Lecture notes for Winter School on
"Social Science Research tools in Inland Fisheries development"
January 7-27, 2008, CIFRI, Barrackpore

FISHERIES PROJECT FORMULATION AND APPRAISAL

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Introduction

A developing country like India is generally faced with the problem of a rapidly growing population. The rapid growth of population has created problems of unemployment and under employment in such countries. An underdeveloped country suffers from a chronic deficiency of capital resources. The capital per capita is very low to the tune of $350. It is the opinion of most demographers that population pressures are likely to increase still further in future in the under developed countries. As such it becomes necessary to step up the rate of development in order to outstrip the rate of population increase.

There is a universal clamour in the underdeveloped countries for quick and accelerated "Economic Growth" within the shortest possible time. Prof. Rostow, defines economic growth as the relation between the rates of increase in capital and working force on one hand and increase in population on the other such that per capita output is rising. Thus per capita output (income) becomes the test of economic growth.

Therefore, it is better to emphasize the need for comprehensive economic planning for a backward, under developed economy on the ground that it assures a high rate of economic growth through a quicker process of capital formation. Hence, sound and effective planning is necessary for development and again this planning will be a success with good projects and both move together

What is a Project?

Project is an investment activity in which financial resources are expended to create capital assets that produce benefits over an extended period of time. That's why projects are often referred to as the cutting edge of development. Project preparation is clearly not the only aspect of fisheries development or planning. Identification of national fisheries development objectives, selecting priority areas for investment, designing effective price policies, and mobilizing resources are all critical. Unless, projects are carefully prepared in substantial detail, inefficient or even wasteful expenditure is almost sure to result- a tragic loss in nations short of capital.

Often projects form a clear and distinct portion of a larger, less precisely identified programme. Again, all we can say in general about a project is that it is an activity for which money will be spent in expectation of returns and which logically, seems to lend itself to planning, financing and implementing as a unit. It is a specific activity, with a

specific starting point and as a specific ending point, intended to accomplish specific objectives. Hence, project acts as a "time slice".
It will have a well-defined sequence of investment and production activities and a specific group of benefits that we can identify, quantify, and usually in fisheries projects, determine a money value for. Its development can be pictured as a progression with temporal, spatial, socio-cultural, financial, and economic dimension. Projects can be seen as temporal and spatial units, each with a financial and economic value and a social input that makes up the continuum. Therefore, project is the smallest operational element prepared and implemented as a separate entity in national plan as a part of development.

A sound and effective plan for national aquaculture development depends upon a number of appropriate investment projects that are viable and contribute to national economy. Poorly identified and prepared investment projects often slow the development of a national aquaculture industry and waste scarce resources.

Virtually every developing country has a systematically elaborated national plan to hasten economic growth and further a range of social objectives. Project provides an important means by which investment and other development expenditure foreseen in plans can be clarified and realized. Sound development plans require good projects, just as good project require sound planning. The two are interdependent.

An investment- project may be anything from a single programme to an entire integrated programme that includes the entire following programme:

1. Fish pond
2. Hatchery
3. Feed plant
4. Ice plant
5. Cold storage
6. Processing plant
7. Wholesale and retail market.
8. Training, Extension etc.

Advantages of projects

1. The project gives us an idea of cost year by year, so that those responsible for providing the necessary resources can do their own planning. Project analysis tell us something about the effects of a proposed investment on the participants in the project, whether they are farmers, small farms, governments enterprises or the society as a whole.
2. Projects enable a better judgment about the administrative and organizational problems that will be encountered. It enables a strengthening of administrative arrangements; if these appear to be weak and tells something of the sensitivity of the return to the investment of managerial problem arises. The project gives both managers and planners better criteria for monitoring the progress of implementation.

3. The project encourages conscious and systematic examination of alternatives. The effects of a proposed project on national income and other objectives can conveniently be compared with the effects of projects in other sectors, of other projects in the same sectors or very important of alternative formulations of virtually the same project.
4. Another advantage of the project is that it helps contain the data problem. In many developing countries, national data are unavoidable or are to a substantial degree, unreliable.

It is true that a project must be seen in a national context, but in many instances the direction that a countries development effort should take is well known, even if precise figure are not available. Most countries know they must increase food production even if they cannot cite reliable figures about total food production or recent growth rate.

Limitations of Projects

1. The quality of project analysis depends on the quality of the data used and of the forecasts of costs and benefits made. To begin with, projects will exist in a changing technical environment. For some projects, the possibility of technological obsolescence will affect judgments about the attractiveness of the investment.

2. Techniques of projects analysis offer only limited help because future circumstances will change. One must judge the risks and uncertainty surrounding a project. It is impossible to quantify completely the risk of a project. We can however note that different kinds of projects or different formulation of essentially the same project may involve different degree of risk. These differences will affect the choice of project design. We can also test a project for sensitivity to change in some specific element, see how the benefits produced by the project will be affected and then judge how likely it is that such changes will occur and whether the changes in benefits will alter or willingness to proceed.

3. Project analysis is a species of what economists call "partial analysis". Normally we assume that the project themselves are too small in relation to the whole economy to have a significant effect on prices. In many instances, however a proposed project is relatively large in relation to national or regional economy. In this event we must adjust our assumption about future price levels to account for the impact of the project itself.

4. Another limitation of the project is an underlying conceptual problem about valuation based on the price system. The relative value of item in a price system depends on the relative weights that individuals participating in the system attach to the satisfaction they can obtain with their incomes. They choose among alternatives and thus the prices of goods and services balance with the values attached to these goods services by all that participate in the market.

Although project analysis must consciously be placed in a broader political and social environment, in general the effects of projects on this environment can be assessed only subjectively. Often economic refers to "externalities" or side effect, such as skill creation and the development of managerial abilities that are by-products of a project. Project may also be under taken to further many objectives, such as regional integration, job creations, beyond economic growth rate alone

Project Cycle

There is a natural sequence by which projects are planned and carried out and this sequence is called 'Project cycle'. International development agencies tend to use the World Bank methodology [Baum, 1982]. Under this scheme the cycle is broken down to six stages.

1. Identification or conception
2. Formulation or preparation
3. Appraisal or analysis
4. Implementation
5. Monitoring and control
6. Evaluation

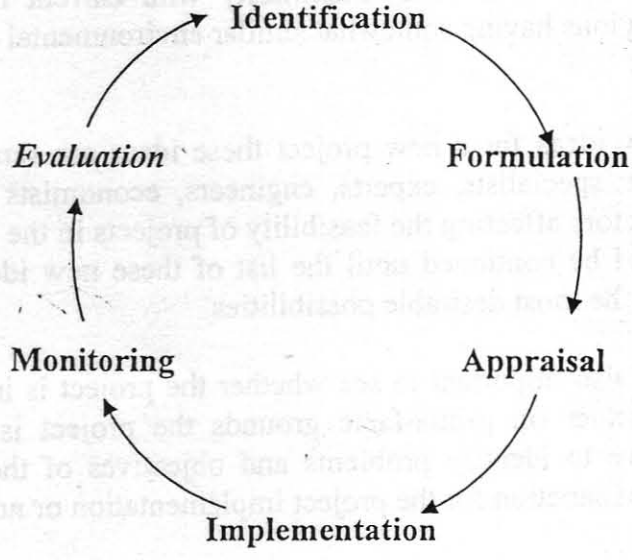

Fig.I The Project Cycle

Conception or Identification of the projects

It is the first phase of the project cycle and here we find or identify potential or suitable projects. There can be many sources from which ideas may come for the identification of good projects.

- Ideas for new projects can evolve from the present programmes.
- Analysis of import and export trends may also brings in new ideas.

- The most common will be well informed technical specialists and local leaders - as while performing their professional duties, technical specialists will have identified many areas where they feel new investment might be profitable.
- A survey of the state or district to project the future needs over the next decade or so will also enable to identify potential projects.
- By investigating local markets: The quality or price of certain raw materials may lead to opportunities to produce competitively for export and /or domestic markets.
- By studying available skills: Labour and management skills which have already been developed in the area, such as in processing agricultural outputs may suggest the possibility of producing other things requiring similar know how. For export possibilities, it will be useful to compare labour costs at different skill levels with the international market.
- By making industry studies: Good opportunities may be found in expanding or diversifying already established processing methods. A thorough analysis of existing industries may lead to identifying logical new projects.
- By review of old projects: projects previously developed but not implemented often become feasible as markets increase or related industries change. It is often possible to find new opportunities in old ideas for which the economic circumstances have improved.
- By observing experience elsewhere: Familiarity with current development in other countries or regions having somewhat similar environmental conditions may suggest possibilities.

After the generation of new ideas for a new project these ideas are screened with the assistance of subject matter specialists, experts, engineers, economists etc who have specialized knowledge of factors affecting the feasibility of projects in the various fishery sectors, the screening should be continued until the list of these new ideas for a good project is narrowed down to the most desirable possibilities.

In identification phase, it is also important to see whether the project is implemented in high priority areas and whether on prima-facie grounds the project is economically feasible. It is also imperative to identify problems and objectives of the projects and whether the government gives sanction for the project implementation or not.

The important stages in the process of identification are:

- Preliminary study
- Pre-feasibility study
- Feasibility

Preliminary study

In this stage, we assess whether the project proposed on the grounds of prima-fascia is feasible and the objectives of the project are achieved. On this ground, the preliminary

study should embody the investment proposals, benefits extended from the project and method of implementation.

Pre-feasibility studies

Pre-feasibility study of project is used to present the framework within the project will operate and should take the form of a fisheries sector review. A full description of the project should be made stating its objective, how these accords with government planning objectives in the sector, how it relates to other fisheries, proposals and to the existing industry. An indication of its total costs in firms of both capital and operating costs and its net foreign exchange costs must be given. Some discussion of the effects of the project on other sectors needs to be made, for example, its linkage effects on shipbuilding, port congestion; its need for new infrastructure development or increased marketing and processing inputs. The likely effect of the project on fish prices, exports, imports and domestic consumption of fish should be considered.

Feasibility studies

In a full feasibility study a detailed analysis and assessment of a project is carried out to enable the levels of risks and rewards to be more fully quantified. This phase is of critical importance because it is the final analysis to be performed before the decision is taken to proceed with full-scale investment.

The study will contain full technical details of processes involved in the project and all assumptions underlying the anticipated markets, yield predictions, and cost estimates. To achieve this, available information of the site, water soil and infrastructure must be collected and assessed. Any gaps in the data must be exposed to establish if they are likely to undermine confidence in the technical assumptions. In a comprehensive study it may be possible to include comparisons with the performance of similar viable projects elsewhere.

Formulation or preparation

The following points are considered while formulating the projects. The location of the project and project site must be based in technical analysis and technical feasibility of the project. The location of the project depends upon available physical resources, market conditions. Marketing facilities, alternative investment prospects, administrative experience, farmers objectives, technical skills, motivations, demand for products etc. Technical analysis must take into consideration all aspects of technology to be used in the project, and account for all inputs of goods and services. Assessment of suitability and adequacy of natural resources in advance based on the scientific investigations is also essential. Alternatives to the resource use are to be considered in formulation of the project. Due consideration is to be given to all the aspects such as technical, financial, commercial, managerial, organizational, social, economical etc. in the formulation of the projects. Identification of the missing links in the infrastructure system particularly in

relation to adequacy of communication systems, markets and storage facilities is important.

Aspect of project preparation and analysis

According to RIPMAN, 1964, project preparation and analysis can be divided into six aspects:

- Technical aspects
- Institutional-organizational-managerial aspects
- Social aspects
- Commercial aspects
- Financial aspects
- Economic aspects

Technical aspects

The technical analysis concerns the projects input (supplies) and outputs (production) of real goods and services. It is extremely important and the project framework must be defined clearly enough to permit the technical analysis will examine the possible technical relation in a proposed fisheries project; the soil in the region of the project and their potential for fisheries development, the availability of ground water, the species variety, the production supplies or the vessels, gear and other infrastructure and also storage facilities etc. On the basis of these and similar considerations the technical analysis will determine the potential yields in the project area.

As the technical analysis proceeds, the project analyst must continue to make sure that the technical estimates and projections relate to realistic conditions and that farmers using the proposed technology on their own fields can realize the results of projects.

Institutional-Organizational-Managerial Aspects

The institutional, organizational and managerial aspects have an important role on projects have an important role on project implementation. The socio-cultural patterns and institutions of those the project will serve must be considered. Does the project design take into account the customs and culture of the farmers who will participate? Will the project involve disruption of the ways in which farmers are accustomed to working? If it does, what provisions are made to help them shift to new skills? By this way one group of questions ask whether the institutional setting of the project is appropriate.

To have a chance of being carried out, a project must relate properly to the institutional structure of the country and region. The project may incorporate local institutions and use them to further the project. How will the administrative organization of the project relate to existing agencies? Is there to be a separate project authority? What will be its links to the relevant operating ministers? Will there be institutional jealousies?

The organizational proposals should be examined to see that the project is manageable. Is the organizational such that lines of authority will be clear? Does the organizational design encourage delegation of authority, or do too many people report directly to the project Director? Are ample provisions included for managers and government supervisors to obtain up- to-date information on the progress of the project? Is a special monitoring group needed? What about training arrangement? Does the project have sufficient authority to keep its account in order and to make disbursements promptly?

Managerial issues are crucial to good project design and implementation. The analyst must examine the ability of available staff to judge whether they can administer such large-scale public sector activities as a complex water project, an extension service, or a credit agency. If such skills are scarce or absent, should this be reflected in a less complex project organization? In fisheries projects, the analyst will also want to consider the managerial skills of the farmers who will participate. If farmers with past experience limited to crop production are to become fish farmers, enough time must be allotted for them to gain their new skills. There must be extension agents who can help farmers learn to new skills and provision must be made for these agents in the organizational design and in the administrative costs of the project.

Social Aspects

Project analysts are also to examine carefully the broader social implications of proposed investments. We have noted proposals to include weight for income distribution in the formal analytical framework so that projects benefiting lower income groups will be favored .So it is the more important in the project design that explicit attention be paid to income distribution.

For social reasons, many governments want to emphasize growth in particular regions and want projects that can be implemented in this region. The project analyst will want to consider carefully the adverse effects a project may have on particular groups in particular regions. In some areas the introduction of mechanical equipment has deprived women of work they needed to support their children. Will a proposed project have such an adverse effect on the income of working women and their families? Those designing or reviewing project will also want to consider the issue of adverse environmental impact and the quality of life that should be a part of any project design.

Commercial Aspects

The commercial aspects of a project include the arrangements for marketing the output produced by the project and the arrangements for the supply of inputs needed to build and operate the project.

On the output side, careful analysis of the proposed market for the project production is essential to ensure that there will be no effective demand at a remunerative price, where will the products be sold? Is the market large enough to absorb the new production

without affecting the price? Is the project for domestic consumption or for export? What financing arrangements will be necessary to market the output?

On the input side, appropriate arrangements must be made for farmers to secure the supplies of quality seed, fertilizers etc. they need to adopt new technology. Do market channels for input exist, and do they have enough capacity to supply new inputs in time? What about financing for the suppliers of inputs and credit for the farmers to purchase these supplies? Commercial aspect of a project also includes arrangement for the procurement of equipment and supplies.

Financial Aspects

It deals with the financial effects of a proposed project on each of its various participants or individuals. A major objective of the financial analysis of farms is to judge how much farm families participating in the project will have to live on. The analyst will need budget projections that estimate year-by-year future gross receipts and expenditures, including the costs associated with production and the credit repayment farms families must take, to determine what remains to compensate the family for its own labour, management skills and capital. Financial analysis must judge whether the family will receive may be in food that is consumed directly in the households or the family realizes a considerable increase in income or "net incremental benefit" by participating in the project.

Economic Aspects

The economic aspects of project preparation and analysis require a determination of the likelihood that a proposed project will contribute significantly to the development of the total economy and that its contribution will be great enough to justify using the scarce resources it will need. The point of view taken in the economic analysis is that of the society as a whole.

In economic analysis taxes and subsidies are treated as transfer payments. The new income generated by a project includes any taxes the project can bear during production and any sales taxes buyers are willing to pay when they purchase the projects products. These taxes are transferred to the government, which acts on behalf of the society as a whole and are not treated as costs. Conversely, a government subsidy to the project is a cost to the society. Generally, in financial analysis taxes are usually treated as a cost and subsidy as a return.

Appraisal or analysis

Appraisal should take place before the implementation of the project. When a project is fully prepared it is appraised before being accepted as an investment suitable for borrowing. A team of independent experts appointed by government, the project sponsor, the funding agency, or the multilateral bank concerned undertakes appraisal.

The objective of appraisal is to check the thoroughness of the project by making a completely objective and independent study of the project as it has been presented, data have to be checked for reliability, consistency, the reasonableness of its projections, its accuracy in calculations and the validity of its assumptions. It is also necessary to examine the banking, administrative and commercial structures, which will be involved in project implementation and to ensure these have been properly conceived.

There are five criteria for appraisal of fisheries projects.

1. Technical review
2. Commercial review
3. Organization and Management review
4. Financial review
5. Economic review

Implementation

This is the most crucial phase of the project cycle. The secret of successful implementation depends upon the extent of realism put into the plans drawn before hand. It is often not uncommon, to notice our plans getting deviated from the reality. Here the role of prudent decisions by the personnel incharge of implementation to tackle the situation comes into play. Project implementation can be divided into three different periods viz. Investment period, developmental period and Full-production period. Investment period may range from few months to few years depending upon the nature of assets to be acquired. Assets proposed should be of superior quality. Development period too consumes time. Implementing agency should make all efforts to reduce the gestation period as per the plan envisaged in the beginning. Full production period is the time during which the beneficiaries start reaping the benefits of the project. Implementing agency should ensure that the beneficiaries do continue to receive benefits during the entire life span of the project.

Monitoring

Monitoring is the timely collection and analysis of data on the progress of a project, with the objective of identifying constraints, which impede successful implementation. This is highly desirable, particularly when projects fail, to be completed as per time schedule or in the process of attaining the set goals. It is imperative to get the feedback on the problems faced so that effective measures can be taken up to plug the deficiencies, which hamper the speedy implementation. Monitoring has to be done continuously to offset various shortcomings that crop up from time to time with regard to various aspects of implementation.

Evaluation

This is last phase of the project cycle. It is not confined to the completed project. Evaluation can be done several times during the life of a project. In the evaluation

process, it is important to see how far the objectives set out in the project are achieved. Deficiencies, snags or failures to achieve the objectives may be analysed and appropriate solutions to such failures answered. Evaluation process is to be completed in three phases. They are mid course evaluation, concurrent evaluation and ex-post evaluation. In the first phase, evaluation is attempted before any change occurs in the existing situation. This is primarily meant to assess economic feasibility of the projects, since it is done at the very beginning. This type of analysis is otherwise called pre-project evaluation. Sometimes it is also important to take up evaluation when the project is in execution, and such evaluation is called concurrent evaluation. This type of evaluation is basically meant for identifying and analyzing the pitfalls in the execution of the project. Evaluation is also resorted to particularly when the project is completed in all its phases, in order to assess the achievement of ends or objectives set out by the projects. Such evaluation is called ex-post evaluation or end-evaluation. Evaluation is done by the agency other than the implementing one, like financing bank or sponsoring agency or government

Measures of Project Worth

There are two types of measures of project worth i.e. undiscounted and discounted. The basic underlying difference between these two lies in the consideration of time value of money in the project investment. Undiscounted measures do not take into account the time value of money. Any economic decisions including fish production involve benefits and costs that are expected to occur at future time period. The construction of ponds race ways, and fish tank, for example, requires immediate cash outlay, which with the production and sale of fish, will result in future cash inflows or returns .In order to determine whether the future cash inflows justify present initial investment, we must compare money spent today with the money received in the future.

The time value of money influences many production decisions. Everyone prefers money today to money in the future. Therefore in order to invest a rupee in fish production today, one must be guaranteed a return in the future that is equal to or greater than the rupee invested today. The preference for the rupee now instead of a rupee in the future arises from three basic reasons: Uncertainty, Alternative uses and Inflation.
Uncertainty- influences preferences because one is never sure what will take place tomorrow. Alternative uses- it will determine whether one invests in one project or another.

Inflation-affects the purchasing power of the rupee.

Interest

According to Seligman, "Interest is the return from the fund of capital. "Carver has defined interest as, "The income that goes to the owner of capital. "So, interest is the price paid for the use of credit. The interest rate is considered as an exchange price between present and future rupee. The interest rate can be of two type: Simple and compound. *Re.1* today exchanges for *(1 + I)* one period in the future or alternatively Re 1 payment made one period in the future exchanges 1/ (1 + I) now. (I= interest rate, either

simple or compound). The interest rates are always positive because of the (+) ve time preference for money i.e. the sooner money is available, the greater its value.

Compounding

The process of finding the future of a present sum is called compounding.

We have Rs.1000 to invest in a bank paying interest at 6 percent compounded annually. (i=6percent). After 1year we will have Rs.1000+Rs.1000xi=1000(1+i) =1000(1+0.6)=Rs. 1,060.

After 2 year we will have Rs.1000 (1+i)+1000(1+i) x i

$=1000(1+i)(1+i)=1000(1+i)^2$

$=1000(1+0.6)^2$ =Rs.1,123.6

So a general formula for obtaining the future value of a present sum may be written as

$$V_N=Vo\ (1+i)^N$$

Where, V_N= Future value

Vo=present value

i= Interest rate

N=Number of conversion period

In case of value of a series of payments:

If a fish farmer wants to invest money in a finfish production activity which will generate returns over a number of years (N). The fish farmer wants to know the value of payments a or returns after a number of years .We are finding the future value of series of payments which is easy to calculate using this formula

$$V_N=Po\ (1+i)^N + P_1\ (1+i)^{N-1} + P_2\ (1+i)^{N-2} + \ldots\ldots\ldots + Pn$$

$$= \sum_{N=0}^{N} P_N\ (1+i)^{N-n}$$

Where, V_N=the future value of a series of payments.

P_N=the payment of each conversion period (n)(n= 0, 1, 2, 3, ...N).

Example:

Let us consider the income from an aerator in the pond which will yield income flows of Rs. 300,400, 500, 600, and Rs.700 during the 1st to 5th year of functioning. If we assume that interest rate is 9percent then what is future value of the series of payments?

$V_N = 300(1.09)^4 + 400(1.09)^3 + 500(1.09)^2 + 600(1.09)^1 + 700(1.09)^0$

$= Rs.2,889.53$

But the summed value of the income generated over the 5-year period is Rs.2500. The additional accrued amount is the result compounding, since it is believed that the income received is invested at 9 percent per year.

Discounting

The process of finding the present value of a future payment is called discounting. The future value must be discounted to reflect the earnings lost by not being able to immediately invest the future sum in the alternative investment. The general formula for discounting is as follows:

$$V_o = \frac{V_N}{(1+i)^N} = V_N(1+i)^{-N}$$

For series of payments, $Vo = \sum_{n=o}^{N} \frac{Pn}{(1+i)^n}$

Where, V_o = the present value of the payment series.

Pn = the payment for each conversion period (n)

(n = 0, 1, 2, 3, ...N)

i = Interest rate.

Example

If return from five years is Rs. 300, 400, 500, 600, 700, for the 1st, 2nd, 3rd, 4th, & 5th year respectively at a discount rate of 9 percent, the present value of the return is

$$V_o = \frac{300}{(1.09)^1} + \frac{400}{(1.09)^2} + \frac{500}{(1.09)^3} + \frac{600}{(1.09)^4} + \frac{700}{(1.09)^5}$$

$= 275.23 + 336.67 + 386.09 + 425.06 + 454.95 = Rs.1877.97$

Discounted Measures of project worth

The technique of discounting permits to determine whether to accept for implementation, projects that have variously shaped time streams i.e., patterns of when costs & benefits fall during the life of the project that differ from one another - and that are of different durations. The most common means of doing this is to subtract year-by-year the costs from the benefits to arrive at the incremental net benefits stream-the so-called cash flow- and then to discount that. This approach will give one of three discounted cash flow measures of project worth:- the net present worth , the internal rate of return or the net benefit investment ratio . Another discounted measure of project worth is to find out the present worth of the cost and benefit stream separately and then to divide the present

worth of the benefit stream by the present worth of the cost stream to obtain the benefit-cost ratio.

Because the benefit and cost streams are discounted, the benefit -cost ratio is a discounted measure of project worth. But because the benefit and cost streams are discounted separately rather than subtracted from one another year-by-year, the benefit-cost ratio is not a discounted cash flow.

Discounted payback period

It is a simple method which estimates the length of the time required for an investment to itself out; that is the number of years required for a firm to cover its original investment from the net cash inflows.

Although the period is easy to calculate, it can lead to erroneous decisions .As can be seen from our example, it ignores income beyond the payback period, & therefore is biased towards projects with shorter maturity periods .The payback period is sometimes used by investors who are short of cash and need to reinvest all cash flows that occur in early stages of the projects. Investors who are risk averse often use this technique in evaluating projects. Such investors need to receive cash at the early stages of projects since the future is uncertain. This, the payback period method is somewhat better reflection of liquidity than profitability.

Table: Net cash inflow for project A & B:

	Project A					**Project B**			
Year	Inves-ment	Net Cash Inflow	Discount factor (12%)	Present value of Net cash inflow	Year	Invest -ment	Net Cash Inflow	Discount factor (12%)	Present value of Net cash inflow
0	2000	-	1. 000		0	2000	-	1. 000	
1		700	0. 893	635. 10	1		300	0. 893	267. 90
2		600	0. 797	478. 20	2		400	0. 797	318. 80
3		500	0. 712	356. 00	3		500	0. 712	356. 00
4		400	0. 636	254. 40	4		600	0. 636	381. 60
5		300	0. 567	170. 10	5		700	0. 567	396. 90
6		200	0. 507	101. 40	6		800	0. 507	405. 60
7		100	0. 452	45. 20	7		900	0. 452	406. 80

The first project (A) is an Rs.2000 investment for the purpose of one aerator, & the second (B) is to invest in a feed shed of equal cost. The payback period for the aerator is

3.5 years and that for feed shed is approximately 4.3 years. If decision- maker wants to cover the cost of investment in the shortest period of time, project (A) will be preferred over (B). But this decision completely unwise because the discounted payback periods for project (A) & (B) are nearly 6.8 years and 5.8 years respectively. So the project (B) is to be preferred over the other one and this will be actually wise decision.

Derivation of Incremental Net-Benefit (Incremental cash flow)

When we consider a project, we see it as earning a gross benefit streams from which we must deduct the capital investment and pay the operation costs-the costs of machinery, fertilizer, hire labour, consultants and the like. What is then left over is a residual (what will likely be negative in the early years of the project) that is available to recover the investment made in the project (the return of capital) a compensate for the use of resources invested in the project (the return to or on capital). The residual is the net benefit stream. Deducting the without-project net benefit gives the incremental net benefit stream.

The major characteristic of the incremental net benefit stream or incremental cash flow is that it includes, without differentiating, both the return of capital and return to capital. To compute the incremental net benefit or cash flow we do not deduct from the gross benefit neither any allowance for the depreciation (that is return of capital) nor any allowance for interest on the capital investment employed that has been supplied by the entity for which we are doing the analysis.

We do not deduct depreciation because the incremental net benefit stream already allows for the return of capital over the life of the project. We do not deduct interest on the capital supplied by the entity for which we are doing because in effect the result of a discounted cash flow analysis is the allowance for the return to the entity's capital. Income taxes must be deducted to arrive at the incremental net-benefit. It may include non-cash elements like values of home- consumed production and of wages in kind.

The incremental net benefit is the increase in net benefit with project as opposed to the case without project. In early stages of the project the incremental net benefit usually is negative. The net incremental benefit is the basis for calculating measures of project worth, the most important of which are discounted measures of Net Present Value (NPV), Internal Rate of Return (IRR) and Net Benefit Investment Ratio (N/K) ratio. In reaching these measures (usually called Discounted cash flow analysis), costs are entered in the year they are incurred, and benefits are entered in the year they are realized. As a result, no depreciation is deducted before arriving at the incremental net benefit.

In building project accounts for the financial analysis, the incremental net benefit may be derived as (1) the incremental net benefit before financing in which case any financing transaction is excluded, and (2) after financing in which case loans or their financial receipts are added to the incremental net benefit and debit service or other financial payments are subtracted from the incremental net benefits.

Net present value (NPV)

It is a discounted cash flow technique (DCF) .It is the present value discounted at firm's required rate of return on the stream of net cash flows from the project minus the project's net investment. The NPV method uses the discounting formula of a non-uniform or uniform series of payments to value the projected cash flow for each investment alternative at one point in time. To obtain the NPV, the following formula is used: -

$$NPV = -INV + \frac{P_1}{(1+i)^1} + \frac{P_2}{(1+i)^2} + \frac{P_3}{(1+i)^3} + \ldots\ldots\ldots\ldots + \frac{P_n}{(1+i)^n}$$

Where, P1.....P_n are net cash flows.

i = the interest rate or marginal cost of capital .

n = the project expected life.

INV = the initial investment.

The model indicates that the net cash flows of the project are discounted and then added to yield the NPV. The initial investment is negative since it represents a cash flow.

or

$$NPV = \sum_{t=1}^{n} \frac{P_t}{(1+i)^t} - INV$$

An investment project would be accepted if the NPV > 0 and rejected if NPV < 0. This is because the money being invested is greater than the present value of the net cash flow. If NPV=0, the decision maker would be indifferent. The NPV method assures that funds may be reinvested at the firm's interest rate. In case of series of cash out flows and cash inflows the can be written as

$$NPV = \sum_{t=1}^{n} \frac{B_t - C_t}{(t+i)^t}$$

Where,

B_t → Benefit in each year

C_t → Cost in each year

i → Discount rate

Benefit cost ratio (BCR)

It is also called as Profitability Index (PI). It is the ratio of present value of future net cash flows over the life of the project to the net-investment.

$$PI = \frac{\sum_{t=1}^{n} \frac{P_t}{(1+i)^t}}{INV} \quad \text{or} \quad PI = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+t)^t}}{\sum \frac{C_t}{t=1 \quad (1+i)^t}}$$

(In case of series of cash inflows and outflows in a year)

The method usually produces the same result as the NPV and IRR in project evaluation, but it is very important in separating projects of varying sizes. If a project has a PI value greater than or equal to1, (PI $\geq$ 1) it should be accepted and should be rejected if the PI value is less than 1 (PI<1).

Example: A fish culturist has invested and got Net benefit at the end of 1st, 2nd, 3rd & 4th year of fish culture in the following way:

Year	Investment (Rs.)	Net benefit	Discount factor (12%)	Present value investment	Present value of Net benefit
0	40,000	-	1.000	40,000	-
1	2,000	15,000	0.893	1,786	13,395
2	3,000	20,000	0.797	2,391	15,940
3	4,000	19,000	0.712	2,848	13,528
4	1,000	16,000	0.636	636	10,176
Total	50,000	70,000		47,661	53,039

NPV = Present value of Net benefit – present value of investment
= 53,039 – 47,661 = 5378 (+) ve

$$\text{BCR or PI} = \frac{\text{Present value of Net benefit}}{\text{Present value of investment}} = \frac{53,039}{47,661} \quad 1.11 \text{ (more than 1)}$$

Internal Rate of Return (IRR)

It is the interest rate that will equate the sum of net cash flows to the initial investment. The interest rate that satisfies this equation is called internal Rate of Return (IRR).

There is no way of finding the IRR. One is forced to use a systematic procedure of trial & error to find out the discount rate that will equate the net cash flows to the initial investment.

When the NPV =0, then

$$\sum_{t=1}^{n} \frac{P_t}{(1+i)^t} = INV \quad \text{or} \quad \sum_{t=1}^{n} \frac{Bt - Ct}{(1+i)^t} = 0 \text{ (in case of series cash flows)}$$

i = Internal Rate of Return (IRR)

Acceptability of project depends upon comparing the IRR with the investor's required rate of return (RRR) sometimes called minimum acceptable rate of return (MARR). If IRR is greater than RRR (MARR), accept the project, if IRR is less than that, reject the project, if IRR=RRR, be indifferent.

If NPV is greater than (or less than) zero (0), and only if the IRR is greater than (or less than) RRR, the NPV & the IRR method result in identical decisions to either accept or reject an independent project

The IRR method implicitly assumes that returns from an investment are reinvested to earn the same rate as the IRR of interest

Example: Initial investment capital for composite fish farming is Rs.25, 000.

Year	Cash flow (Rs.)	Discount factor (12% Ra)	Present value (12%)	Discount factor (20% Rb)	Present value (20%)
1	12,000	0.8929	10,715	0.8333	10,000
2	10,000	0.7972	7,972	0.6944	6,944
3	8,000	0.7118	5,094	0.5787	4,630
4	6,400	0.6356	3,432	0.4823	2,604
Total			27,813		24,178

NPV (for 12percent discount rate Ra)= 27,813-25,000 = 2813
NPV (for 20percent discount rate Rb)= 24,178-25,000 = - 822

Net-Benefit Investment Ratio (N/K ratio)

This is also a discounted measure of project worth.

$$\text{N/K ratio} = \frac{\text{The present worth of the net benefits}}{\text{The present worth of the investments}}$$

$$\text{N/K ratio} = \frac{\sum_{t=1}^{n} \frac{N_t}{(1+i)^t}}{\sum_{t=1}^{n} \frac{K_t}{(1+i)^t}}$$

Where,

Nt = incremental net benefit in each year after stream has turned positive

K_t = incremental net benefit in initial years when stream is negative.

t = 1 ,2 ,3 ,.....n

n = No. of years

i = interest (discount) rate

The selection criterion is to accept all projects with a net benefit-investment ratio (N/K) of 1 or greater.

Selection Among The Project Alternatives

Let us consider the following four cases of fisheries projects- we have to choose the best one of the 4 projects.

Project (1)

I---------- Incremental cost ----------I

Year	Capital item	Operation & Maintenance cost	Production cost	Gross Cost	Value of incremental production (Gross benefit)	Net value of incremental production
1	30,000	-	-	30,000	-	-
2	-	2,000	3,000	5,000	20,000	15,000
3	-	2,000	3,000	5,000	20,000	15,000
4	-	-	-	-	-	-
Total	30,000	4,000	6,000	40,000	40,000	30,000

Project (2)

1	30,000	-	-	30,000	-	-
2	-	2,000	3,000	5,000	20,000	15,000
3	-	2,000	3,000	5,000	20,000	15,000
4	-	2,000	3,000	5,000	9,100	4,100
Total	30,000	6,000	9,000	45,000	49,100	34,000

Project (3)

1	30,000	-	-	30,000	-	-
2	-	2,000	3,000	5,000	7,000	2,000
3	-	2,000	3,000	5,000	19,000	14,000
4	-	2,000	3,000	5,000	31,000	26,000
Total	30,000	6,000	9,000	45,000	57,000	42,000

Project (4)

1	30,000	-	-	30,000	-	-
2	-	2,000	3,000	5,000	7,000	2,000
3	-	2,000	3,000	5,000	31,000	26,000
4	-	2,000	3,000	5,000	19,000	14,000
Total	30,000	6,000	6,000	45,000	57,000	42,000

The net value of incremental production is the value of incremental production less the operation & maintenance cost of the project.

NPV, IRR, BCR &N/K ratio of the four projects:

Project (1)

Year	Gross cost	Value of Incremental production (Gross Benefit)	Incremental net benefit cash flow	Discount factor (12%)	Present worth (12%)	Present worth calculation Internal Rate of Return (IRR) Discount Factor (0 %)	Present worth (0%)
1	30,000	-	-30,000	0.893	-26,790	1.00	-30,000
2	5,000	20,000	+15,000	0.797	+11,955	1.00	+15,000
3	5,000	20,000	+15,000	0.712	+10,680	1.00	+15,000
4	-	-	-	-	-	-	-
Total	40,000	40,000	0	2.402	-4,155	3.00	0

Net present worth (value) NPV at 12percent = - 4,155,
Benefit cost ratio (at 12percent) =0.83

Internal Rate of Return = 0 percent
N/K ratio (at 12percent) =22,635÷26,790= 0.84

Project (2)

						D.F(at 8%)	P.W (at 8%)
1	30,000	-	-30,000	0.893	-26,790	0.926	-27,780
2	5,000	20,000	+15,000	0.797	+11,955	0.857	+12,855
3	5,000	20,000	+15,000	0.712	+10,680	0.794	+11,910
4	5,000	9,000	+4,100	0.636	+2,608	0.735	+3,014
Total	45,000	49,000	+4,000	3.038	-1,547	3.312	-1

Net present worth (NPV) at 12percent = -1,547
Benefit cost ratio (12percent) = 0.96
IRR = 8percent
N/K ratio (at12percent)) = 25,243 ÷ 26,790 = 0.94

Project (3)

						DF (at14%)	PW (at14%)
1	30,000	-	-30,000	0.893	- 26,790	0.877	-26,310
2	5,000	7,000	+2,000	0.797	+1,594	0.769	+1,538
3	5,000	19,000	+14,000	0.712	+9,968	0.675	+9,450
4	5,000	31,000	+26,000	0.636	+16,536	0.592	+15,392
Total	45,000	57,000	+12,000	3.038	+1,308	2.913	+70

Net present worth (NPV) at 12percent = 1,308
Benefit cost ratio (12percent) = 1.03
IRR = 14percent
N/K ratio (at12percent) = 28,098 ÷ 26,790 = 1.05

Project (4)

						DF (at16%)	PW (at16%)
1	30,000	-	- 30,000	0.893	-26,790	0.862	-25,860
2	5,000	7,000	+2,000	0.797	+1,594	0.743	+1,486
3	5,000	31,000	+26,000	0.712	+18,512	0.641	+16,666
4	5,000	19,000	+14,000	0.636	8,904	0.552	+7,728
Total	45,000	57,000	+12,000	3.038	+2,220	2.798	+20

Net Present worth (at 12percent) = 2,220
Benefit cost ratio (at 12percent) = 1.06
IRR = 16percent
N/k ratio (at 12percent) = 29,010 ÷ 26,790 = 1.08

It is clear that we would reject both the project (1) & (2) at 12percent discount rate. We would accept the project (2) if the discount rate were 8percent or lower and it would have a net present worth of zero (0) or greater than zero (0), an internal rate of return at or above the cut off rate, and a net benefit-investment ratio of 1 or greater than one. At the

12percent discount rate we would accept both projects (3) and (4). Since both have positive net present worth (NPV), internal rate of return (IRR) above the cut off rate, and benefit cost & net benefit investment ratios greater than one (1). If, however, our investment funds were limited to some 30 thousands rupees (ignoring any problem of the cash flow within 2 years), we would have to choose between projects (3) & (4).

We can see that by increasing the discount rate, an unambiguous choice would be made. If we set the discount rate 15percent, we would accept only project (4), which would have a positive net present value (NPV) and an IRR value just above the cut off rate. We would have just used all our investment funds, so our selection criterion would be clear.

Alternatively, and more simply, we could select project (4) on the basis that it has the higher net benefit -investment ratio at a 12percent discount rate.

At any given discount rate, we cannot use the net present worth, or the IRR or the benefit cost ratio as ranking measures; our criteria tell us only to accept all projects which meet the selection criteria for these three measures. The net benefit - investment ratio is the only measure of the ones that can be used with confidence to rank directly project (4) ► 1^{st}, (3)► 2^{nd}, (2)► 3^{rd}, (1)►4rth.

References

Ajit. K. Dasgupta and Pearce, D.W. 1978. Cost-Benefit Analysis, Theory and Practice, The Macmillan Press, London.

Andrew Palfreman 1999. Fish Buisness Management: Strategy- Marketing-Development, Fishing News Books, London.

Banerjee, S. 1982. Principal and practices of management, Oxford & IBH Publishing co, New Delhi.

Campleman, G. 1976. Manual on the Identification and Preparation of Fishery Investment Projects, Fisheries Technical Paper, 149, FAO, Rome.

Campsey, B.J and Eugene F.Brigham 1985. Introduction to Financial Management, Chicago Press, Chicago.

Colin E. Nash 1995. Aquaculture Sector Planning and Management, Fishing News Books, London.

Daniel O'C Lie 1992. Crustacean Farming, Blackwell Scientific Publications, London.

David Insull and Colin E.Nash 1990. Aquaculture Project Formulation, Fisheries Technical Paper No. 316, FAO, Rome.

Desai, B. M, and Narayana Rao, Y. 1981. Project approach in agricultural financing. IIM, Ahmedabad.

Dwivedi D.N. 1980. Managerial economics, Vikas publishing House, New Delhi.

Engstrom, J.E. 1978. Preparation of Fishery Investment Projects, CIDA/FAO/CECAF Workshop on Fishery Development Planning and Management, 1978, FAO, Rome.

FAO 1981a. Monitoring Systems for Agriculture and Rural Development Projects, Economic and Social Development Paper No.12.

FAO, 1995. Fisheries Technical Paper, 351. Economic engineering Applied to the Fishery Industry.

Goyal, S. C. 1995. Modern Management Technique, Deep and Deep Publications.

Handbook of Fisheries Statistics, 2000. Ministry of Agriculture, Government of India.

Jinghan, M.L. 1982. The Economics of Development and Planning (15th ed.), Vikas Publishing House NewDelhi.

Knooutz, H., O'Donell,C and Weihrich, H. 1994. Management, McGrawhill International Book Company.

Lawson, Rowena 1980. Post Evaluation of Fisheries Projects, Marine Policy, 4,1.

Pandey I. M. 1997. Financial Management, Vikas Publishing Home Pvt. Ltd.

Pearce, D.W. 1976. Environmental Economics, Longman Group Ltd., London.

Pillay,T.V.R. 1994. Aquaculture Development: Progress and Prospects, Fishing News Books,Great Britain.

Price Gittinger, J. 1982. Economic analysis of agricultural projects.2nd ed., The John Hopkins University Press, London.

Rowena M. Lawson 1984. Economics of Fisheries Development, Francis Pinter [Publishers], London.

Shang, Y. C. 1981. Aquaculture Economics: Basic Concepts and Methods of Analysis, Croom Helm Ltd., Great Britain.

Skabo, H. 1983.Financing Fisheries Projects, Infofish,5.