 | Issue : 4 | April 2015 • ISSN No 2277 - 8179

4. Present methodology & its limitations[2.]

The Report of the Irrigation Commission clearly mentions that the irrigation policy in India will have several objectives besides increasing the production of foodgrains and fibres, etc., and such a policy must also be at par with the declared national objectives of a socialistic pattern of society. In this background, the present procedure for B-C ratio calculation appears inadequate,(Sinha and Bhatia, 1982) because:

- the objectives of employment generation, income re-distribution and removal of regional

disparities do not get reflected explicitly in the benefit-cost ratio used for project selection.

- the consideration of adjustments for the possible divergence between market prices and the opportunity costs of resources is not observed except in the case of capital, for which a 10 per cent rate of interest has been recommended to reflect the prevailing demand for capital. The scarcity of resources such as foreign exchange , surplus of resources such as unskilled and semi-skilled labor in the country are not reflected. But if the benefits and costs are evaluated at shadow prices rather than at market prices, the B-C ratios of different projects may change, thus affecting their ranking and selection.

-the economic criterion does not take into consideration benefits of employment generation in a labor surplus economy, distribution of income among regions and persons and other social welfare factors. The Commission has taken these considerations into account to some extent by accepting a B-C ratio of 1.0 for drought-affected regions instead of 1.5 for other regions.

- the annualized costs and benefits do not take into account the time factor and the trend of production during the life of the project while calculating B-C ratio.

- no risk and uncertainty analysis has been suggested. It has simply been stated that a higher rate of interest i.e. 10 percent also covers some of the risks that arise on account of the uncertainties.

- sensitivity analysis of the project's economic feasibility w.r.t. escalation of cost, delay in project completion & hence benefits, are found missing. Basically reducing risk by taking precautions is necessary.

5.THE SOCIAL BENEFIT COST ANALYSIS [3] :

The cost of WRPs have been going up considerably. Good / simpler project sites have almost exhausted. The newer/more difficult dam sites fail to satisfy the present norm / criteria of Benefit Cost Ratio and Internal Rate of Return. The time has changed leading to more expenditure and at the same time substantial benefits to the society due to project, other than the direct monetary benefits which are considered in the present methodology. Hence to satisfy the said norms using existing procedure, manipulations in the cost and benefit are inevitable.

Considering these limitations of the economic criteria suggested by the Irrigation Commission, there is need for a detailed social benefit-cost analysis of an individual WRP, which can be used to evaluate a project in terms of the national objectives viz. employment generation, redistribution of income and development of backward regions, etc.

The literature on social benefit-cost analysis for project appraisal / evaluation mentions two main approaches ,viz. United Nations Industrial Development (UNIDO) method and the Little and Mirrlees (LM) approach, also commonly known as the Organisation for Economic cooperation & Development(OECD) method.

The UNIDO method is more realistic in assuming that there are many restrictions on economic activities and prices reflected as quotas, tariffs, subsidies and administered prices of labor, foreign exchange and many scarce commodities. All the items involved in a project are valued in terms of shadow prices, which reflect societal benefits & cost. (Chawla, 1987).

On the other hand, in Little-Mirrlees approach all the costs and benefits of the project are systematically broken down into commodities. For instance, project costs are seperated into cost values for cement, steel, petroleum products, power, mechanical, electrical, transport equipments etc. Also various categories viz. unskilled labour and skilled labour are considered. Then, these commodity quantities are evaluated at their market prices for financial cost & benefit estimates and also at economic prices for the economic or social cost & benefit estimates.

To obtain the economic prices from corresponding market price, the construction conversion factor (CCF) of 0.75 is used for capital costs. The 'standard conversion factor' (SCF), SCF of 0.8 is used for most of the small items and non-tradable commodities including O & M cost, except for tax/subsidy adjustment of the market prices. For estimating shadow wage rate to reflect the social cost of unskilled labour used in the project, the adjustment factor of 0.65 is applied to the actual labour cost to obtain the social opportunity cost of unskilled labour.

The SBCA[4] of Auranga project in Bihar State is one such study available. A study conducted by Directorate of Irrigation Research & Development (DIRD)[5] Pune under United States Agency for International Development (USAID) covering one major, one medium & one minor irrigation projects in Maharashtra on irrigation impact evaluation of completed irrigation projects also takes into consideration the indirect benefits viz. employment generation, positive health impacts, influence area benefits, in addition to the direct monetary benefits. (Daines, 1989)

"Table 1 Details of industries in Aurangabad Districts"

The **Table 1**[6] below speaks volumes about the indirect tangible & intangible benefits due to one project in Marathwada region of Maharashtra viz. Jaykwadi with consideration of only one aspect of development. Industrial development has made a tremendous increase in infrastructure development, schools, collages. Social & economic up liftment of people. These benefits are not considered presently when it comes to Project evaluation of irrigation projects.(MWIC, 1998)

Table1.
Contribution of Jayakwadi Project in Regional Socio–Economic Development
Details of industries in Aurangabad Districts

Name of industrial estate	Number of industries prior to taking up of project	No. of industries after completion of projects	Source reservoir
1	2	3	4
Aurangabadbad	4	92	Jayakwadi
Chikaltana		429	
Paithan		108	
Waluj		569	
TOTAL	1198		

6.ESTIMATION OF NATIONAL / REGIONAL PAREAMETERS[7]

The above discussion suggests that for a social benefit cost analysis of an irrigation project, one needs the values of the following national/regional parameters:

- Social Rate of Discount:
- Shadow Price of Investment (or the adjustment factor for savings):
- Shadow Price of Labor for different categories by season and by region;
- Shadow Price of Foreign Exchange;
- Income Distribution Weights

Generally, the estimates of these parameter values are specified by the national/regional planning agencies and the project authorities have to use these values.

7. IDENTIFICATION OF SOCIAL COSTS AND BENEFITS[8]

The SBCA takes into consideration costs or benefits of the project from society point of view but not from governments point of view. SBCA does not consider only cash inflows and outflows but it also considers the effects on society, due to project, both direct and indirect. (Dholakia, 2011)

Generally, all costs and benefits are measured in real terms or at constant prices. The different types of costs & benefits those can be considered in SBCA are listed below.

7.1Costs: All the costs can be classified into four categories like direct and indirect, tangible and intangible.

7.1.1*Direct Tangible Costs:* All project costs are direct tangible costs. They include

- construction of the dam, distribution network, drainage,
- domestic /drinking and industrial water supply structures,
- operation and maintenance (O & M) costs,
- costs for command area development and catchment area treatment, etc.
- cost of the land inundated by the reservoir. (Since such land would be permanently lost to society, its social cost should be considered which includes both agricultural and forest land and products from such land, i.e. crops and forest produce).

7.1.2.Direct Intangible Costs: This is an emotional cost. Very often such intangible costs are not evaluated and are excluded.

- These would include trauma of families displaced by inundation are also direct intangible costs.
- rare plant species, archaeological monuments, the temples/ holy places and which would be permanently lost.

7.1.3.Indirect Tangible Costs: This would include

- the cost of public health due to mosquitoes and water borne deceases.
- cost of afforestation if the direct cost of inundated forest land is not considered.
- costs of water logging & salinity. animal health

the loss of fisheries downstream in the river. For example, supply of water by tankers would practically stop with SSP water becoming available. Similarly, the demand for diesel and coal would significantly decline with SSP because surface water would substitute ground water and hydro-power would substitute thermal power. Such indirect tangible costs are not adequately captured and estimated in the appraisals of SSP.

7.1.4.Indirect Intangible Costs:

- psychological costs of those who are resettled / rehabilitated
- psychological costs of those unemployed
- disturbance of ecological and carbon-oxygen balance through submergence of Land in the reservoir.

7.2.Benefits:

These include incremental real benefits to society as a whole, from the project, based on, with project and without. Benefits can be classified as direct and indirect, tangible and intangible.

7.2.1. *Direct Tangible Benefits:*

- irrigation benefits - agriculture crop production
- domestic and drinking water
- industrial water use
- hydro-power generation
- navigation and waterways.
- increased fisheries / animal husbandry
- savings on account of flood control in the downstream (if this is an objective for construction)

7.2.2.Direct Intangible Benefits:

- attractions for tourists & scenery.
- assured water supply in a severely water-scarce area is intangible benefit to society.
- public parks on the dam site

7.2.3.Indirect Tangible Benefits:

- increased flow of tourists
- increased level of ground water in the command through recharge
- tangible public health benefits
- increase in employment due to more options of business.
- If hydropower project, then cleanest source of energy causing significant environment benefits

7.2.4.Indirect Intangible Benefits:

- reduction in seasonal and permanent migration of people and animals due to water availability, which is a emotional, psychological.
- education of the children of such migrants, a significant long term social benefit.
- improvement in ground water quality and reduction in salinity

8.Economic Rate of Return[7] (ERR)

ERR is the discount rate at which the cost and benefits of a project, discounted over its life, are equal. ERR differs from the financial rate of return. ERR takes into account the economic prices.

9.Conclusion:

In the view of, number of limitations of the economic criteria suggested by the Second Irrigation Commission Government of India, changing times & phenomenon and neds of society,

- it is high time that we need to adopt the Social Benefit Cost Analysis (SBCA) for the WRPs . This technique can be used to economically evaluate projects & also evaluate in terms of the explicit National objectives viz. employment generation, redistribution of income & development of backward regions, etc.
- The economic appraisals/ evaluations or the SBCA of any project should consider, serious estimations of the direct intangible costs and benefits, several indirect intangible benefits and most of the indirect intangible costs and benefits.
- The quantification, estimation & the standardization of social costs & benefits, conversion of all these in monetary terms and developing procedures / methodology to carryout these is the major requirement.
- To go one step further, the need of time is, setting up of a **Third Commission on Water & Irrigation at Government of India level** which may redefine the whole procedure for project appraisal and Evaluation of WRPs.

Volume : 4 | Issue : 4 | April 2015 • ISSN No 2277 - 8179

Annex-1.

FORMAT FOR CALCULATION OF BENEFIT COST RATIO				
2			3	4
GROSS RECEIPTS			Without roject	With Project
Gross value of farm produce (A-1)				
Dung receipts (as 30%) of the foder expenditure				
Total (A): Gross Receipts (1 +2)				
EXPENSES				
Expenditure on seeds				
Expenditure on manure etc.				
Expenditure on hired labour (human and bullock)				
Without Project	With Project			
Fodder expenses	15% of item A-1	10% of item A-1		
Depreciation on implements	2.7% of item A-1	2.7% of item A-1		
Share and cash Rent	5% of item A-1	3% of item A-1		
Land Revenue	2% of item A-1	2% of item A-1		
Total (B) Expenses (1 to 7)				
NET VALUE OF PROCEDURE				
Total Gross receipts (Total A-3)				
Minus total expenses (Total B-8)				
Net value of procedure © : (1-2)				
ANNUAL AGRICULTURAL BENEITS:				
Net value with project (C-3)				
Minus net value without project (C-3)				
Net Annual Benefits (D): (1-2)				
Other net annual benefits due to adequate including pisciculture, drinking & industrial water supply, hydro-power generation animal husbandry, catchment area treatment chargeable to project, canal bank plantation, reservoir periphery afforestation etc.				
TOTAL NET ANNUAL BENEFITS (D3 + E)				

ANNUAL COSTS:	
Interest on capital @ 10% (Estimated total cost of the project including cost of land development @ Rs. 3000 per ha.)	
Depreciation of the project @ 1% of the cost of project for 100 years life of the project and @ 2% for 50 years life of the project.	
Annual operation and maintenance charges @ Rs. 450 per ha. of CCA ----	
Maintenance of the head works @ 1% of its cost	
Depreciation of the pumping system @ 8.33% of the estimated cost of the pumping system assuming life of the system as 12 years (Applicable to lift irrigation).	
Depreciation of the raising mains @ 3.33% of the estimated cost of the raising mains assuming life of the system as 30 years (Applicable to lift irrigation).	
Power charges for lift irrigation @ Rs.... Per ha. (Applicable to lift irrigation).	
Total (G): Annual costs (1 to 7)	
BENEFIT COST RATIO = Annual Benefits / Annual Costs	= F / G8

REFERENCE

1. THE GUIDELINES OF CENTRAL WATER COMMISSION (CWC). | 2. GOVT. OF INDIA, (1972): THE REPORT OF SECOND IRRIGATION COMMISSION | 3. CHAWALA KRISHNAN, (1987): SOCIAL COST BENEFIT ANALYSES. | 4. BASWAN SINHA & RAMESH BHATIA, (1982): ECONOMIC APPRAISAL OF IRRIGATION PROJECTS IN INDIA. | 5. DAINES S.R, (1989): A REPORT ON IRRIGATION IMPACT EVALUATION SYSTEM, DIRD, PUNE, GOVT. OF MAHARASHTRA. | | 6. REPORT OF MAHARASHTRA WATER & IRRIGATION COMMISSION (MWIC), (1998). | 7. NITIN DESAI COMMITTEE,(1983): REPORT OF REVIEW COMMITTEE ON | PRESENT METHODOLOGY (B.C. RATIO TECHNIQUE). | 8. PARTHSARTHI,R.P. AND RAVINDRA DHOLAKIYA (EDITIORS), (2011): SARDAR SARVOAR PORJECTS ON THE RIVER NARMADA VOLUME-I. |