NUANCES IN PROJECT FORMULATION FOR PRODUCTION, MARKETING DEVELOPMENT AND FISHERIES FINANCE

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Introduction

Indian fisheries and aquaculture is an important sector of food production providing nutritional security, besides livelihood support and gainful employment to more than 14 million people, and contributing to agricultural exports. With diverse resources ranging from deep seas to lakes in the mountains and more than 10% of the global biodiversity in terms of fish and shellfish species, the country has shown continuous and sustained increments in fish production since independence. The sector constitutes about 6.3 percent of the global fish production and contributes to 0.91 percent of the GDP and 5.23 percent of the agricultural GDP. The total fish production of 13.34 million metric tonnes presently has nearly 74 percent contribution from the inland sector and rest by the marine sector. Paradigm shifts in terms of increasing contributions from inland sector and further from aquaculture have been significant over the years. With high growth rates, the different facets, viz., marine fisheries, coastal aquaculture, inland fisheries, freshwater aquaculture, and coldwater fisheries are contributing to the food basket, health, economy, exports, employment and tourism of the country.More than 50 different types of fish and shellfish products are being exported to 75 countries around the world. Fish and fish products have presently emerged as the largest group in agricultural exports from India, with 13.77 lakh tonnes in terms of quantity and ₹ 45,106.89 crore in value. This accounts for around 10% of the total exports and nearly 20% of the agricultural exports, and contribute to about 0.91% of the GDP and 5.23% to the Agricultural GDP of the country.

The PradhanMantriMatsyaSampadaYojana (PMMSY) is an initiative launched by the Government of India to establish a comprehensive framework and reduce infrastructural gaps in the fisheries sector. The scheme was announced by the Finance Minister, NirmalaSitharaman during her speech in the parliament of India while presenting the Union budget for 2019–20 on 5 July 2019. The government intends to place India in the first place in Fish production and processing by implementing Blue Revolution. This scheme is in line with governments aim to double the farmers' income by 2022–23.The policy envisages to integrate all the fishermen with agricultural farmers and provide all the facilities available through various farmer welfare schemes to the fishermen. A new dedicated department of Fisheries was constituted in a newly carved out Ministry of Fisheries, Animal Husbandry and Dairying to implement this and other policy initiatives of the government.

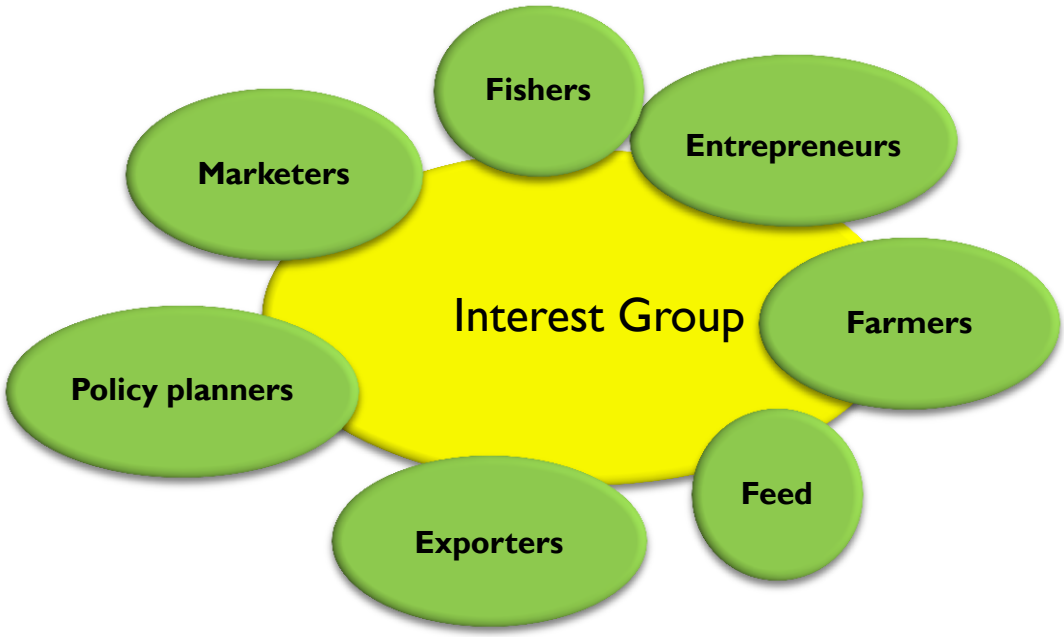
Projects - the cutting edge of development

Post liberalization era of Indian economic scenario reveals disinvestments of public enterprises and the flourishing of private firms. Bank rates were slashed in order to boost the morale of venture capitalists. Fisheries with an annual sectorial growth of 8 percent became an ideal niche for bulk of those investors who lost their interest due to BCR from agriculture. Family enterprises flourished in many places all over India and entrepreneurship became a key word in fisheries sector.

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.

Project formulation is an important part of entrepreneurship development. Fisheries sector, hosting a gamut of entrepreneurship venture, corroborates the importance of technical knowhow in project planning, formulation and implementation. Diverse information in projects targeted at a heterogeneous group has been modified to suit the needs of an entrepreneur seeking assistance in his venture.

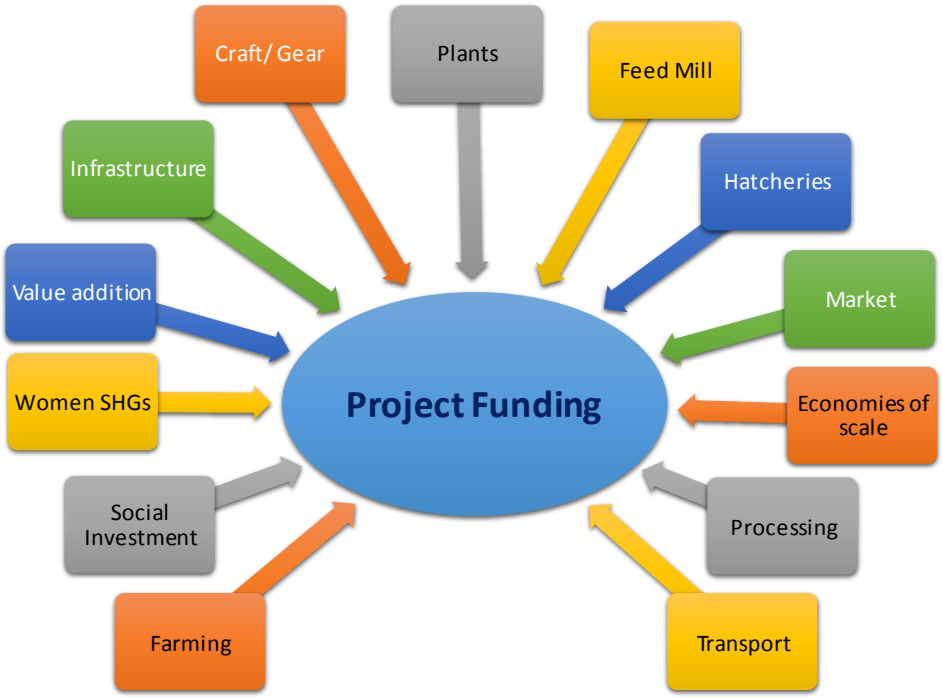
Interest groups in fisheries projects



Project funding in fisheries

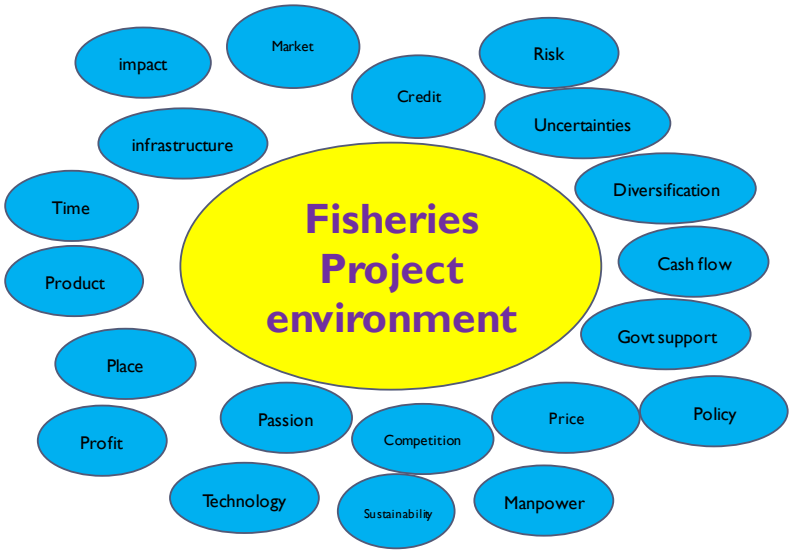
Foreseeing the vast resource potential and possibilities in the fisheries sector, a separate Department of Fisheries was created in February 2019. The Government has merged all the schemes of fisheries Sector into an umbrella scheme of 'Blue Revolution: Integrated Development and Management of Fisheries' focusing on increasing fish production and productivity from aquaculture and fisheries resources, both inland and marine. Towards realization of these objectives the creation of the Fisheries and Aquaculture Infrastructure Development Fund (FIDF) was approved with a total fund size

of ₹7522.48 crore. The project funding opportunities has become diverse over the years and is given in Figure.



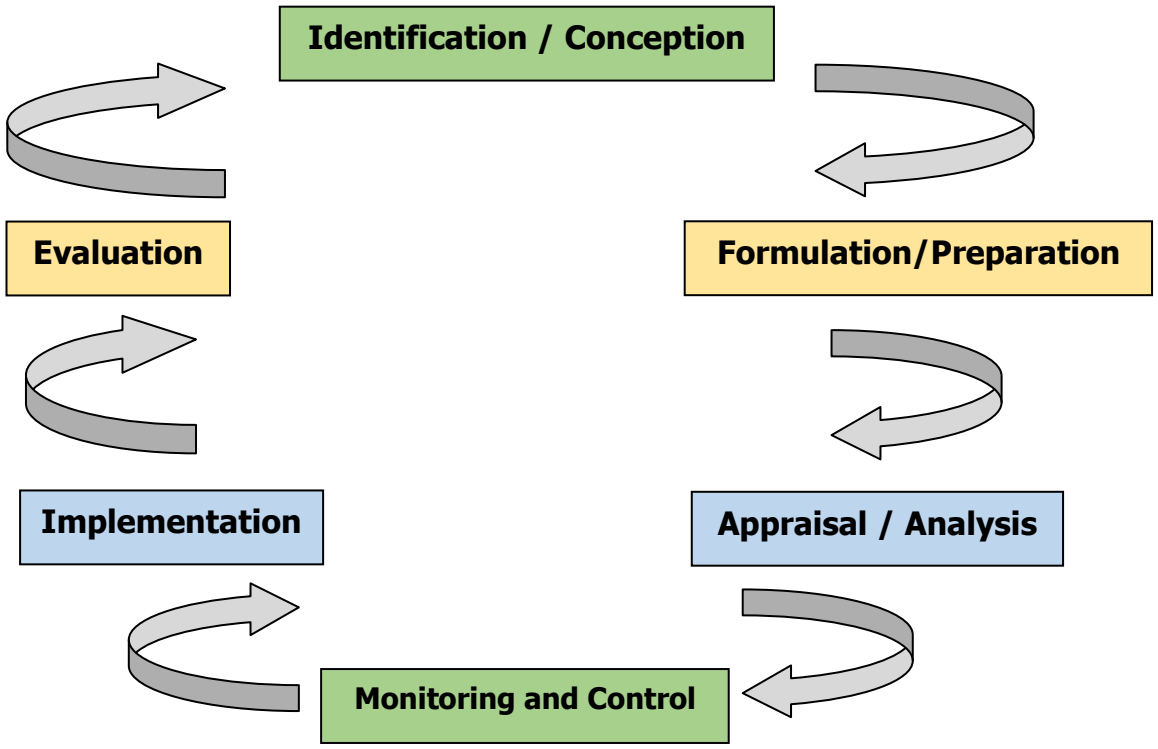
Fisheries project environment

Fisheries project environment is intricate with different domains operating in unison and each requiring specific choices in decision making



Project Cycle

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



Investment feasibility assessment of fisheries projects

In order to ascertain whether an aquaculture investment project is feasible or not, a cooperative evaluation should first be conducted by both the biologist and economist. Only those species and projects that are suited to the local environment and are biologically feasible for development should be considered. Thereafter, a socioeconomic study can be undertaken. Basically, an economic evaluation includes both the production and marketing functions.

a. The first requirement for any aquaculture investment project in both the public and private sectors is the availability of suitable land and water resources.
b. The species selected for development should be adapted to the local environmental conditions and the stocking materials and suitable feed should be readily available at reasonable cost. The species should also be fast growing and culture technology should be locally available.
c. There should be no legal constraints on development (this is particularly important for private investors).
d. The products of the investment project should have a high market demand with a reasonable price.
e. The investment project should be financially lucrative compared to other investment opportunities for private investors and should also be socio-economically feasible with alternative means of achieving the national objectives for public investment. Private investors usually use profitability as a measure of financial feasibility when assessing commercial aquaculture projects, and public officials usually consider socioeconomic benefit-cost and/or the social internal rate of return as measures of economic feasibility along with some qualitative judgments.In order to evaluate the feasibility of an investment protect in aquaculture, one must consider six criteria:
    i. Resource availability,
    ii. Environmental suitability,
    iii. Biological feasibility,
    iv. Market potential,
    v. Economic feasibility, and
    vi. Institutional feasibility
f. It is also important to realize that many variables ought to be considered for each criterion. Each variable can be assessed as favourable, partially favourable, unfavourable, etc. Each ranking can then be scored (or coded) numerically—weighted or unweighted. Next, a general score or

code can be assigned to each criterion after evaluation of all the subscores and codes, and the bio-economic feasibility can be determined by weighting the general score or code for each criterion. This procedure can be varied to suit particular projects.

Criteria for selection of fishery projects

The important criteria for the selection of fisheries project are briefly summarized below.

i. **Work selection criteria:** This relates to immediate needs of the project area and has a direct or indirect relation in increasing prospects of fisheries production, income and employment.

ii. **Priority criteria**: it deals with whether the project implemented falls under priority area or not.

iii. **Social criterion:** It considers the direct employment prospects, ecological balances, externalities, pollution etc.

iv. **Financial criteria-** According to this criterion it is determine whether the required amount of capital is supplied or not for the implementation of the project. In case the execution is delayed, additional capital requirements are to be assessed.

v. **Supply criterion**-This is concerned with available resources like physical inputs, labour availability and other resource endowment. Supply of skilled labourers and un-skilled labourers and technical personnel are to be evaluated for the completion of the project on time.

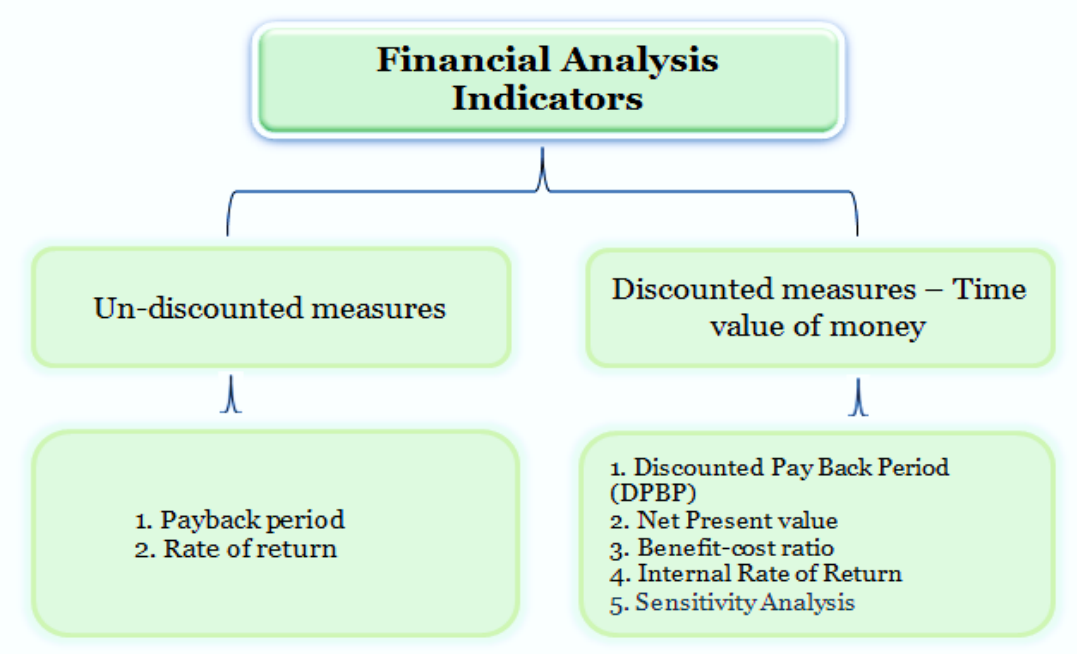
vi. **Implementation criterion:** This is based on organizational and management abilities of technical personnel. Organization refers to the organization hierarchy of the implementing agency. The availability of staff at various cadres, demarcation of authority and linking of authority and responsibility etc. are to be analyzed in detail.

vii. **Project benefits criterion**: Both tangible and intangible benefits must be correctly assessed and evaluated. In this process the benefits accrued due to forward linkages and backward linkages need to be given specific

weightage. The benefit must address community defined priority needs in the areas of health, education, training and income generation.

Financial performance

The profitability of a fisheries projects influences its value and the amount of income it generates for its producers/ beneficiaries. The financial performance of an enterprise is analyzed by working out various types of indicators as given below. These measures compute either in terms of undiscounted or discounted – mainly taking into consideration of the time value of money.



Time value of money

Many 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 (TVM) is the concept that money you have now is worth more than the identical sum in the future due to its potential earning capacity. This core principle of finance holds that

provided money can earn interest, any amount of money is worth more the sooner it is received. The time value of money (TVM) is an important concept to investors because a dollar on hand today is worth more than a dollar promised in the future. Provided money can earn interest, this core principle of finance holds that any amount of money is worth more the sooner it is received. The determination of the time value of money is determined by the following:

i. Number of time periods involved (months, years)
ii. Annual interest rate (or discount rate, depending on the calculation)
iii. Present value (what you currently have in your pocket)
iv. Payments (If any exist; if not, payments equal zero)
v. Future value (The amount you will receive in the future. A standard mortgage will have a zero future value because it is paid off at the end of the term)

The intrinsic value of money diminishes over time and for the same output we might need to pay more money and the intrinsic loss is captured by **DISCOUNTING** factor which is 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 discounting factor could be rate of interest/ inflation level.

The financial feasibility analysis is done using the following capital budgeting techniques with appropriate assumptions on the duration of the farming, annual days of operation, inflation of costs and returns and related parameters. Three indicators will be estimated namely, Net Present Value (NPV), Benefit Cost Ratio (BCR) and Internal Rate of Return (IRR).

There are 4 discounted measures:

i. **Discounted Pay Back Period (DPBP):**

Number of years required to return the capital investment, which is computed by the cumulative sum of discounted cash inflows.

ii. **Net Present Value / Net Present Worth (NPV):**

NPV is the difference between the discounted benefit and discounted cost where present value of the expected future net cash flows discounted at a specified discounted rate.

NPV= $\sum_{t=1}^{n} \frac{CF_t}{(1+r)^t}$

$= \left[\frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + \frac{CF_t}{(1+r)^t}\right] - C,$

where, C is the Capital investment, (CF_1 ….CF_t) is the Cash inflow and t is the time in years

iii. **Benefit Cost Ratio (BCR) :**

Ratio of the discounted benefit of cash inflows to the discounted investment outlay.

$$\text{B/C ratio} = \frac{\text{Total Discounted Benefit}}{\text{Total Discounted Cost}}$$

BCR=$\frac{\sum_{t=1}^{n} \frac{B_t}{(1+r)}}{\sum_{t=1}^{n} \frac{C_t}{(1+r)^t}}$, where B_t is the Cash inflow and C_t is the Cash outflow

iv. **Internal Rate of Return (IRR) :**

IRR is the discount rate at which Net Present Value (NPV) is equal to zero and benefit cost ratio is equal to one where discount rate is that equates the present value of the expected future cash flows or receipts to the initial cost of the project.

IRR= NPV = 0

For working out IRR two discount rates, one of which gives positive NPV and the other gives negative NPV are generally used. The formula used is as follows

IRR=$r_L + [\frac{P_v - C}{\Delta P_v}] \times \Delta r$,

where,IRR is the Internal Rate of Return, r_L is the lower rate of discount,P_V is the present value at lower value of discounting, C is the capital investment,ΔP_V is the Difference in the present values at the two discount rate,Δr is the Change in discount rate.

Risk and Uncertainties

In project analysis once the stream of costs and benefits for a project is defined in the form of cash flows, the next step is to assess the worthwhileness of the project using a variety of appraisal criteria (or evaluation methods). *A project manager will search for the project that will satisfy the project goals, and that includes the wisest and best use of resources to satisfy human wants. The most common criteria employed in determining the financial desirability of investment projects are NPV, BCR and IRR.*One of the real advantages of careful economic and financial analysis in fisheries project is that it may be used to test what happens to the earning capacity of the project if events differ from guesses made about then in planning for e.g. a disease outbreak, fall in prices, natural calamities like floods, etc. These unforeseen incidents can be grouped into two i.e. risks and uncertainties.

i. **Risk**

Few management decisions are made under conditions where the outcomes associated with each possible course of action are known with certainty. Most major managerial decisions are made under conditions of uncertainty. The frequency of uncertainty in managerial decisions and the risk involved dictate risk analysis be given due consideration in farm and project management decisions. Risk refers to the possibility that some unfavorable event will occur. The probability of a risk occurring can be quantified. It is the possibility of loss, injury, or exposure to harm. In aquaculture, risk comes from stock losses. Anything, which disrupts the rearing of fish, is likely to jeopardize production and marketing of the final product. The levels of risk vary among species and at different stages of

production. The relative lack of knowledge of fish biology in comparison to some land animals makes fish production more risky than the production of food animals. As Secretan (1988) indicates, on a scale of 1 to 100, we know 75 percent of the biology of human beings, and perhaps 50 to 60 percent of the biology of chickens, cows, pigs and other farm animals, but only about 20 percent of the biology of aquatic species. There are numerous risks involved in the breeding, hatching and growing of aquatic organisms under intensive management systems.

What sort of risks plagues the fisheries/ aquaculture industry? Risks may be classified into main groups: (1) socio-economic or business risk and (2) physical or pure risks.

Socio-Economic/Business

Social aspects of socio-economic risks include changes in tastes, attitudes, or social behavior towards production and consumption of a certain species. The expansion of aquaculture depends on individuals changing their attitudes towards species cultured under intensive closed systems. This may be done through government programs, advertising, and public relations. For example, changes in consumer purchases of catfish have been achieved through advertising and public relations. The growing popularity of catfish may be stifled, however, if "off flavour" problems continue to plague the industry.

Economic risks

Economic risks such as changes in price of inputs and output inflation, recession, depression and other economic conditions that affect national income are primary concerns of commercial fish producers. As demand lags behind supply, producers are concerned that prices will fall. This is presently the case in the U.S. catfish industry. Producers are being warned that they should secure markets before expanding production. Also, the degree of elasticity with respect to supply and demand at both the farm and processor level is a clue to the level of economic risks associated with fish production. Processors facing a more inelastic demand than producers will tend to be less

concerned about demand lags. This is one reason that producers are beginning to favor more producer associations or cooperative type marketing organizations.

Marketing risks

Risks may also result from uncertainty in demand, supply and prices. When to move the product to market is the age-old nemesis of farmers. Fish farmers are no different. Significant seasonal price level differences exist in many aquaculture product markets. Today, more farmers in colder climate are over wintering fish to try to market them when there is less supply available to consumers. Additionally, new technologies and product forms are being evaluated in an attempt to avoid some of the marketing risks. Smoked fish as well as dried, frozen, or canned fish are forms used in various markets to reduce the risks associated with marketing time. Assume that forecasters are overly optimistic in their estimates of prices and consumer demand. This optimism is likely to encourage farmers to intensify production (higher stocking rates) in the short-run and expand production (more ponds) in the long run. Intensification increases the potential for diseases, problems such as "off-flavor", and other environmental concerns. The fish arrive at the market only to remain unsold because of weak consumer demand resulting from a dislike for the quality of the fish on the shelf, or insufficient income to purchase fish and other market foods. Longer-term expansion of production means greater amounts of capital and land committed to the aquaculture practice. Because ponds are much easier to build than to remove, thesecommitments tend to become irreversible, even if prices decline. Once again market conditions dictate difficulties for the producer.

Production risks

Many of the marketing risks are also related to production problems. Marketing problems may be logistical in nature, which may impede production schedules. The timely supply of fingerlings may affect the quantity of food

fish produced at a given time. This may result in grave financial problems for producers. Production risks may also be due to lack of trained manpower to manage the operation. This results in serious constraint or even failure in any aquaculture enterprise.

Other risks

Other socio-economic risks encountered are financial and political. Financial risks relate to changes in supply of funds for production and marketing. Credit restriction and availability often affect the aquaculture industry. Lack of education and understanding of aquaculture production processes among lenders is common in areas where the industry is developing.Political risks affect not only an enterprise, but the whole sector. Changes in government and governmental policies have been known to cause changes in supply and demand of inputs and fish. Governmental regulations may affect all stages and aspects of the industry. Regulations on feed, import of inputs, the introduction of species, and changes in labour laws may greatly influence the industry.

Physical or pure risks

Physical risks results from conditions of nature, such as rain windstorms, clouds, flooding, and drought. Other types of pure risks are plant breakdowns, and failure of safety and other devices. These risks associated with physical or pure risks can be managed to minimize their effects on producers.

ii. **Uncertainty**

It is a situation in which the probability of an outcome is not known. Insurance cannot provide any cover against uncertainty. Uncertainty is a state of being doubtful about future events, which cannot be foreseen exactly.

Types of Uncertainty:

Price uncertainty

It is associated with the price of products and input factors, such as price of fish in a market.

Yield uncertainty

The fluctuations in yield are associated with weather conditions and incidence of diseases and pests and the impact of new practices.

Technological uncertainty

Technological changes influence production function and create conditions of variability, which, in turn, lead to uncertainty.

Institutional uncertainty

Conditions of tenure, functioning of credit agencies, action and outlook of farmers are examples of institutional uncertainty.

Risk and Uncertainty Averting Mechanisms

- **Diversification**

  Diversification is a technique that reduces risk by allocating investments among various financial instruments, industries, and other categories. It aims to maximize returns by investing in different areas that would each react differently to the same event. Crop diversification provides the fish farmers with a wider choice in the production of a variety of cultivable species in a given area so as to expand production related activities on various fish species and also to bring down the possible risk.

- **Crop insurance**

  The crop Insurance policies provide coverage for loss of production/yield or how much a farm produces. Some plans combine yield and price coverage. They cover loss in value due to a change in market price during the insurance period, in addition to the perils covered by the standard loss of yield coverage.

- **Continuous or Sequential Marketing**

  Aimed at continuous marketing of the product through the different advertisement so that the market penetration is improved.

- **Future Production Contracts**

  A futures production contract is a legal agreement to buy or sell a particular commodity asset, or security at a predetermined price at a

specified time in the future. Futures contracts are standardized for quality and quantity to facilitate trading on a futures exchange.

- **Government Programs**

  The government programmes include stabilization policies wins at insulating the different risk and uncertainties in terms of loan waiver, evasion of taxes, providing subsidies.

- **Third-Party Equity Capital**

  Capital received for an interest in the ownership of a business which reduces to the risk of the owner for the investment or liability which he/ she possess.

(v) Sensitivity analysis

Sensitivity analysis employs a simple technique to assess the effects of adverse changes on a project. It involves changing the value of one or more selected variables and calculating the resulting change in the NPV or IRR. The extent of change in the selected variable to test can be derived from post evaluation and other studies of similar projects. Changes in variables can be assessed one at a time to identify the key variables. Possible combinations can also be assessed. Sensitivity analysis should be applied to project items that are numerically large or for which there is considerable uncertainty.The results can be presented together with recommendations on what actions to take or which variables to monitor during implementation and operation. The merits includes forces management to identify the underlying variables and their relationships., shows how robust or vulnerable a project is to change in underlying variables and indicates the need for further work in terms of gathering information in NPV or IRR is highly sensitive to changes in some variables.The demerits includes inability to provide leads - if sensitivity analysis merely presents complicated set of switching values it may not shed light on the characteristics of the project and the fact that the impact of variation in one factor at a time, holds other factors constant, may not be very meaningful when underlying factors are likely to be inter-related.

Methodology:

Sensitivity analysis can be done to ascertain the project feasibility at three different stages.

i. **Increasing cost of capital or interest rate increases**

The increasing cost of capital or the interest rate increases can be accounted in the sensitivity analysis by computing the NPV and BCR at different discount rates and thereafter checking the profitability of the changes.

ii. **Escalation of cost of the project due to different risks involved**

The cost of the projects gets escalated due to the various risk factors involved in the business which include the prophylactic measures needed to control and prevent the disease outcome, application of more fertilizers than the expected, more number of irrigations, more number of man days increase due to the inefficiency of human labour, etc. These increase in the cost of the project can be accounted by the exante approach of increasing the project cost by 10 percent and 20 percent and later working the NPV and BCR with the benefit stream keeping unchanged.

iii. **Uncertainties resulting due to differences in the price receivables**

The uncertainties in the project benefit stream arise due to the uncertain nature of the prices that are expected in the market after the harvests. The uncertainties are basically due to the reason that the factors determining prices itself are subjected to changes. The other uncertainties include the yield uncertainty, technological uncertainty and institutional uncertainty. In countering the uncertainties, the anticipated benefit stream in the project can be reduced by 10,20,30 percentages and the NPV and BCR are computed accordingly, keeping the project cost unchanged.

Example: Financial Performance

Compute the discounted payback period, net present worth, benefit-cost ratio and internal rate of return for the aquaculture project. The discount rate is 12 percent.

Year	Cash outflow	Cash inflow	Discounting factor	Discounted cash outflow	Discounted cash inflow
1.	250000	-	1	250000	-
2.	-	120000	0.8929	-	107150
3.	-	100000	0.7972	-	79720
4.	-	80000	0.7118	-	56940
5.	-	54000	0.6355	-	34320
Total	**250000**	**354000**		**250000**	**278130**

Solution:

1. Discounted Pay Back Period = 4.5 years
2. Net Present Value = 27,8130 - 25,0000 = 2,8130
3. Benefit Cost Ratio = 27,8130 ÷ 25,0000 = 1.112
4. Internal Rate of Return

Year	Cash outflow	Cash inflow	Discounting factor at 12%	Discounted cash outflow	Discounted cash inflow at 12%	Discounting factor at 20%	Discounted cash outflow
1.	250000	-	1	250000	-	1	-
2.	-	120000	0.8929	-	10,7150	0.83300	10,0000
3.	-	10,0000	0.7972	-	7,9720	0.6944	6,9440
4.	-	8,0000	0.7118	-	5,6940	0.5787	4,6300
250000					27,8130		24,1780
Net Present Value =					+ 2,8130		- 8220

There are discount rates which gives a positive and negative net present worth.

$$IRR = rL + \frac{[P_V - C]}{\Delta P_V} \times \Delta r$$

$$IRR = 12 + \left[\frac{(278130 - 250000)}{(278130 - 241780)}\right] \times (20 - 12)$$

$$IRR = 12 + \left[\frac{2813}{\quad}\right] \times 8$$

3635

IRR = 18.19

Conclusion

The project is feasible because the NPV is greater than zero, BCR is greater than one and IRR is greater than the opportunity cost of capital

Example on Sensitivity Analysis:

For the following fisheries project, perform the sensitivity analysis for the three different cases

- Increasing cost of capital
- Increased cost of project due to risks involved at 10 and 20 percent cost like
- Uncertainties due to the differences in the price receivables at 10, 20 and 30 percent reduction for the yield

CASE I: Increasing Cost of Capital

Year	Cost	Benefit	d.f. at12%	d.c.at 12%	d.b. at 12%	d.f.at 20%	d.c.at2 0%	d.b. at 20%	d.f. at 25%	d.c. at 25%	d.b. at25%
1	25000	0	1	25000	0	1	25000	0	1	25000	0
2	5000	20000	0.893	4465	17860	0.833	4165	16660	0.8	4000	16000
3	5000	20000	0.797	3985	15940	0.694	3470	13880	0.64	3200	12800
4	5000	20000	0.712	3560	14240	0.579	2895	11580	0.512	2560	10240
5	5000	20000	0.636	3180	12720	0.482	2410	9640	0.41	2050	8200
6	5000	25000	0.567	2835	14175	0.402	2010	10050	0.328	1640	8200
				43025	74935		39950	61810		38450	55440
				NPV	31910		NPV	21860		NPV	16990
				BCR	1714		BCR	1.5471		BCR	1.4418

Remarks:

The computation of the NPV and BCR at different cost of capital indicates that the project is feasible and profitable even at 25 percent discount rate. At 25 percentage discount rate also there exists a positive NPV and BCR of more than one. The exercise indicates the high yielding capacity of the project even at higher discount rates.

CASE II: Escalation of the cost of the project due to the different risks involved

Year	Cost	Benefit	d.b. at 12%	d.c. at 12%	d.b. at 12%	Cost increase by 10%	d.c. at 12%	d.b. at 12%	Cost increase by 20%	d.c. at 12%	d.b. at 12%
1	2500000	0	1	25000	0	27500	27500	0	30000	30000	27500
2	5000000	20000	0.893	4465	17860	5500	4911.5	17860	6000	5358	4911.5
3	500000	20000	0.797	3985	15940	5500	4383.5	15940	6000	4782	4383.5
4	500000	20000	0.712	3560	14240	5500	3916	14240	6000	4272	3916
5	500000	20000	0.636	3180	12720	5500	3498	12720	6000	3816	3498
6	500000	25000	0.567	2835	14175	5500	3118.5	14175	6000	3402	3118.5
				43025	74935		47327.5	74935		51630	47327.5
				NPV	31910		NPV	27607.5		NPV	-4302.5
				BCR	1.741		BCR	1.58		BCR	0.92

Remarks:

On increasing the cost of the project taking into consideration the different risks involved the computed NPV and the BCR values indicate that the project is feasible and economical to a discount level rate of less than 20 percentage cost increase. At 20 percentage increase in the total cost of the project the NPV appears to be negative and the BCR is lesser than one that are negative indicators of project appraisal.

CASE III: Uncertainties resulting due to the differences in the price receivables

Year	Cost	Benefit	DF at 12%	DC at 12%	DB at 12%	Reduction in benefit of 10%	Discounted benefit	Reduction in benefit of 20%	Discounted benefit	Reduction in benefit of 30%	Discounted benefit
1	250000	0	1	25000	0	0	0	0	0	0	0
2	5000	20000	0.893	4465	17860	18000	16074	16000	14288	14000	12502
3	5000	20000	0.797	3985	15940	18000	14346	16000	12752	14000	11158
4	5000	20000	0.712	3560	14240	18000	12816	16000	19392	14000	9968
5	5000	20000	0.636	3180	12720	18000	11448	16000	10176	14000	8904
6	5000	25000	0.567	2835	14175	22500	12757.5	20000	11340	17500	9922.5
				43025	74935		67441.5	84000	59948	73500	52454.5
				NPV	31910	NPV	24416.5	NPV	16923	NPV	9429.5
				BCR	1.71	BCR	1.56	BCR	1.39	BCR	1.21

Remarks

The uncertainties in the project benefit stream can be sensitized by the *exante* approach of reducing the anticipated project benefit stream at 10, 20, 30 percentages. The computed NPV and BCR ratios indicate that the project can withstand uncertainties to the tune of even 30 percent reduction in the yield due to the different uncertainties. The NPV and BCR at 30 percentage reduction in the yield in the project benefit stream was found to be ₹ 9,429 and 1.21

Conclusion

The above tools namely cost and return indicators, budgeting analysis and financial feasibility indicators including sensitivity analysis provides various opportunities in assessing the economic efficiencies – *exante* and *expost*. However it is important to include social and environmental assessment too so as to ensure that the business option is inclusive and sustainable. The sustainable farming would encompass the facets of ecologically sound, environment friendly, socially acceptable, technologically sound, financially feasible, economically viable, user friendly, culturally compatible, indigenously resource sourced and market driven.

Suggested further readings

- Battese, G.E. and T.J. Coelli, 1992. Frontier production functions, technical efficiencyand panel data with application to paddy farmers in India, The Journal ofProductivity Analysis, 3:153-169.

- Battese G.E. and T.J. Coelli, 1995. A model for technical inefficiency effects in astochastic frontier production function for panel data. Empirical Economics, 20:325-332.

- Narayanakumar, R., 2009. Economic analysis of cage culture of sea bass. In: Coursemanual: National training on cage culture of seabass. Imelda, Joseph and Joseph, Edwin and Susmitha, V., (eds.) CMFRI & amp; NFDB, Kochi, pp: 120-122.

- Narayanakumar, R and Krishnan, M., 2013. Socio-economic assessment of seaweedfarmers in Tamil Nadu - A case study in Ramanathapuram District. Indian Journal of Fisheries, 60 (4), pp: 51-57.

- Narayanakumar, R., Shyam S Salim, Shinoj, P and Ramachandran, C., 2017. Methodological Tools for Socioeconomic and Policy Analysis in Marine Fisheries. CMFRI Special Publication (127). Central Marine Fisheries Research Institute, Kochi.

- Pandey, S. K., Shyam S Salim and Biradar, R. S., 2005. Economics of Freshwater Aquaculture Technologies. Central Institute of Fisheries Education, Mumbai.

- Shyam S Salim, 2002. Business Strategies for Venturing into Fisheries enterprises [Teaching Resource].

- Shyam S Salim, Biradar, R. S and Pandey, S. K., 2004. Economic analysis of fisheries projects. Central Institute of Fisheries Education, Mumbai.

- Shyam S Salim, Biradar, R. S and Pandey, S. K., 2005. Fisheries Economics and Marketing- An introduction. Central Institute of Fisheries Education, Mumbai.

- Shanmugam, K.R., Atheendar and Venkataramani, 2006.Technical efficiency inagricultural production and its determinants:An exploratory study at district level,Ind. Jn. of Agri. Econ. Vol. 61, No. 2, Apr-Jun 2006.

- Sathiadhas, R and Narayanakumar, R., 2010. Economic analysis of Open sea cage farming. In Course Manual: Training Programme on Sea cage farming of seabass andlobsters CMFRI, 2010.

- SAS Institute Inc. 2014. SAS/ETS® 13.2 User's Guide. Cary, NC: SAS Institute Inc.

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