

Economic Appraisal of Fishery Technologies

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For every technology it is possible to construct an economic equation or production function that gives us a quantity of yield or output for specified doses or quantity of input. Thus

$$Y = X_1, X_2, X_3 \dots \dots X_n$$

where Y = quantity of output; X_1 to X_n are quantities of inputs.

As an example, we can consider the technology of non motorised manually operated country craft. Here Y can be the catch., X_1 , can be cost of craft, X_2 cost of manpower and X_3 the cost of gear. Generally all these variables are represented in their financial magnitude, The equation can be constructed for annual averages of catches and cost for individual trips.

The important purpose of constructing these economic equations is to work out the optimum or most efficient combination of inputs for a given output. This is done through a variety of methods ranging from linear programming techniques to multiple regression techniques. The optimum or most efficient combination of inputs for a given output is that combination from which slight or marginal change of inputs reduces the output.

In practice fishermen reach this optimum combination of factors constantly experimenting with using more hands on the craft or reducing them, adding gear length or reducing them.

The economic equation

$Y = X_1, X_2, X_3 \dots \dots X_n$ tells us an important limitation to changing quantities of Y by changing quantities of., $X_1, X_2, X_3 \dots \dots X_n$. It is not at all possible to change inputs infinitely to reap an infinitely high Y. For instance, for a specific technology of non-motorised country craft we cannot increase manpower and gear five times for a craft and yet get 5 times the catch. Craft size and its capacity become the limiting factor.

If we also increase craft, at one stage or the other, managing the number becomes the limiting factor, Hence it is 'Clear that a given technology puts limits on the input use and output realization. Both of these will have to fall within close range of the economic equation of the technology.

It is this limit set by a technology that forms the economic justification, or ground for advancement in technology. For each new technology it is possible to construct a new production function of the same description as

$$Y = Z_1, X_2, X_3 \dots \dots X_n$$

The new technology may be large in scale without fresh set of inputs as in the case of larger country crafts, or may use fresh inputs such as a motor and fuel. It may use more of

one factor than of another factor. Generally speaking innovations enhance the capital input of a technology in relation to labour input.

Innovation of new technologies are at present quite frequent and common. Economic evaluation of technology under these circumstances have to be on three distinct and well recognized criteria, viz., (i) return on investment (ii) factor substitution and (iii) catch capability.

Return on investment

Return on investment is by far the most important criteria of evaluating a technology. We can consider two methods of evaluating a technology. We can consider two methods of evaluating investment. (i) Net present value and (ii) Internal Rate of Return.

Net present value method (NPV)

As per this method we estimate the present value of the sum of future streams of income. This is done by discounting the future streams of income by the cost of capital and deducting the initial capital from the incomes.

$$NPV = \sum_{t=1}^n At / (I+K)^t - I$$

PV = Net present value

At = Net cash flow for the year t (cash surplus above cost)

K = Cost of capital

N = Life of the project

I = Initial outlay

Example: Suppose a motorised craft requires an initial investment of Rs. 1,00,000 and it will have a life of seven years. Assume their annual cash flow (net of running cost) is as below:

Year	0	1	2	3	4	5	6	7
Net cash flow (Rs.)	1,00,000	10,000	20,000	30,000	30,000	30,000	30,000	40,000

The cost of capital, that is the rate of interest is 12%

The NPV can be worked out as:

$$(1,00,000) + (10,000 / (1.12)) + (20,000 / (1.12)^2) + (30,000 / (1.12)^3) + (30,000 / (1.12)^4) + (30,000 / (1.12)^5) + (30,000 / (1.12)^6) + (40,000 / (1.12)^7)$$

= Rs. 15,610

According to this method project can be arranged on the basis of their NPV. Higher the NPV, the more desirable the project is. Projects, which have positive NPV, are accepted. Projects, which have a negative NPV, are rejected.

Internal Rate of Return (IRR)

Under this method we first estimate annual net cash flows during the life of the fishing unit. These flows are then discounted using different rates to find out that rate which equalizes the sum of flow of income with the initial investment.

IRR is the value of r in the following equation

$$I = \sum_{t=1}^n \frac{A_t}{(1+r)^t}$$

- I = initial outlay
- A_t = cash flow for the years
- R = IRR
- n = life of the unit.

Example: Suppose the initial outlay is Rs. 10,000 (investment) and unit will last ten years. The estimated cash flow are: 1000, 1000, 1000, 2000, 2000, 2000, 2000, 3000, 3000, 3000

The IRR is the value of r in the equation

$$10000 = \left(\frac{1000}{(1+r)} \right) + \left(\frac{1000}{(1+r)^2} \right) + \left(\frac{1000}{(1+r)^3} \right) + \left(\frac{2000}{(1+r)^4} \right) + \left(\frac{2000}{(1+r)^5} \right) \\ + \left(\frac{2000}{(1+r)^6} \right) + \left(\frac{2000}{(1+r)^7} \right) + \left(\frac{3000}{(1+r)^8} \right) + \left(\frac{3000}{(1+r)^9} \right) + \left(\frac{3000}{(1+r)^{10}} \right)$$

In this equation r is the only unknown. Choosing an arbitrary value of r solve the equation. Choosing different value of r , the process can be continued until we get Rs. 10000 on the right hand side. The r that equates the right hand side to Rs.10000 is the IRR.

The IRR represents the compound rate of return earned on the initial investment for the life of the project. Higher the value of r , higher the return on investment

Criteria of factor substitution

In applying the above discussed criteria of Rate of return on capital we have taken investment as one financial lumpsum. We have not particularly considered whether the technology uses more capital in place of labour to harvest a given quantity of catch. If an existing technology uses a lakh rupees worth of capital and 25 labour to harvest 10 lakh worth of fish a new technology is unlikely to keep the labour capital equation. It may reduce labour from the ratio of 1 lakh to 25 number to 1 lakh to 15 numbers while enhancing the harvest. This may be called capital substituting the labour or capital displacing the labour. Though the economic efficiency of the technology may not be impaired by this substitution, it may lead to social problems like throwing labour out of job. Between two technologies that have comparable economic efficiency that which leads to lower levels as capital substituting for labour should be considered better. That is against a background of overcrowded labour market. Where labour availability is less, the technology that substitutes capital for labour would be considered better.

Criteria of catch capability

This criterion needs very careful understanding. Fish harvest is season bound. Several studies show that 65% of the total catch is obtained from 35% of the trips falling in short peak seasons. That means the technology of fish harvest should be potent enough to spread its net to capture the full potential of the catch available at short notice. The ability of responsiveness, to act quickly to avail the short time abundance, will decide the total fish catch available to the market as well as the annual absolute income available to the fisherman.

The catch lost for want of quick responsiveness cannot be regained for the benefit of the consumer or the fisherman. Contribution of a technology to catch capability plays therefore crucial economic role. Perhaps the pace with which mechanisation, motorisation and all energisation of fishing is taking place in India, where capital is scarce and labour abundant, can be attributed to this underlying economic criteria of enhancing catch capabilities.

Conclusion

We have surveyed the most essential features of economic evaluation of fishery technology. In particular we have seen the structuring techniques of economic logic into technologies. We have seen various criteria of evaluating technologies. It should be noted however that economic evaluation does not exhaust the social critique of any technology. It can be approached from social and environmental consequences as well. In short economic evaluation is just one aspect of a wider area of technology evaluation.