PRACTICAL MANUAL

FISHERIES PROJECT FORMULATION AND MANAGEMENT

Shyam. S. Salim

R. S. Biradar

भा.कृ.अनु.प.
ICAR

CENTRAL INSTITUTE OF FISHERIES EDUCATION
(Deemed University)
Fisheries University Road,
Versova, Mumbai - 400 061

Published

December, 2001

Published by

Dr. S. Ayyappan
Director, CIFE

Technical Assistance

Mrs. S. S. Gajbhiye
Mr. Vijay. Venugopal

Cover Design
Mrs. Madhavi P. Pikle

About the authors :

Mr. Shyam S. Salim, Scientist, Fisheries Economics Section, Central Institute of Fisheries Education, Mumbai and **Dr. R. S. Biradar,** Principal Scientist & Head, Fisheries Informatics, Technology Evaluation and Transfer Division, Central Institute of Fisheries Education, Mumbai - 400 061.

FOREWORD

Project formulation is an important part of entrepreneurship development. Fisheries sector, hosting a gamut of entrepreneurship venture, requires technical know-how in project formulation and management. Keeping this in mind, my colleagues Mr. Shyam S. Salim, Scientist and Dr. R. S. Biradar, Principal Scientist of Fisheries Informatics, Technology Evaluation and Transfer Division of this Institute have written a course manual on "FISHERIES PROJECT FORMULATION AND MANAGEMENT" in a simple and systematic manner to cater to the requirements and expectations of students of fishery science. The manual contains basic concepts and applications, which are necessary to understand and practice the subject. I am sure the manual would also serve as a useful handbook to research workers.

एस. अय्यप्पन

(S. Ayyappan)

Director

PREFACE

Fisheries sector is one of the fastest growing food sectors in India. In order to sustain the faster growth, developmental projects and programmes need to be formulated, implemented, monitored and managed scientifically. It is therefore necessary that fisheries students should develop necessary skills in this area. Books and course manuals on this subject based on Indian experience are lacking. It is in this background that an effort is made to prepare a practical course manual on FISHERIES PROJECT FORMULATION AND MANAGEMENT for the benefit of graduate and post-graduate students in fisheries. The manual includes important topics that are necessary for fisheries project formulation, evaluation and management. Each of the topic covered includes basic concepts followed by examples. Authors are grateful to Dr. S. Ayyappan, Director, Central Institute of Fisheries Education, Mumbai for his constant encouragement and support to this endeavour. Thanks are also due to Mrs. S. S. Gajbhiye and Mr. Vijay V. for their technical assistance.

Shyam. S. Salim
R. S. Biradar

Mumbai
5th December, 2001

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Exercise 1	RATIO ANALYSIS

Basic Concepts :

- Measures the profitability of the investment in fisheries activities.
- Liquidity of the farm assets

A. Expense : Income Ratios :

- Measures input - output efficiency.
- Indicates margin by which the value of total production exceeds production costs.

(i) Operating Ratio (OR)

$$OR = \frac{\text{Total operating expenses}}{\text{Gross income}}$$

(ii) Fixed Ratio (FR)

$$FR = \frac{\text{Fixed expenses}}{\text{Gross income}}$$

(iii) Gross Ratio (GR)

$$GR = \frac{\text{Total expenses}}{\text{Gross income}}$$

B. Asset Liability Ratio :

(i) Current Ratio (CR)

$$CR = \frac{\text{Current assets}}{\text{Current liabilities}}$$

(ii) Intermediate Ratio (IR)

- Ability to meet the debts over 1-10 years period.

$$IR = \frac{\text{Current assets + Intermediate assets}}{\text{Current liabilities + Intermediate liabilities}}$$

(iii) Net Capital Ratio (NCR)

- Indicates overall solvency of the business.

$$NCR = \frac{\text{Total assets}}{\text{Total liabilities}}$$

(iv) Debt Equity Ratio (DER)

$$DER = \frac{\text{Total debts}}{\text{Owner's equity}}$$

C. Income - Investment Ratio :

(i) Capital Turn Over Ratio (CTOR)

$$CTOR = \frac{\text{Gross income}}{\text{Average capital investment}}$$

(ii) Rate of Return on Capital (RRC)

$$RRC = \frac{\text{Net profit + Interest on investment to capital investment}}{\text{Capital investment}}$$

(iii) Rate of Return on Equity (RRE)

$$RRE = \frac{\text{Net profit - Management labour}}{\text{Average net worth}}$$

Example :

Given the following data :

Particulars	(Rs.)	Particulars	(Rs.)
Fixed Cost	12,000	Owner's Equity	47,000
Variable Cost (Operating expenses)	21,000	Gross Income	79,000
Current Assets	15,000	Average Capital Investment	55,000
Intermediate Assets	20,000	Capital Investment	22,000
Long Term Assets	38,000	Net Profit	24,000
Current Liabilities	18,000	Interest on Investment to Capital Investment	22,000
Intermediate liabilities	27,000	Management Labour	12,000
Long Term Liabilities	20,000	Average Net Worth	17,000

Determine the following ratios :

1. Operating Ratio
2. Fixed Ratio
3. Gross Ratio
4. Current Ratio
5. Intermediate Ratio
6. Net Capital Ratio
7. Debt Equity Ratio
8. Capital Turn Over Ratio
9. Rate of return on capital
10. Rate of return on equity

Interpret the financial position of the farm.

Solution :

(i) Operating Ratio $= \dfrac{\text{Total operating expenses}}{\text{Gross income}}$

$= \dfrac{21,000}{79,000} = 0.265$

(ii) Fixed Ratio $= \dfrac{\text{Fixed expenses}}{\text{Gross income}}$

$= \dfrac{12,000}{79,000} = 0.151$

(iii) Gross Ratio $= \dfrac{\text{Total expenses (Operating expenses + Fixed expenses)}}{\text{Gross income}}$

$= \dfrac{33,000}{79,000} = 0.417$

(iv) Current Ratio $= \dfrac{\text{Current assets}}{\text{Current liabilities}}$

$= \dfrac{15,000}{18,000} = 0.833$

(v) Intermediate Ratio $= \dfrac{\text{(Current assets + Intermediate assets)}}{\text{(Current liabilities + Intermediate liabilities)}}$

$= \dfrac{15,000 + 20,000}{18,000 + 27,000}$

$= \dfrac{35,000}{45,000} = 0.777$

(vi) Net Capital Ratio $= \dfrac{\text{Total assets}}{\text{Total liabilities}}$

$$= \frac{15,000 + 20,000 + 38,000}{18,000 + 27,000 + 20,000}$$

$$= \frac{73,000}{65,000} = 1.123$$

(vii) Capital Turn Over Ratio $= \dfrac{\text{Gross income}}{\text{Average capital investment}}$

$$= \frac{79,000}{55,000} = 1.436$$

(viii) Debt Equity Ratio $= \dfrac{\text{Total debt (liabilities)}}{\text{Owners equity}}$

$$= \frac{18,000 + 27,000 + 20,000}{47,000}$$

$$= \frac{65,000}{47,000} = 1.382$$

(ix) Rate of Return on Capital $= \dfrac{\text{Net profit + Interest on investment to capital investment}}{\text{Capital investment}}$

$$= \frac{24,000 + 22,000}{22,000} = 2.09$$

(x) Rate of Return on Equity $= \dfrac{\text{Net profit - Management labour}}{\text{Average net worth}}$

$$= \frac{24,000 - 12,000}{17,000} = 0.705$$

Exercise 2 | COMPUTATION OF DEPRECIATION

Basic Concepts :

- ❖ The decline in the value of capital equipment due to wear and tear is called depreciation.
- ❖ It is caused by time and use.
- ❖ The serviceability and value of asset diminishes.

Depreciation

Depreciation due to physical condition	Depreciation due to financial condition
• Wear and tear • Physical decay • Accidental • Deferred maintenance and neglect	* Inadequacy (reduction in efficiency) * Obsolescence

Method of computation of depreciation

1. Straight Line Method :

$$\text{Annual depreciation} = \frac{\text{Original cost - Junk value}}{\text{Expected life of the asset (No. of useful years of life)}}$$

(Junk value is also referred as Scrap Value or Salvage Value or Residual Value)

2. Annual Revaluation Method :

Depreciation = Difference in market value of the asset in the beginning and the end of the year.

3. Diminishing Balance Method :

- Fixed rate of depreciation is used for every year and applied to the value of the asset at the beginning of the year.

- Done until salvage value is reached and no further depreciation is possible.

4. Sum of the Year - Digits Method (Reducing fraction method) :

Annual depreciation = Fraction x Amount to be depreciated

$$\text{Fraction} = \frac{\text{The years of life remaining at the beginning of accounting period}}{\text{The sum of the years of life of the assets}}$$

Amount to be Depreciated = Cost minus salvage value

Rate of annual depreciation = (Original cost - Junk value) x Fraction for the particular year.

5. The Insurance Policy Method :

- Covers the risk.
- Premiums are paid on the insurance policy.
- Machine insured with the company.

6. Machine Hour Basis Method :

- Life of machine in hours.
- Depreciation charges are calculated per hour

$$= \frac{\text{Original charges - Junk value}}{\text{No. of hours}}$$

7. Compound Interest Method :

(a) *Sinking Fund Method*

$$D = \frac{R\,(C - S)}{(1+R)^{N} - 1}$$, where

D = Rate of depreciation per year.

R = Rate of interest on accumulated fund in fraction number.

C = Total cost of machine.

S = Scrap value.

N = No. of years of life of machine.

(b) *Annuity Charging Method*:

- Interest charged on the cost of machine / assets every year on the book value.
- Depreciation is constant every year.

$$D = \frac{\{C\,(1+R)^N - S\}\,\{1-(1+R)\}}{1-(1+R)^N}$$, where

D = Rate of depreciation.

R = Rate of interest in fraction.

S = Scrap value.

N = No. of years of machine life.

C = Cost of machine.

- Value of machine after one year C becomes C_1.

$$D = CR + C - C_1 = C\,(1+R) - C_1$$

- Value of machine after two year C becomes C_2.

$$D = C_1R + C_1 - C_2 = C_1\,(1+R) - C_2.$$

Examples :

1. Straight Line Method :

An irrigation pump costs Rs.5, 000 and it is expected to have a productive life period of 10 years. The salvage value after 10 years is Rs 500. Compute the following values using the different methods discussed above :

- Value at the beginning of the year
- Annual depreciation.
- Depreciated value at the end of the year.

Solution :

1. **Straight line method :**

$$\text{Annual depreciation} = \frac{\text{Original cost - Scrap value}}{\text{No. of years (productive life)}}$$

$$= \frac{5000 - 500}{10} = \frac{4500}{10}$$

$$= 450.$$

Life period	Value at the beginning of the year (Rs.)	Amount to be depreciated (Rs.)	Depreciated value at the end of the year (Rs.)
1	5,000	450	4,550
2	4,550	450	4,100
3	4,100	450	3,650
4	3,650	450	3,200
5	3,200	450	2,750
6	2,750	450	2,300
7	2,300	450	1,850
8	1,850	450	1,400
9	1,400	450	950
10	950	450	500

2. Annual revaluation method :

Year	Market value at the beginning	Market value at the end	Depreciation value
1	5,500	5,200	300
2	5,200	4,900	400
3	4,800	4,200	600
4	4,200	3,200	1,000
5	3,200	2,100	1,100

3. Diminishing balance method :

Years of life	Value at the beginning of the year	Amount to be depreciated (10% of the diminished value)	Depreciated value at the end of the year (Diminished balance value)
1	1,000.00	100.00	900.00
2	900.00	90.00	810.00
3	810.00	81.00	729.00
4	729.00	72.90	656.10
5	656.10	650.61	590.49
6	590.49	59.05	531.44
7	531.44	53.14	478.30
8	478.30	47.83	430.47
9	430.47	43.05	387.42
10	387.42	38.74	348.68

4. Sum of the year-digits method :

Compute the following for the tractor whose cost is 92,000 and expected to last for 10 years.

Annual depreciation = Fraction x Amount to be depreciated.

Year	Value at the beginning of the year	Annual depreciation (Rs.)	Remaining balance (Rs.)
1	92,000	(92,000 - 9,200) x 10/55 = 15,054.55	92,000 - 15,054.55 = 76,945.55
2	76,945.55	(92,000 - 9,200) x 9/55 = 13,549.09	76,945.55 - 13,549.09 = 63,396.46
3	63,396.46	(92,000 - 9,200) x 8/55 = 12,043.64	63,396.46 - 12,043.64 = 51,352.82
4	51,352.82	(92,000 - 9,200) x 7/55 = 10,538.18	51,352.82 - 10,538.18 = 40,814.64
5	40,814.64	(92,000 - 9,200) x 6/55 = 9,032.73	40,814.64 - 9,032.73 = 31,781.91
6	31,781.91	(92,000 - 9,200) x 5/55 = 7,527.27	31,781.91 - 7,527.27 = 24,254.64
7	24,254.64	(92,000 - 9,200) x 4/55 = 6,021.82	24,254.64 - 6,021.82 = 18,232.82
8	18,232.82	(92,000 - 9,200) x 3/55 = 4,516.36	18,232.82 - 4,516.36 = 13,716.46
9	13,716.46	(92,000 - 9,200) x 2/55 = 3,010.90	13,716.46 - 3,010.96 = 10,705.56
10	10,705.56	(92,000 - 9,200) x 1/55 = 1,505.45	10,705.56 - 1,505.45 = 9,200.11

5. Machine hour basis method :

A machine is costing Rs.1, 10,000 and expected to run for 10 years, at the end of which its scrap value is likely to be Rs.10, 000. The machine is expected to run 2,000 hours per year on the average. Estimate the depreciation charges per hour of the machine.

Solution :

Cost of machine	=	Rs. 1,10,000
Scrap value	=	Rs. 10,000
Depreciation fund	=	1,10,000 - 10,000 = 1,00,000
Life of machine	=	10 years
	=	10 x 2,000
	=	20,000

$$\text{Depreciation charges per hour} = \frac{1,00,000}{20,000} = \text{Rs. 5 per hour}$$

6. Compound interest method :

(a) Sinking fund method

A machine is purchased for Rs.40, 000. The estimated life of machine is 15 years and scrap value is Rs.15, 000. If the rate of interest on depreciation fund is charged at 5 per cent, calculate the rate of depreciation by sinking fund method.

$$D = \frac{R\,(C - S)}{(1 + R)^{N} - 1}$$

$$= \frac{0.05\,(40,000 - 15,000)}{(1 + 0.05)^{15} - 1}$$

$$= \frac{0.05\,(25,000)}{(1.05)^{15} - 1} = \frac{1,250}{2.080 - 1}$$

$$= \frac{1250}{1.08} = 1157.40$$

Thus 1159.40 is the required amount of depreciation and is deducted every year for 15 years period.

(b) Annuity charging method :

Find the depreciation annuity by the annuity charging method after 3 years, when the cost of pump set is Rs.8, 000 and scrap value is 4,000. Rate of interest is 5 per cent.

$$D = \frac{\{C (1+R)^N - S\} \{1 - (1+R)\}}{1 - (1 + R)^N}$$

$$D = \frac{\{8000 (1+0.05)^3 - 4000\} \{1- (1+0.05)\}}{1- (1 + 0.05)^3}$$

$$= \frac{(8000 \times 1.16 - 4000) (- 0.05)}{1 - 1.16}$$

$$= \frac{5,280 \times 0.05}{0.16} = 1,650$$

Hence, depreciation annuity = Rs. 1,650

Exercise 3 | VALUATION OF PROJECT INVENTORIES

Basic Concepts :

Inventory : List of all properties of a business along with their value at a specific date.

Advantages of inventory valuation :

- Important while buying and selling a farm.
- Assess the borrowing capacity of the farm.
- Assess tax payable.
- Calculate compensation when it is taken over by the government.

Techniques include :

- Physical count
- Valuation

Physical Count : Describing and listing all productive resources and farm assets including verification of weights and measurements.

Valuation :

(1) *Market Cost Method* :

- Market price is used for valuation
- Application for feed, seed, fertilizer and for one time production period.
- Cost of transportation is added.

(2) *Net Selling Price* :

- Valuation at net selling price.
- Net selling price = Market price - Selling cost
- Application : Farm products ready for sale like fry, fingerlings, etc.

(3) *Cost Minus Depreciation* :

- Depreciation
- Application : For farm machinery

(4) *Farm Production Cost Method* :

- Valued accordingly based on the production cost
- Application : When products are valued before attaining market weight.

(5) *Cost / Market Price* :

- The actual cost of producing or purchasing an item is compared with its current market and the lower of the two values is taken as the value of the asset.
- Application : For farm tools and spare parts.

(6) *Replacement Cost* :

- Cost of replacement of an asset under current prices and technology is the value of the asset.
- Application : For valuing buildings.

(7) *Income Capitalisation Method* :

- The income capitalisation method is normally resources, which have an appreciation in their value over the years.
- Application : For valuing land whose contribution towards income measures for each production period and which have long life.

$$\text{Present Value} = \frac{\text{Annual return}}{\text{Interest rate}}$$

Example :

For the following details given below, estimate the inventories.

(a) Stock available :

(i) Feed 5 tonnes - Rs. 10,000

(ii) Fertilizer

Urea 100 kg - Rs. 400

Super phosphate 50 kg - Rs. 250

(b) Fish seed :

(i) Fry - 1 lakh number @ Rs. 50 per thousand

(ii) Fingerlings - 10,000 @ Rs.500 per thousand

(c) Pump set purchased during 1998 at Rs.10,000. (Productive life - 10 years) Junk value Rs. 1,000.

(d) Land giving an annual return of Rs.10, 000. Interest rate at 10 per cent.

(e) Building of 500 sq.ft. worth Rs. 2 lakh.

Fry - Net selling price = Marketing price - Selling cost
(Selling cost of Rs. 50 per 10,000)

Fingerlings - Net selling price = Marketing price - Selling cost
(Selling cost of Rs. 100 per 1,000)

Pump set - Junk value = 1,000

$$\text{Depreciation} = \frac{\text{Cost of the pump set - Junk value}}{\text{No. of years}}$$

Building - As time passes the value of building decreases by 5 per cent.

Solution :

Valuation of inventories.

Sl. No.	Item	Method of Valuation	Methodology	Qty.	Amount (Rs.)
1.	(i) Feed	Market cost method	Market price	5 tons	10,000
	(ii) Fertilizers	Market cost method	Market price	150 kg	650
2.	(i) Fry	Net selling price	Market price - selling cost	1 lakh	500
	(ii) Fingerlings	Net selling price	Market price - selling cost	10,000	5,000
3.	Pump set	Cost - depreciation	Depreciation		8,200
4.	Land	Income capitalisation method	Present value = Annual return by interest rate		1,00,000
5.	Building	Replacement cost	Cost of replacement	500 sq.ft.	1,80,000

Exercise 4 FARM BUDGETING

Basic Concepts :

- Method of analysing plans for the use of resources at the command of decision maker.
- Process of estimating costs, returns and net profit of a farm or a particular enterprise.

Two Types :

- Complete budgeting (whole farm budgeting) - plan for the farm as a whole.
- Partial budgeting (enterprise budgeting) - partial change in the farm operation.

Enterprise budgeting :

- Appropriate tool to evaluate the economic viability of a change - change in culture, technology, intensity of farming, adding of new machine, adding of new species.

Partial Budgeting Format :

Sl.No.	Debit (cost)	Credit (Benefit)
1	Added cost (A_1)	Reduced cost (B_1)
2.	Reduced Return (A_2)	Added Return (B_2)
Total	$A = A_1 + A_2$	$B = B_1 + B_2$

Partial budgeting $= (B_1 + B_2) - (A_1 + A_2) = B - A$

Decision Makers :

If B – A is positive, profit - change is advisable.

If B – A is negative loss - change is not advisable.

If B – A is zero, no profit - no loss.

Added Costs :

Additional expenses associated with the proposed change.

Reduced Return :

Listing of all receipts that would no longer be obtainable under the alternative plan.

Added Return :

Estimate of additional receipts that will occur from the proposed change.

Reduced Cost :

Listing of all input and their values, which will no longer be incurred if the change is made.

Example :

A fish farmer cultivating local varieties of carp wants to replace it with the composite fish culture technology. The per hectare costs and returns from the two methods are given below. The duration of both the varieties are four months. Interest on working capital is 14 per cent. Suggest whether the fish farmer could adopt the composite fish culture technology to enhance farm profit.

Price of fish	- Rs. 30 per kg	Working capital	- Rs. 8,750
Local carp	- 1200 kg	Working capital	- Rs. 20,550
Composite fish culture	- 2015 kg.		

Solution :

	Debit (Cost) (A)	Credit (Benefit) (B)
1.	Added cost (A_1) $11800 + \frac{(20{,}550 - 8{,}750) \times 14 \times 14}{100 \times 12}$ $A_1 = 12{,}350.75$	Reduced cost (B_1) Nil B_1
2.	Reduced Return (A_2) Nil A_2	Added Return (B_2) (2015 - 1200) x 30 = 24,450
Total	**12350.75**	**24,450**

Partial budgeting = B - A

= 24450 - 12350.75

= 12099.25

The partial budgeting is feasible and profitable.

Exercise 5	CASH FLOW ANALYSIS AND CASH FLOW STATEMENT

Basic Concepts :

- Summary of cash inflow and outflow.
- Cash inflow - cash sales, receivables, credit sales, loans as well as equity.
- Cash outflow - cash expenditure, tax payments and loan repayments.
- Takes into account of future also.
- Prepared in the beginning of each year preferably agricultural year.
- Done on monthly basis - anticipated cash inflows / project cash outflows.

Sample Cash Flow Budget :

Sl. No.	Particulars	J	F	M	A	M	J	J	A	S	O	N	D
1	Cash Inflows												
	Cash balance												
	Credit sales												
	Cash sales												
	Other cash inflow												
	Total												
2	Cash outflows												
	Operating expenditure												
	Loan repayment												
	Tax payments												
	Total												
3	Cash available												
	New borrowing												
	Interest												
	Depreciation												
4	Ending cash balance												

Example :

Prepare the cash flow statement for the fishermen based on the following information :

(i) Pre-monsoon (Feb-May) Average yield 1,500 kg / month

(ii) Monsoon (June-Sept) " 500 kg / month

(iii) Post-monsoon (Oct-Jan) " 1,000 kg / month

(iv) Price of fish is Rs. 30, 50 and 40 per kg respectively during pre – monsoon, monsoon and post monsoon seasons.

(v) Family expenditure remains invariably the same as Rs. 3,000 per month except for the months of May and June that is Rs. 10,000 per month.

(vi) A trawler will be purchased at the start of the monsoon (month of June) with 4 lakhs at 15 per cent interest and the repayment will be done in a period of seven months.

Inferences :

- Anticipated cash inflows.
- Projected cash outflows.

Cash flow	J	J	A	S	O	N	D	J	F	M	A	M
In- flow Cash sales	400000 25000	15000 25000	37000 25000	59000 25000	81000 40000	118000 40000	92857 40000	67714 40000	42301 45000	21888 45000	1475 45000	- 18938 45000 +400000
Total	425000	40000	62000	84000	21000	158000	132857	107714	87301	66888	46475	426062
Out-flows	400000 10000	3000	3000	3000	3000	62143 3000	62413 3000	62413 3000	62413 3000	62413 3000	62413 3000	62413 10000
Total	410000	3000	3000	3000	3000	65143	65143	65143	65143	65143	65143	72143
Balance Total	15000	37000	59000	81000	18000	92857	67714	42301	21888	1475	- 1893	353919

Exercise 6	NET WORTH STATEMENT - BALANCE SHEET

Basic Concepts :

- Shows the financial condition and stability of the business at a particular point of time.
- Gives an account of total assets and liabilities.
- Indicates net worth/equity or net deficit.
- Assets include
  - Current assets (12 months)
  - Intermediate assets (1-10 years)
  - Fixed or long term assets (more than 10 years)
- Liabilities include
  - Current liabilities (12 months)
  - Intermediate liabilities (1-10 years)
  - Fixed or long term liabilities (more than 10 years)

Format of Net Worth Statement

Sl.No.	Liabilities (A) (Rs.)	Assets (B) (Rs.)
1		
2		
3		
	Total =	Total =
	Networth (B - A) =	

Example :

Prepare the networth statement of a fish farmer based on the following data :

The liabilities :

Short term loans :		
Hand loans	-	2,000
Fertilizers	-	7,000
Feeds	-	3,000
Loans on machinery and equipment	-	35,000
Loans on purchase of brooder stock	-	50,000

The assets include :

Cash in bank	-	15,000
Cash on hand	-	6,000
A/c receivable	-	12,000
Feed	-	1,000
Fertilizer	-	2,500

Intermediate assets include :

Machinery and equipment	-	60,000
Fingerlings	-	15,000
Land	-	80,000
Farm building	-	29,000

Solution :

Liabilities (A)		**Assets (B)**	
1. Current		**Current**	
Short term loans :		Cash in bank	15,000
Hand loans	2,000	Cash on hand	6,000
Fertilisers	7,000	Account receivable	12,000
Feeds	3,000	Feed	1,000
		Fertilizers	2,500
Sub-total	12,000	Sub-total	36,500
2. Intermediate		**Intermediate**	
Loans on machinery and equipments	35,000	Machinery and and equipments	60,000

Loans on purchase of brooder stock	5,000	Fingerlings	15,000
Sub-total	40,000	Sub-total	75,000
3. Long term (fixed)		**Long term (fixed)**	
Nil	-	Land	1,50,000
		Farm buildings	2,000
Sub-total	-	Sub-total	17,000
Total liabilities	**52,000**	**Total assets**	**2,81,50**

Net worth = Total assets - Total liabilities

= Rs. 2,81,500 - Rs. 52,000

= Rs. 2,29,500.

Exercise 7	INCOME STATEMENT : PROFIT OR LOSS STATEMENT

Basic Concepts :

- Considers operational efficiency in terms of receipts and expenditure.
- Summary of receipts and gains minus expenses and losses during a specified period.
- Prepared for an agricultural (production) year.
- Monetary values are assigned to inputs and outputs.

Receipts :

- Returns obtained from the sale of crop produce and supplementary produce.
- Gain in the form of appreciation of assets.

Expenses :

- Operating and fixed costs.
- Losses in the form of depreciation of asset value.
- Purchase of capital assets is not considered.

Net Income :

Net Cash Income

Position of cash receipts minus cash expenses during the period for which income statement is prepared.

Net Operating Income

Deducting operating expenses from the gross income. Operating expenses include crop loans.

Net Farm Income

Net operating income - Fixed cost return accrued to owned capital and family labour employed.

Example :

Prepare the income statement for a following farm based, on the data given below :

Returns from the sale of fish	-	57,000
Revenue from poultry	-	8,000
Returns from other enterprises	-	12,000
Gifts	-	2,000
Appreciation on the value of assets	-	3,000

Operating expenses or costs

Hired human labour	-	10,500
Machine labour	-	1,500
Seed	-	1,100
Feed	-	5,000
Manures and Fertilizers	-	3,000
Veterinary aid	-	500
Irrigation	-	1,000
Miscellaneous	-	2,000
Interest on working capital	-	2,100

Fixed expenses or costs

Depreciation	-	3,000
Land revenue	-	200

Interest on fixed capital (includes interest as Rs.1, 500 paid)

Towards term loan	=	Rs. 3,200
Rental value of owned land	=	Rs.10,000

Solution :

Income Statement

Particulars	Amount (in Rs.)
I. Receipts	
A. Returns from the sale of fish	57,000
B. Revenue from poultry	8,000
C. Revenue from other enterprises	12,000
D. Gifts	2,000
E. Appreciation in the value of assets	3,000
Gross Income	**82,000**
II. Expenses	
A. Operating expenses or costs	
(i) Hired human labour	10,500
(ii) Machine labour	1,500
(iii) Seed	1,100
(iv) Feed	5,000
(v) Manures and Fertilizers	3,000
(vi) Veterinary aid	500
(vii) Irrigation	1,000
(viii) Miscellaneous	2,000
(ix) Interest on working capital	2,100
Total	**26,700**
B. Fixed expenses or costs	
(i) Depreciation	3,000
(ii) Land revenue	200
(ii) Interest on fixed capital	3,200
(iii) Rental value of owned land	10,000
(iv) Total fixed cost	16,400
III. Net cash income	79,000 - 26,700 = Rs.52, 300
IV. Net operating income	82,000 - 26,700 = Rs.55, 300
V. Net farm income	55,300 - 16,400 = Rs.38, 900

Exercise 8	PROJECT APPRAISAL TECHNIQUES - UNDISCOUNTED MEASURES

Basic Concepts :

- Appraisal is the analysis of costs and benefits of a proposed project.
- Assuring a rational allocation of limited funds.
- Among alternative investment opportunities for achieving certain specified goals.
- Time value of money is not considered.

Different techniques include -

- Ranking by inspection.
- Pay back period.
- Returns per rupee of outlay.
- Average return per rupee of outlay.

(a) Ranking by inspection :

Investment cost and shape of cash flow stream.

- Longer duration
- Other intangible benefits.

(b) Pay back period :

- Length of time taken for the net benefits to return the cost of capital investment.
- The earnings after the pay back and timings of returns are not considered.

(c) Returns per rupee of outlay :

- Return per rupee of investment.

(d) Average return per rupee of outlay :

Steps - (i) Total returns / Number of years

(ii) Average returns / Investment cost (Original outlay)

Example :

Among the following four projects, select them based on the different undiscounted techniques:

Project	Capital items	Net-value of production	Profit duration	Average value of production	Return per rupee outlay	Average return per rupee outlay
1	2	3	4	5	6=3/2	7=5/2
1	40,000	40,000	4	20,000	1.00	0.50
2	40,000	41,944	4	13,981	1.05	0.35
3	40,000	47,000	5	15,667	1.18	0.39
4	40,000	47,000	5.12	15,667	1.18	0.39

Conclusion :

- Project III and IV have higher returns per outlay but higher pay back period.
- Project I and II have the same pay back period.
- Project II has higher returns per rupee of outlay and hence it is preferred.

Exercise 9	PROJECT APPRAISAL TECHNIQUES - DISCOUNTED MEASURES

Basic Concepts :

- Basic idea is that money has a time value.
- Discounting - process of finding the present worth of a future income.
- Discount rate - the interest rate used for discounting.
- Opportunity cost of capital - the rate at which the cash flows of the projects are disccunted.

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) :

Present value of the expected future net cash flows discounted at a specified discounted rate.

NPV is the difference between the discounted benefit and discounted cost.

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

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

C = Capital investment

CF_t = (CF_1 ....CF_t) Cash inflow

t = Time in years

(iii) Benefit Cost Ratio (BCR) :

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

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

$$\text{BCR} = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+r)}}{\sum_{t=1}^{n} \frac{C_t}{(1+r)^t}}, \text{ where}$$

B_t = Cash inflow

C_t = Cash outflow

(iv) Internal Rate of Return (IRR) :

Discount rate that equates the present value of the expected future cash flows or receipts to the initial cost of the project.

IRR is the discount rate at which Net Present Value (NPV) is equal to zero and benefit cost ratio is equal to one.

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:

$$\text{IRR} = r_L + \left[\frac{Pv - C}{\Delta P_V} \right] \times \Delta r, \text{ where}$$

IRR = Internal Rate of Return

r_L = Lower rate of discount

P_V = Present value at lower value of discounting

C = Capital investment

ΔP_V = Difference in the present values at the two discount rate.

Δr = Change in discount rate.

Selection Criteria of Projects :

1. NPV greater than zero.
2. BCR more than one.
3. IRR greater than the bank rate of interest or the opportunity cost of capital.
4. The discounted pay back period is less.

Example :

Compute the discounted pay back 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	25,000	-	1	25,000	-
2	-	12,000	0.8929	-	10,715
3	-	10,000	0.7972	-	7,972
4	-	8,000	0.7118	-	5,694
5	-	5,400	0.6355	-	3,432
Total	25,000	35,400		25,000	27,813

Solution :

1. Discounted Pay Back Period = 4.5 years.
2. Net Present Value = 27,813 - 25,000 = 2,813
3. Benefit Cost Ratio = 27,813 ÷ 25,000 = 1.112
4. Internal Rate of Return

Year	Cash out-flow	Cash inflow	Discounting factor at 12%	Dis-counted cash outflow	Discounted cash inflow at 12%	Dis-counting factor at 20%	Discounted cash outflow
1	25,000	-	1	25,000	-	1	-
2	-	12,000	0.8929	-	10,715	0.8330	10,000
3	-	10,000	0.7972	-	7,972	0.6944	6,944
4	-	8,000	0.7118	-	5,694	0.5787	4,630
				25000	27,813		24,178
Net Present Value =					+ 2,813		- 822

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

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

$$IRR = 12 + \left[\frac{(27,813 - 25,000)}{(27,813-24,178)}\right] \times (20 - 12)$$

$$IRR = 12 + \left[\frac{2813}{3635}\right] \times 8$$

$$IRR = 18.19$$

Conclusion :

The project is feasible because :

(i) NPV is greater than zero.

(ii) BCR is greater than one.

(iii) IRR is greater than the opportunity cost of capital.

Exercise 10	PROJECT MANAGEMENT TECHNIQUES - CHARTS

Basic Concepts :

Project Management involves decision making for the planning, organising, co-ordination, monitoring and controlling of a number of inter-related time bound activities.

- Effective not only for drawing up the best possible initial plan but also capable of projecting instantaneously the impact of deviations so as to initiate necessary corrective measures.

A. Bar Charts :

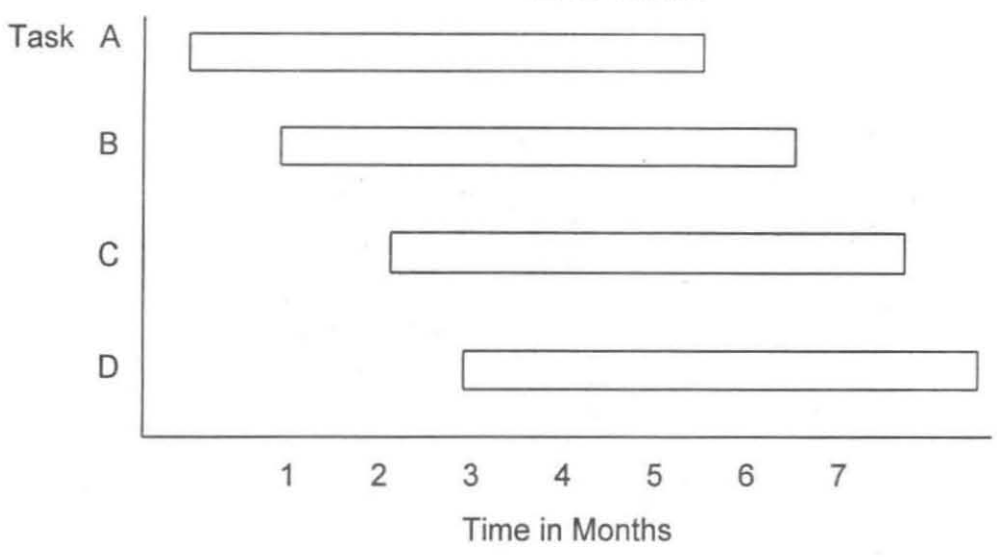
Bar chart are better known as Gantt chart (developed by Henry L. Gantt) for monitoring project activities.

- Pictorial representation specifying the start and finish time in a horizontal scale.
- Project activities broken down to identifiable and controllable units called the tasks.
- Tasks are indicated by means of a bar in the vertical axis and time is plotted on the horizontal axis.
- Length of the bar indicates required time for the task.

Disadvantages :

- Does not indicate the interrelationship between tasks.

BAR CHART



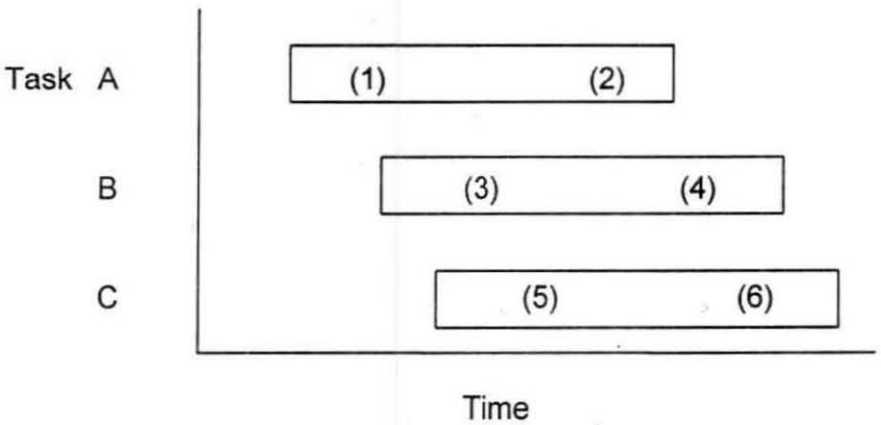
B. Milestone Charts :

- Milestone chart is an improvement over the bar chart by introducing the concept of milestone.
- Milestone represented by a circle over a task in the bar chart indicates completion of a specific phase of the task.
- Shows the sequential relationship among the milestones or events within the same task.

Disadvantages :

- Does not indicate the dependence between tasks.
- Does not indicate critical activities.
- Does not consider the concept of uncertainty in accomplishing the tasks.

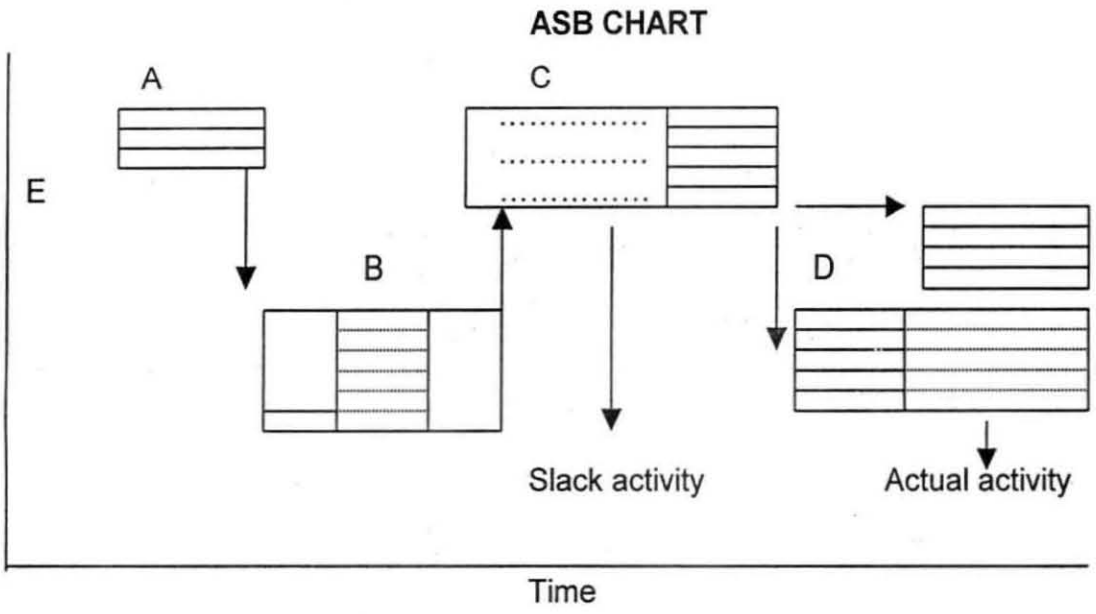
MILESTONE CHART



Activity slack bar chart (ASB - Chart)

- Related to biological projects.
- Applicability to systems that are season bounded, time specific and growth pattern dependent.
- Takes into consideration of sequential activities having an inbuilt slack (waiting time), which are fixed and inflexible.
- In the presence of a built in slack, the real activity cannot start until the specified slack period is over.

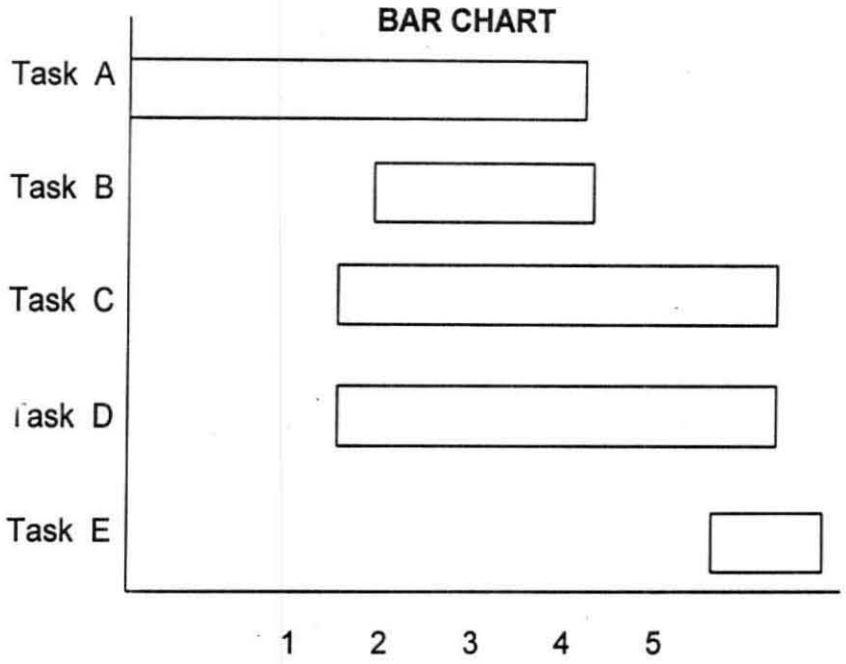
- Bar is divided into two parts - one with continuous parallel lines and representing the actual activity period and other part with broken lines for inbuilt slack line as the activity. The relationship between the activities is indicated by arrows (⟶) with the head and tail of the arrow indicating the succeeding and preceding activity.



Example :

For the following operations in one hectare carp grow out pond draw the project management chart for a period of 80 days.

Sl.No.	Activity	Task symbol	Duration (days)
1.	Pond preparation	A	1-15
2.	Stocking	B	25-39
3.	Feeding	C	30-150
4.	Water quality management	D	30-150
5.	Harvest	E	100-180



Steps Involved :

→ Eradication of weeds

→ Eradication of unwanted fishes

→ Liming

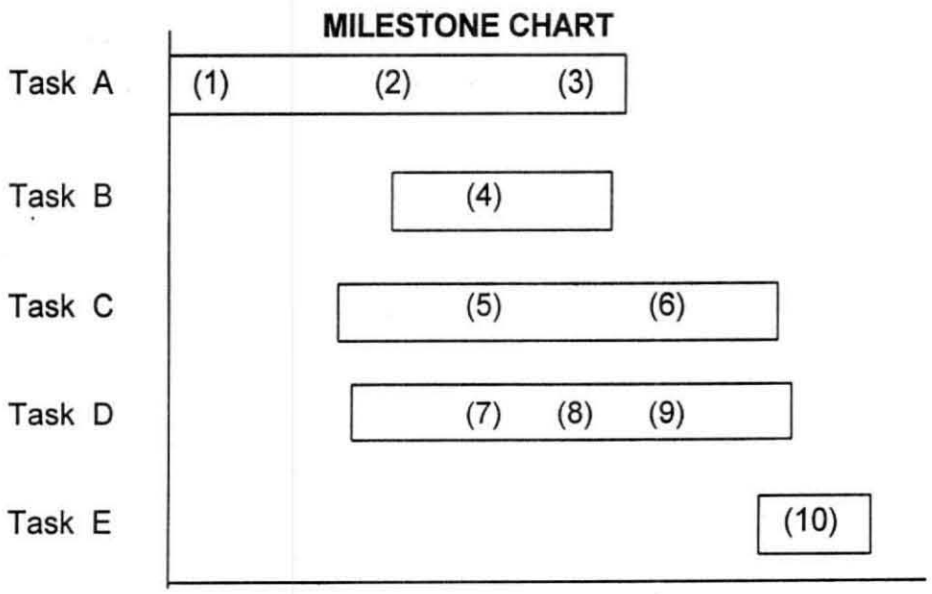
→ Fertilization

→ Aquatic insects control

→ Stocking

→ Feeding

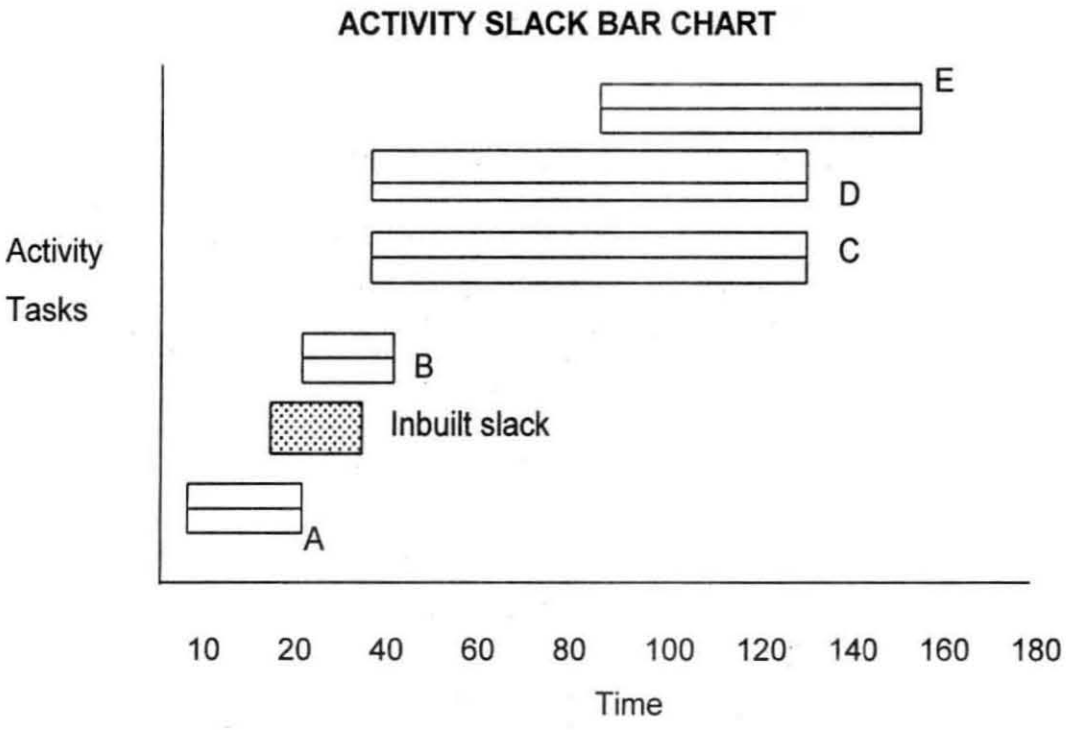
→ Harvesting



1 2 3 4 5

Milestones:

1. Maintenance of inlet and outlay
2. Liming
3. Fertilizer application
4. Feeding
5. Probiotics
6. Water quality
7. Application of insecticides



Exercise 11	PROGRAMME EVALUATION AND REVIEW TECHNIQUE (PERT) AND CRITICAL PATH METHOD (CPM)

Basic Concepts :

Programme Evaluation and Review Technique is a method of minimizing trouble spots, programme bottlenecks, delays and interruptions by determining critical activities before they occur so that various activities in the project can be co - ordinated.

Terms frequently used are :

- **Activity** - Recognizable work item of a project requiring time and resource for its completion.
- **Dummy Activity** - An activity that indicates precedence relationship and needs no time and no resource.
- **Critical Activity** - Activities on critical path having zero slack / float time.
- **Critical path** - The longest time path connecting the critical activities in the project network. Total time on this path is the shortest duration of the project.
- **Event** - An instantaneous point in time signifying completion or beginning of an activity.
- **Burst Event** - An event which give rise to more than one activity.
- **Merge Event** - The event which occurs only when more than one activity is accomplished.

- **Expected time** $(T_E) = \dfrac{T_o + 4T_M + T_P}{6}$, where

  T_o - Optimistic time

  T_M - Most likely time

  T_P - Pessimistic time

❖ **Earliest Occurrence Time (EOT) :**

The earliest possible time at which the event can occur. Also denotes Earliest Start Time (EST) of an activity indicating the earliest time at which an activity commences without affecting the immediate preceding activity.

❖ **Latest Occurrence Time (LOT) :**

The latest time at which the event can take place. Also referred as the Latest Start Time (LST) indicating the latest time at which an activity can begin without delaying the project completion time.

❖ **Slack** - The amount of spare time available between completion of an activity and beginning of next activity.

Steps for Network Analysis :

1. Prepare the list of activities.
2. Define the preceding and succeeding relationship for all activities.
3. Estimate the activity duration.
4. Assemble the activities in the form of a flow diagram.
5. Draw the network diagram.
6. Analyse the network, i.e., compute EOT and LOT; identify critical events, critical path and critical activities.

Example :

Establishing a feed mill at Fish Nutrition Division, Central Institute of Fisheries Education, Mumbai.

Step-1 : *Prepare the list of activity and give codes.*

Each activity is given an alphabetical symbol / code. When the numbers of activities are more than 26, alpha numeric or multi-alphabet codes can be used.

Sl.No.	Activity	Symbol
1.	Market Survey	A
2.	Procurement of machines for feed mill	B
3.	Installation of machine	C
4.	Selection of machine operator	D
5.	Training of machine operator with manufacturer	E
6.	Test run	F

Step-2 : *Define the preceding activities.*

It gives the relationships among the activities of the project - specified by identifying preceding activities for each activity. Only the terminating activities will not have any preceding activity. All other activities must appear atleast once as a preceding activity in the table.

Sl.No.	Activity	Symbol	Preceding Activity
1.	Market survey	A	-
2.	Procurement of machines	B	A
3.	Installation of machine	C	B
4.	Selection of machine operator	D	A
5.	Training of machine operator with manufacturer	E	B, D
6.	Test run	F	C, E

Step-3 : *Estimation of Activity Time :*

Activity time is the time that is actually expected to be expended in carrying out the activity. The expected time and its variance for each activity is computed as following :

$$\text{Expected time } (T_E) = \frac{T_o + 4T_M + T_P}{6}, \text{ where}$$

T_o - Optimistic time (minimum time assuming every thing goes well)

T_M - Most likely time (modal time required under normal circumstances)

T_P - Pessimistic time (maximum time assuming everything goes wrong)

Activity Table

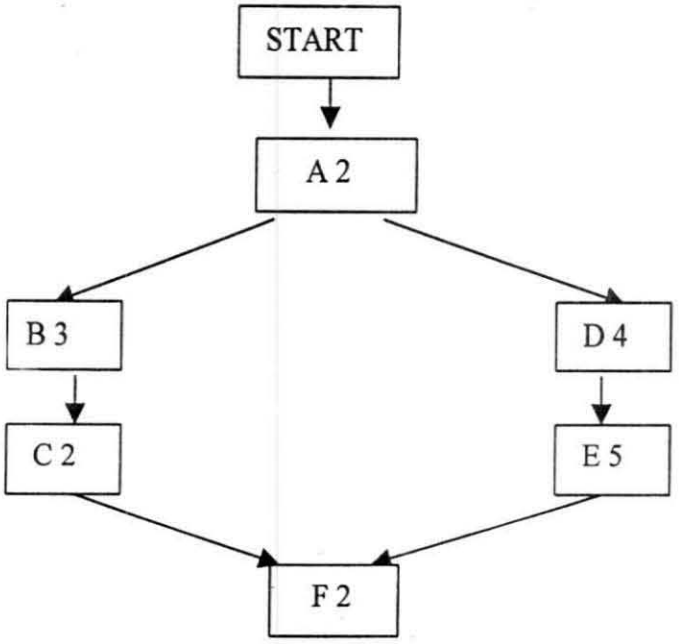
Sl. No.	Activity	Sym-bol	Preced-ing Activity	Optimi-stic Time (T_o)	Most Likely Time (T_M)	Pessi-mistic Time (T_P)	Esti-mated Time (T_E)
1.	Market survey	A	-	1	2	3	2
2.	Procurement of machine	B	A	2	3	4	3
3.	Installation of machine	C	B	1	2	3	2
4.	Selection of m/c operator	D	A	2	3	10	4
5.	Training of m/c operator with manufacturer	E	D, B	3	4	11	5
6.	Test run	F	C, E	1	2	3	2

Step-4 : *Assemble the activities in the form of a flow chart*

Box - Activity and its duration

Connecting lines - According to the preceding and succeeding activity relationship.

Critical path for project - Comparing various path lengths (sum of activity time on (longest path in chart).



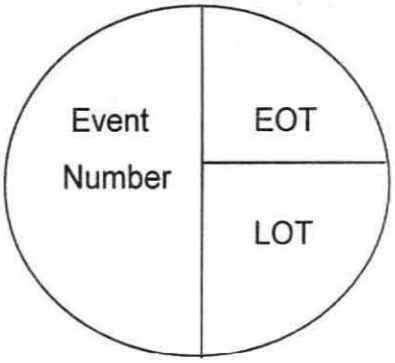
Path I	A-B-E-F	2+3+5+2	=	12
Path II	A-B-C-F	2+3+2+2	=	9
Path III	A-D-E-F	2+4+5+2	=	13

Critical path is A-D-E-F (The longest path)

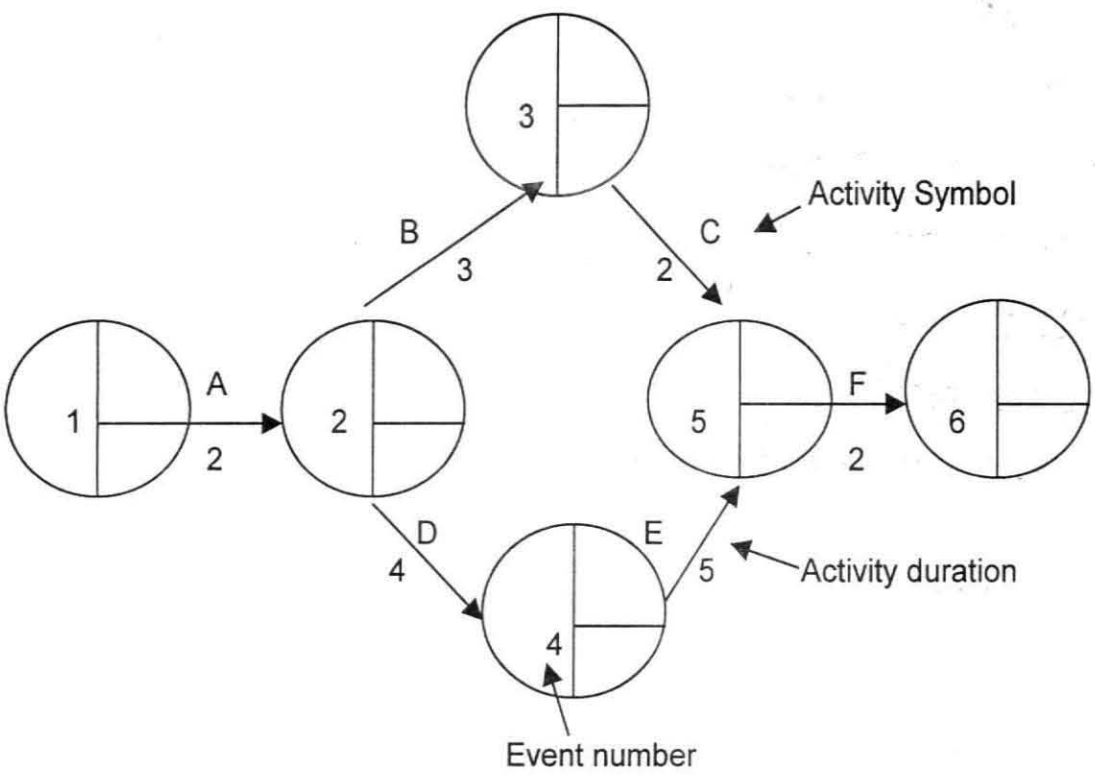
Step-5 : *Draw the Network*

Rules for drawing the network.

1. Each activity is represented by one and only one arrow in the network.
2. Dotted line arrows represent dummy activities.
3. An event is represented by circle.
4. Every activity starts and ends with an event.
5. No two activities can be identified by the same head and tail event.
6. Do not use dummy activity unless required to reflect the logic.
7. Avoid looping and crossing of activity arrows.
8. Every activity, except the first and the last, must have at least one preceding and one succeeding activity.
9. Danglers, isolated activities must be avoided.
10. For coding use alphabets for all activities including the dummy activity and numbers for events.
11. Standard representation of the event.



Network diagram showing the inter-relationship of activities



Step-6 : *Analyse the network, in compute EOT and LOT : Identify critical events and critical path and critical activities*

Computing Earliest Occurrence Time (EOT) and Latest Occurrence Time (LOT).

- The EOT and LOT are computed in 2 phases.
- The EOT is calculated first in the forward pass beginning from the start event.

- For the start event the EOT is always set to zero so that it can be scaled to any convenient calendar date at a later stage.
- The EOT at the last event is generally considered to be the project duration is the minimum time required for project completion.
- EOT and LOT are equal at the end event.
- LOT for other events is then calculated through backward pass starting from the end event.

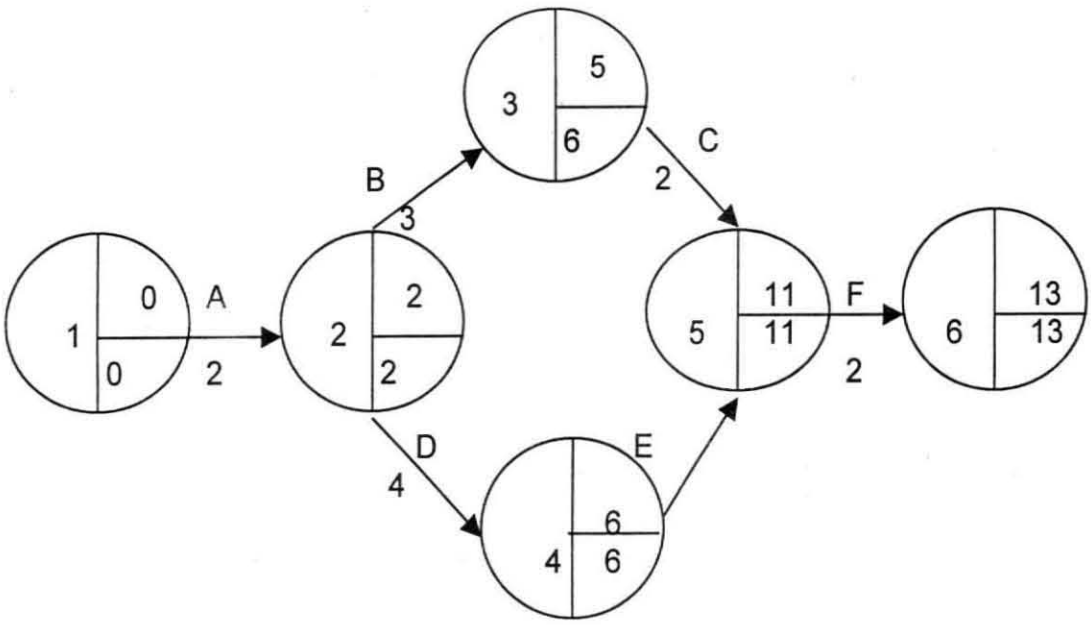
Steps involved in computation are :

EOT	LOT
Through forward pass.	Through backward pass.
Calculation begins from start event.	Calculation starts from end event.
Proceeds from left to right.	Proceeds from right to left.
At start event EOT is zero.	At end event LOT equals to EOT.
Adding the activity time to EOT.	Subtracting the activity time from LOT.
At a merge event takes a maximum value.	At a burst event take minimum value.

Computation of EOT and LOT for the project are as follows :

Event No.	EOT	Event No.	LOT
1.	0	6.	13
2.	0 + 2 = 2	5.	13-2 = 11
3.	2 + 3 = 5	4.	11-5 = 6
4.	Max. (2+4=6, 5+0=5) = 6	3.	Min. (6-0=6, 11-2=9)=6
5.	Max. (5+6=11,5+2=7)=11	2.	Min. (6-3=3, 4-2=2)=2
6.	11+2 = 13	1.	2-2 = 0

Network diagram showing the inter-relationship of activities



Identification of Critical Events :

The difference between LOT and EOT for an event is called event slack. For critical events this slack is zero, i.e., the value of LOT and EOT are equal.

Event Slacks

Event No.	LOT	EOT	Event Slack	Critical/ Not critical
1	0	0	0	Critical
2	2	2	0	Critical
3	6	5	1	Not critical
4	6	6	0	Critical
5	11	11	0	Critical
6	13	13	0	Critical

With above values of EOT, LOT and event slack the Critical Events are 1, 2, 4, 5 and 6.

Identification of Critical Activity :

An activity can be called as critical activity, if the following conditions are satisfied:

1. LOT and EOT are equal at the head event.
2. LOT and EOT are equal at tail event.
3. Difference between EOT at head and tail event of the activity equals to the activity time.
4. Difference between LOT at head and tail event of the activity equals to the activity time.

Review of computation results suggests that the critical activities in the project are A, D, E and F.

Critical Path Method (CPM)

Identification of Critical Path :

- Critical path is the chain of critical activity spanning the network from start to end, i.e., the path joining all the critical events.
- It is also the longest path from start to end of the project network.
- Comparing all the possible path lengths can identify the critical path (see flow diagram).
- Critical path time is the shortest duration of the project.
- The critical path is denoted by denoting the critical events on the path.
  Critical path for the project is A-D-E-F.
- Critical path can also be denoted in terms of event numbers.
  In this project : 4-4-5-6
- That a project has multiple critical paths. In such case the length of all the critical paths will be to distinguish the critical path from other paths, use a thicker line to demarcate the critical path.
- It is quite possible equal.

Critical Path and Project Management :

The critical path time being the shortest project time, any delay in completion of any of activity on the critical path would delay the entire project. Therefore, it is the critical activity that needs to be monitored for timely completion of project.

Exercise 12	PREPARATION OF PROJECT ON ESTABLISHMENT OF SHRIMP HATCHERY

Need for the Project :

Aquaculture has come to occupy a crucial place in fisheries development. The reason for this is that they have become the main source of seed supply for aquaculture, for raising brooders, for induced breeding and ranching / revival of depleting wild stocks. The sudden upsurge of demand for fish and crustacean seed in the past two decades have resulted in a situation that government hatcheries are finding difficulty in catering to the requirements. This is where the importance of private hatcheries is realised.

In Kerala at present there are just seven Tiger / Freshwater Prawn Hatcheries - two in government sector (BFDA shrimp hatchery, Matsyafed Prawn Hatchery both at Kollam) and five in private sector. This proposal for a 40 million shrimp hatchery in Azhikode is desirable for uninterrupted seed supply in Kerala. As a case study, project proposal on establishment of a shrimp hatchery in Kerala is presented below.

Area :

The land requirement for this hatchery is 5 ha which is taken on lease. The site is located at Azhikode, which is situated in Thrissur border. This plan has special importance since it was here that K.H. Alikunhi established the first hatchery in India. The proposed site is located near Azhikode bar mouth and seawater could be drawn from adjoining Arabian Sea.

Profile of the Area :

Climatic conditions :

The area has a warm climate (25 - 32°C), which is most suitable for establishment of prawn hatchery since a number of seed production cycles can be obtained over an extended period.

Availability of Broodstock :

Availability of ripe / berried shrimps in the vicinity of the proposed site is very helpful for a continuous seed production programme.

Seawater Parameters :

Temperature 25 °C, turbidity very low except during July - September. Dissolved oxygen 4-6 ml/l; Phosphate (0.8 - 1g -at/l); low NH_3 0-0.2g -at/l; pH 8-8.4. Primary productivity of surface seawater is medium 20-40mg $C.m^3$/day.

Chlorophyll	0.4-0.5 mg/m^3;
Zooplankton	0.5-1 ml/m^3;
Organic carbon	400-500 mg/m^3.

Species Selected	Selection Criteria
Penaeus monodon	Good aquaculture potential
Penaeus indicus	Good demand in EU and wide availability in the region.

Technical Suitability :

The spawner demand may be met either from Government Farms or purchased from experienced fishermen. Artemia, which is the main feed for shrimps, may be bought in bulk from Gujarat. Galveston System of hatchery rearing is adopted in this hatchery as it offers a better survival rate. The main features of Galveston system consists of indoor location of larval and post-larval tanks of smaller size (10t), high stocking rate (1 million nauplii / 10t), high water exchange (100%) and high survival (60%) at PL_{20}.

Labour Availability :

High quality labour is available in Kerala. Experienced hands are needed as hatchery managers and technicians.

Credit Facility :

Financial assistance can be obtained from MPEDA, Kochi.

Other Aspects :

As Kerala faces severe power shortage, frequent power failures may occur. Hence a provision for stand by generators is made. Distribution of the seed from the hatchery is done to local farms as well as to other parts of Kerala by renting lorries equipped for the purpose.

Technology Level :

The shrimp hatchery will basically adopt intermediate level of technology with the following broad targets.

	Projected Target
- Number of successful runs per year	08
- Maturation	
➤ Density (No./ton)	03
➤ Spawning success	60%
➤ Water exchange rate	100%
- Larval rearing (upto PL_5)	
➤ Density (Nauplii / ton)	1 lakh
➤ Survival rate	60%
➤ Water exchange	50% / day
- Nursery rearing (PL_5 to PL_{20})	
➤ Density (PL_5 / ton)	10,000
➤ Survival rate	60%
➤ Water exchange	100% / day

ECONOMIC VIABILITY

CAPITAL ITEMS

Items	Units	Unit Cost (Rs.)	Cost (Rs. '000)
- Land 5 ha			On lease
- Land preparation			40
Buildings			
- Rearing sheds	400 m^2		
- Nursery shed	1000 m^2		
- Brood tanks	300 m^2	800/m^2	1440
- Hatchery chamber	60 m^2		
- Algal culture	40 m^2		
- Stores / Offices / Quarter	200 m^2	1500/m^2	414
- Blower / Electricity / Housing	40 m^2		
- Salt water / Freshwater pump house	36 m^2		
- Seed packing area	70 m^2	1000/m^2	70
Sub-total buildings			**Rs. 1964**
Tanks			
- Brood stock tanks 12 t	6	25	150
- Spawning tanks FRP	24	5.5	132
- Hatching tanks FRP	24	6.5	156
- Larval rearing 10 t	30	18	540
- Nursery tanks 20t	40	25	1000
- Algal tanks 300 l FRP	60	2	120
- Algal tanks 1500 l FRP	60	5.25	315
- Artemia tanks 300 l FRP	24	2	48
Sub-total tanks			**Rs. 2461**

Other Structures			
- Brood stock ponds earthwork	10,000m^2	10/m^3	100
- Inlet / Outlet / Pumping jets			116
- Water supply salt watering freshwater			700
- Filter reservoirs and sand filter			224
- Water / Air distribution lines			800
Sub-total			**Rs. 1940**
- Electrical distribution system		1 lakh	100
Equipment			
- Salt water pumps 3 HP	6	45	270
- Salt water pumps 5 HP	6	50	300
- Freshwater pumps 0.7 HP	2	13	26
- Freshwater pumps 1.5 HP	3	25	75
- Blower 2 HP	6	80	480
- Stand by Gen. 75 KVA	1	3 lakh	300
- Transformer 75 KVA	1	1 lakh	100
- Transfer Pumps 1 HP	5	15	75
- Refrigerator	1	20	20
- Air conditioner	1	39	39
- Other (lab/office)		2 lakhs	200
Sub-total of equipment			**Rs.1885**

TOTAL CAPITAL COST = Rs.82, 50,000

OPERATIONAL COST

Items	Quantity	Unit Cost (Rs.)	Cost (Rs. '000)
- Land lease	5 ha	400/ha	2
- Salaries	-	-	410
- Broodstock	1000	35	35
- Brood feed	1000	30	30
- Artemia	150 kg	1500	225
- Feed for PL	1000 kg	40	40
- Transport of seed (PL_{20})	40 million	500	20
- Chemicals	-	-	40
- Electricity	40,000	0.30	12
- Labour	2000 man days	20	40
- Packing	40 million	2000	80
Insurance			
- Machinery / Equipment @ 0.7%	-	-	30
- Structures / Building @ 0.3%	-	-	12
Maintenance			
- 2% of buildings / structures	-	-	78
- 5% of machinery / equipment			217
Sub-total			**1271**
- Add overheads(Admin/Sundries) 5%	-	-	69
Total			**1340**

TURNOVER- SAY 13.4 LAKHS (1st Year)

40 million PL_{20} @ Rs.120 / 1000.

NET PRESENT VALUE

Year	Capital (lakhs)	Operating Cost (l)	Total Cost (l)	Cash inflow	Net cash inflow	Discounted rate 12%	Present value of cash flow
1	85.4	14.56	99.96	119	19.04	0.8929	17.00
2		60.00	60.00	100	40.00	0.7972	31.88
3		60.00	60.00	100	40.00	0.7118	28.47
4		60.00	60.00	100	40.00	0.6355	25.42
Investment **NPV**							**102.77** **- 85.40** **+ 17.37**

INTERNAL RATE OF RETURN

Year	Net Cash inflow	Discount 12%	Present value of cash flow	Discount 21%	Present value of cash flow
1	19.04	0.8929	17.00	0.83	15.8
2	40.00	0.7972	31.88	0.68	27.2
3	40.00	0.7118	28.47	0.56	22.4
4	40.00	0.6355	25.42	0.47	18.7
Investment **NPV**			**102.77** **- 85.40** **+ 17.37**	**Investment** **NPV**	**84.1-85.4** **- 1.3**

$$IRR = 12 + \frac{(102.77 - 85.4)}{18.67} \times 9 = 20.4\%$$

DISCOUNTED PAYBACK PERIOD

Year	Net Cash inflow	Discount factor 12%	Present value	Cumulative value
1	19.04	0.8929	17.00	17.00
2	40.00	0.7972	31.88	48.88
3	40.00	0.7118	28.47	77.35 DP
4	40.00	0.6355	25.42	102.77BP

Discounted payback period is between 3rd and 4th year.

DISCOUNTED BENEFIT COST RATIO

Discounted benefit at 12% interest = 102.77 lakhs

Cost (Initial investment) = 85.4 lakhs

Discounted benefit cost ratio $= \frac{102.77}{85.4}$

$= 1.2$

Here in this project NPV positive, IRR greater than bank rate of interest and BCR is greater than 1 and discounted pay back period is between 3rd and 4th year.

Exercise 13	PREPARATION OF PROJECT ON CARP-CUM-PRAWN CULTURE

Introduction :

Aquaculture is the system of culture of aquatic environment in control condition for a targeted production. Fish production can be enhanced in par with the demographic pressures threatening food security by improving aquaculture production as capture fisheries is over exploited. In India also the contribution of aquaculture to the total production is more than 35%.

Within this aquaculture sector, the freshwater aquaculture is of great importance due to high demand in internal market for the freshwater fishes and prawns.

Indian Major Carps are the most sought after fishes in the land locked Indian states that include 3 species Rohu, Catla and Mrigal. Among prawn the giant freshwater prawn *M. rosenbergii* has got great demand from culture point of view. In the cultured conditions IMC and Giant Fresh Water Prawn exhibits high rate of survival, growth rate, compatibility, yield, ready to take supplementary feeding habits. Polyculture of these two is economically and technologically viable in Indian conditions.

Project Title :

The proposed project title is "Polyculture of Indian Major Carp with prawn" in Orissa.

Prospects in Orissa :

The vast inland sector in Orissa has got water support from many river such as, Mahanadi, Bbuchabalanpo, Anga, Jeta, Suktela, Cololo, i.e. Rurikulyo and others. The present project is proposed in West Orissa.

Location :

Binka is a small town (NAC) in Subomapor district of Orissa. It is 300 km away from Bhubaneswar. And it is located in the bank of river Mahanadi having a good transportation facility with Jaya Jaganath road from Raipur to Puri going through the town.

Water source :

In Binka there is no problem of water. The biggest river of Orissa is flowing through it i.e., river Mahanadi. And the said project is near the river Bora. The water can be available with minimum cost from the river itself.

Soil type :

The most productive area of the Western Orissa is the Binka area with good soil fertility. Soil is slightly loamy which is most advised from culture point of view.

Water Temperature :

The maximum water temperature in summer months goes upto 42°C and in winter falls to 10°C. This range is good from culture point of view.

Rainfall pattern :

Rainfall pattern in Western Orissa is indicated by its high crop yielding. Good rainfall in rainy season stimulate the culture here.

Labour availability :

Labour is available in the area throughout the 30 days. And can be utilised.

Credit Facility :

There are 3 bank in the town itself nearby, co-operative bank, state bank and Regional Bank. Credit facility can be easily available from these.

Seed :

In the town itself World Bank fish seed hatchery is there. So for fish seed there is no more expenditure for transportation. And for prawn seed there is transportation cost and can be available.

EXPENDITURE FOR 2 - HECTARE AREA

CAPITAL COST		Rs.
1. Pond excavation		1,50,000
2. 10 HP pump set		50,000
3. Net (cost net + drag net)		10,000
4. Store house and shed for watchmen		10,000
	Sub-total	2,20,000
OPERATING COST		
1. Lime 1,000 kg/2 ha @ Rs.5/kg		5,000
2. Cow dung 25,000 kg/2 ha @ Rs.20/100 kg		5,000
3. Super phosphate 125 kg/2 ha @ Rs.6/kg		750
4. Urea 125 kg/2 ha @ Rs.5/kg		625
	Sub-total	11,375
5. Seed		
- Carp seed 10,000 nos./2 ha @ Rs.300/100 mg		3,000
- *M. rosenbergii* seed 10,000/2 ha @ Rs.600/1000 nos.		6,000
	Sub-total	9,000
6. Feed		
- Rice bran 600 kg/acre @ Rs.5/kg		15,000
- Ground nut oil cake 3,000 kg/2 ha @ Rs.12/kg		36,000
	Sub-total	51,000
7. Maintenance and other		10,000
So total expenditure in operation is		**Rs. 81,375**

INCOME

(a)	Fish production from 2 ha	=	4,000 kg
	So @ Rs.40/kg	=	Rs.1,60,000
(b)	Prawn production from 2 ha	=	3,000 kg
	So @ Rs.250/kg	=	Rs.75,000
	So Total Income	=	Rs. 1,60,000 + Rs. 75,000
		=	**Rs. 2,35,000**

CASH FLOW ANALYSIS FOR A PERIOD OF 10 YEARS

Year	Cash In flow	CASH OUTFLOW			Net Cash flow
		Capital cost	Operation cost	Total outflow	
1	2,35,000	2,20,000	81,375	3,01,375	- 66,375
2	2,35,000	2,20,000	81,375	81,375	1,53,625
3	2,35,000	2,20,000	81,375	81,375	1,53,625
4	2,35,000	2,20,000	81,375	81,375	1,53,625
5	2,35,000	2,20,000	81,375	81,375	1,53,625
6	2,35,000	2,20,000	81,375	81,375	1,53,625
7	2,35,000	2,20,000	81,375	81,375	1,53,625
8	2,35,000	2,20,000	81,375	81,375	1,53,625
9	2,35,000	2,20,000	81,375	81,375	1,53,625
10	2,35,000	2,20,000	81,375	81,375	1,53,625

NET PRESENT VALUE

Year	Net Cash flow (Rs.)	Discounted Cash flow (12%)	Discounted Net Cash flow (Rs.)
1	- 66,375	0.8929	- 59,266
2	1,53,625	0.7972	1,22,469
3	1,53,625	0.7118	1,09,352
4	1,53,625	0.6355	97,628
5	1,53,625	0.5674	87,166
6	1,53,625	0.5066	77,826
7	1,53,625	0.4523	69,484
8	1,53,625	0.4039	62,049
9	1,53,625	0.3606	55,397
10	1,53,625	0.319	49,451

Present values for 10 years

$$\Sigma = 6,71,556$$

$$\frac{\text{Capital}}{\text{NPV}} = \frac{2,20,000}{4,51,556}$$

So Net Present Value = 0.487.

PAY BACK PERIOD

Year	Capital Cost	Net Cash flow	Cumulative Cash flow
1	2,20,000	- 66,375	- 66,375
2	-	1,53,625	87,250
3	-	1,53,675	2,40,875
4	-	1,53,675	3,94,500

So Pay Back Period is 3 years.

DISCOUNTED PAY BACK PERIOD (all in Rs.)

Year	Capital	Net Cash flow	Discounted Factor (12%)	Discounted Net Cash flow	Cumulative Cash flow
1	2,20,000	- 66,375	0.8929	- 59,266	- 59,266
2	2,20,000	1,53,625	0.7972	1,22,469	63,203
3	2,20,000	1,53,625	0.7118	1,09,352	1,72,553
4	2,20,000	1,53,625	0.6355	97,628	2,70,180

So discounted pay back period is 4 years.

AVERAGE RATE OF RETURN

$$\text{ARR} = \frac{\text{Average annual profit}}{\text{Average investment}}$$

$$\text{Average Investment} = \frac{2,20,000}{2} + 81,375$$

$$= 1,91,375$$

$$\text{Average annual profit} = \frac{1,53,625 \times 9 + 1 \times (-66,375)}{10}$$

$$= 1,31,625$$

$$\text{So ARR} = \frac{1,31,625}{1,01,375} = 68\%$$

INTERNAL RATE OF RETURN

Year	Net Cash flow	Discounted Cash flow (12%)	Present Value	Discounted Cash flow (40%)	Present Value (40%)
1	- 66,375	0.8929	- 59,266	0.7142	- 47,405
2	1,53,625	0.7972	1,22,469	0.5102	78,379
3	1,53,625	0.7118	1,09,352	0.3644	55,980
4	1,53,625	0.6355	97,628	0.2603	39,988
5	1,53,625	0.5674	87,166	0.1859	29,125
6	1,53,625	0.5066	77,826	0.1328	20,401
7	1,53,625	0.4523	69,484	0.0948	14,563
8	1,53,625	0.4039	62,049	0.0677	10,400
9	1,53,625	0.3606	55,397	0.0484	7,435
10	1,53,625	0.3219	49,451	0.0345	5,300
			6,71,556		2,14,166
			- 2,20,000		2,20,000
NPV = 4,51,556					**- 5,834**

Internal Rate of Return = IRR

$$= r_L + \Delta r \left[\frac{(P_V - C)}{\Delta P_V} \right] \text{, where}$$

r_L = Lower rate = 12%

Δr = Higher rate - Lower rate = 40 - 12 = 28

Pv = Present value = 6,71,556

C = Capital cost = 2,20,000

ΔPV = 6,71,556 - 2,14,170 = 4,57,386

$$\text{So IRR} = 12 + 28 \left[\frac{4,51,556}{4,57,386} \right]$$

$$= 12 + 27.64$$

IRR = 39.64% that is greater than 12%

DISCOUNTED BENEFIT COST RATIO

Discounted Net Benefit Cost Ratio

$$= \frac{\text{Discounted net flow}}{\text{Discounted capital outlay}}$$

$$= \frac{6,71,556}{2,20,000}$$

$$= 3.05$$

CONCLUSION

From the above feasibility report it is concluded that this project is benefited to satisfy the condition that is

NPV is positive.

IRR more than bank rate of interest

BCR more than one

So this project at Binka is to be taken up.

Exercise 14	PROJECT PROPOSAL ON ESTABLISHMENT OF PROCESSING PLANT IN KERALA

Introduction :

Indian seafood industry contributes more than 3% of GDP of our country. India exports 3,40,000 t of fresh and frozen products of which shrimp contributes more than 45% quantity-wise and 70% value-wise. The value of total exported seafood in India is about Rs. 6400 crores. But even then most of the fin fishes are marketed internally and there is a need for value addition products for export. There arises the need for establishing processing plants with much infrastructure facilities. Now India is exporting items to many Southeast Asian countries. This project is proposed to be in Kerala, which contributes most to Indian seafood export.

Salient Features :

Location :

The proposed plant is situated at Aroor in Alappuzha district in Kerala. This place is selected because it is very near to the landing centre Thoppumpady that facilitates easy transportation.

Capacity:

This plant is of about 2500 t annual capacity. The raw material required for processing would include about 1000 t of shrimps that can be procured from Thoppumpady itself and rest from Neendakara, Rameswaram, etc. To keep a wide base to the project, provision has been made for procurement and processing of about 500 t of marine fish species. Thus making a total of utilised capacity of 1500 t to against installed 2500 t. Depending on market and sea catch trends, the plant could be utilised to its full capacity.

Name and Owner of the Processing Plant :

Processing plant proposed in the project is by Miss Aafreen Shyam.

Raw Material Availability and Utilisation :

Kerala is bestowed with many good landing centres for marine fisheries. Thoppumpady is one of the largest landing centres in Kerala. It contributes 40-50% of the total fish landings. The sea catch includes a high share of pomfrets, ribbon fishes, seer fishes, perches, and several other exportable varieties such as cephalopods. The major target species of shrimps are mostly deep sea prawns, *Penaeus indicus, Metapenaeus dobsoni, Parapenaeopsis stylifera, P. monodon,* etc.

Mostly fishes are exported in the form of fillets, steaks, gutted and whole and shrimps as headless shell on and head on shell on.

A wide spectrum of raw materials like fish species, prawns and shrimps, cephalopods like cuttle fish, squid and octopuses can be processed and frozen depending on the landing trends and demand in the overseas market.

Infrastructure Facilities :

The plant has accordingly been designed to incorporate three freezing systems (i) tunnel, (ii) plate and (iii) IQ freezing. Tunnel freezer has the capacity of 10 t, plate freezer of 5 t capacities and IQ freezing system of 2 t capacities. It possesses a flake icemaker of 5 t capacity, and a shrimp grading unit. Two cold storages of 300 t total capacity and 3 refrigerated trucks they possess. Also a well-advanced QC Lab is also there.

Water Availability :

This plant depends on Municipal Corporation for its water supply. The water supplied by Kerala Water Authority need to be purified by effective chlorination system. They possess two storage tanks of capacity 100 litres each.

Their quantities for different processes of freezing :

Freezing Process

Tunnel	Plate	IQF
Pomfrets (150 t)	HLSO shrimps (250 t)	HLSO shrimps (250 t)
Ribbon fishes (180 t)		HOSO shrimps (500 t)
Seer (90 t)		
Perches (40 t)		
Misc (40 t)		
Sub-total (500 t)	(250 t)	(750 t)
Total		(1500 t)

Staffing details and cost

Staffing	Unit	Unit cost (Rs. '000)	Total cost (Rs. '000)
Plant Manager	1	40	40
Procurement Asst. Manager	2	35	70
Technicians	5	30	150
Microbiologist	1	35	35
Admn./Accounts Assistants	4	30	120
Chief Supervisor	4	30	120
Supervisors	8	20	160
Workman	20	10	200
Sub-total			895
Add 40% (PF, bonus, gratuity, etc.)			382
Total			**1,277**
			i.e. Rs.13 lakhs

Economic Viability (Indicative Cost Structures / Projects)

WORKING CAPITAL

(Cost of unicentory for 25 days inclusive of raw material and gimsted product unicentory) (299 + 185) Rs. 484 lakhs

	Quantity	Unit cost (Rs.)	Total cost (Rs. in lakhs)
TOTAL INVESTMENT			
Source of Investment			
- Borrowed	60%		290.4
- Equity	40%		193.6
- Invest on borrowed capital	16%		77.44
ANNUAL RETURNS			
Fishes			
- Pomfrets	100 (t)	1,00,000	100
- Ribbon fishes	100 (t)	50,000	50
- Seer fishes	200 (t)	45,000	90
- Perches	50 (t)	60,000	30
- Misc.	50 (t)	30,000	15
Sub-total	500 (t)		285
Shrimps			
- HOSO IQF	500	1,90,000	950
- HLSO IQF	250	2,10,000	525
- HLSO block	250	1,80,000	450
Total Turn Over	**1500**		**2,210**
GROSS CONTRIBUTION			
Turn Over			2,210
Less : Operating Cost			1,849
Gross contribution			361
NET PROFIT			
- Gross contribution			361
- Less : Insurance			14.60

- Less : Maintenance			
* Land and building (5%)			3.36
* Machinery and equipment (6%)			13.48
- Less : Depreciation			
* Building (5%)			2.99
* Machinery and equipment (10%)			22.46
- Less : Interest			45.76

Net Profit before tax Rs. 258.35, i.e., Rs. 258 lakhs.

ECONOMIC ANALYSIS (Project for 5 years)

Discounted Day Back Period

Years	Net cash flow (Rs. In lakhs)	Discounted rate 12%	Present value of future money (Rs. In lakhs)	Cumulative value (Rs. In lakhs)
1	258	0.8929	230.3682	-
2	265	0.7972	211.258	441.6262
3	273	0.7118	194.3214	635.9476
4	281	0.6355	178.5755	814.5231
5	286	0.5674	162.2764	976.7995
Total				**976.7995**

Discounted Pay Back Period = By the 1st year itself.

Net Present Value = Present value of future money - Initial net investment

= 976.79 - 477

= 499.79

Internal Rate of Returns :

Table given below shows the present value of cash flows discounted at two rates (one positive and other negative).

Years	Net Cash Flow	Lower Discounting 12% Rate	Present Value	Higher Discounting 49%	Present value
1	258	0.8929	230.37	0.6711	173.14
2	265	0.7972	211.26	0.4504	119.36
3	273	0.7118	194.32	0.3023	82.53
4	281	0.6355	178.58	0.2029	57.01
5	286	0.5674	162.28	0.1362	38.95
Total			**976.79**		**470.99**

$$IRR = 12 + \frac{976}{506} \times 37 = 83.36\%$$

$$\text{Discounted Benefit Cost Ratio} = \frac{976}{477} = 2.05$$

Conclusion :

Since the IRR is more than the Bank rate of interest and DBCR is more than one, so the project is feasible.

Exercise 15	SENSITIVITY ANALYSIS

Basic concepts :

Sensitivity analysis is 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.

Merits :

- It forces management to identify the underlying variables and their relationships.
- It shows how robust or vulnerable a project is to change in underlying variables.
- It indicates the need for further work in terms of gathering information in NPV or IRR is highly sensitive to changes in some variables.

Demerits / Limitations :

1. It may fail to provide leads - if sensitivity analysis merely presents complicated set of switching values it may not shed light on the characteristics of the project.

2. The study of 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 :

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

(i) Increasing cost of capital.

(ii) Increased cost of project due to risks involved at 10 and 20 percent cost like.

(iii) Uncertainties due to the differences in the price receivables at 10, 20 and 30 percent reduction for the yield.

SENSITIVITY ANALYSIS

CASE I : Increasing Cost of Capitals

Year	Cost	Bene-fit	d.f. at 12%	d.c. at 12%	d.b. at 12%	d.f. at 20%	d.c. at 20%	d.b. at 20%	d.f. at 25%	d.c. at 25%	db. at 25%
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

Conclusion :

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.

SENSITIVITY ANALYSIS

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

YEAR	Cost	Bene-fit	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%	db. at 12%
1	25000	0	1	25000	0	27500	27500	0	30000	30000	27500
2	5000	20000	0.893	4465	17860	5500	4911.5	17860	6000	5358	4911.5
3	5000	20000	0.797	3985	15940	5500	4383.5	15940	6000	4782	4383.5
4	5000	20000	0.712	3560	14240	5500	3916	14240	6000	4272	3916
5	5000	20000	0.636	3180	12720	5500	3498	12720	6000	3816	3498
6	5000	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

Conclusion :

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.

SENSITIVITY ANALYSIS

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

YEAR	Cost	Bene-fit	DF at 12%	DC at 12%	DB at 12%	Reduc-tion in benefit of 10%	Dis-coun-ted benefit	Reduc-tion in benefit of 20%	Dis-coun-ted benefit	Redu-ction in bene-fit of 30%	Dis-coun-ted benefit
1	25000	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

Conclusion :

The uncertainties in the project benefit stream can be sensitised 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 Rs. 9,429 and 1.21 respectively.

Exercise 16	CONVERTING FINANCIAL VALUES TO ECONOMIC VALUES IN PROJECT EVALUATION

Basic concepts :

Financial prices

Actual prices at which inputs are bought and sold and are used in financial analysis. Also called nominal current or market price.

Constant prices

Constant price refers to a value from which the overall effect of general price inflation has been removed.

Shadow prices

Shadow prices are prices indicating the intrinsic or true value of a factor or product in the sense of equilibrium prices. These prices may be different for different time periods as well as geographically separated areas and various occupants [in the case of labour]. They may deviate from market prices [Tinbergen 1954].

Official Exchange Rate [OER]

This is the agreed rate of exchange between two countries. It is used in financial analysis.

Shadow Exchange Rate [SER]

The SER is the weighted average of the demand price of foreign exchange paid for by the importers and the supply price of foreign exchange received by the exporters. It is the economic price of foreign exchange.

The relation between OER, foreign exchange premium [the percentage difference between SER & OER], SER and SCF are given below.

$$OER \times [1 + Fx\ premium] = SER, \text{ and}$$

$$\frac{1}{1 + Fx\ premium} = SCF,$$

so that Squire and van der Tak[1975] note,

$$SER = \frac{OER}{SCF} \quad \text{and} \quad SCF = \frac{OER}{SER}$$

Border prices

This term is used in cross-country trading. The price of a traded good at a country's border is known as free on board price [FOB] in case of exports and in the case of imports it is the cost, insurance and freight [CIF] price.

Examples :

Problem I :

The current prices of shrimp from 1990 to 2000 are given with price index numbers for each year. Convert these prices to constant prices.

Solution :

$$\text{Constant price} = \frac{\text{Current price}}{\text{Price index no.}} \times 100.$$

Year	Price of shrimp (Rs. / kg)	Price index no. Base 1990-91	Constant price
1990 – 91	192	100.00	192.00
1991 – 92	208	108.00	192.00
1992 – 93	197	102.60	192.00
1993 – 94	200	104.17	191.90
1994 – 95	218	113.54	192.00
1995 – 96	242	126.64	191.09
1996 – 97	260	130.20	199.69
1997 – 98	275	133.10	206.60
1998 – 99	300	140.20	213.90
1999 - 2000	325	150.01	215.20

Problem II

The cost of labour in a shrimp farm is Rs. 100 per man-day. Find out the economic cost of labour for skilled and unskilled workers.

Given SCF = 0.75 and 0.8 for unskilled and skilled labourers respectively. (SCF = Standard Conversion Factor).

Solution :

$$SCF = \frac{\text{Economic price}}{\text{Financial price}}$$

i.e., Economic price = Financial price x SCF

For unskilled labour

Economic price = 100 x 0.75

= Rs. 75 per man day

For skilled labour

Economic price = 100 x 0.8

=Rs. 80 per man day.

Problem III

A. The Fx premium for one dollar is 20 per cent. Calculate the SCF.

Solution :

$$SCF = \frac{1}{1 + \text{Fx premium}}$$

$$= \frac{1}{1 + 0.2}$$

$$= 0.83$$

B. The OER 1 $ is Rs. 45. The foreign exchange premium for 1 $ is 20 per cent. Calculate SER.

Solution :

SER = OER [1 + Fx premium]

= 45 [1 + 0.2]

= Rs. 54 per US $

C. Given SCF = 0.83 and SER = Rs. 54 per US $. Calculate OER.

Solution :

$$SER = \frac{OER}{SCF}$$

i.e. OER = SER x SCF

= 54 x 0.83

= Rs. 45 per US $

Problem IV

A processing firm in India exports shrimp to USA.

Given the cost of production of 1 kg shrimp is Rs. 350;

- Export taxes Rs. 20.
- Subsidies Rs. 10.
- Local port charges including, storage, loading etc. Rs. 5.
- Local marketing and transporting costs till port of exporting country Rs. 5.
- Freight charges to point of import Rs. 20.
- Insurance charges Rs. 15.
- Unloading from ship pier to port Rs. 3.
- OER = Rs. 45 per US $, SER = Rs. 54 .

Calculate FOB & CIF at financial and economic prices.

Solution :

At financial prices,

FOB = Cost of production

+ Taxes

- Subsidies

+ Local port charges

+ Local marketing and transporting costs

= 350 + 20 – 10 + 5 + 5

= Rs. 370

CIF = FOB + freight charges + insurance + unloading

= 370 + 20 + 15 + 3

= Rs. 408

At official exchange rate

FOB = Rs. 370 / 45

= 8.33 US $

CIF = Rs. 408 / 54

= 9.06 US $

In economic analysis

FOB = [Financial FOB – taxes + subsidies] / SER

= [370 – 20 + 10] / 54

= 6.66 US $

CIF = [Financial CIF – taxes + subsidies] / SER

= [408 – 20 + 10] / 54

= 7.37 US $

Exercise 17	EVALUATION OF INVESTMENT FEASIBILITY OF AQUACULTURE PROJECTS

Basic concepts :

In order to ascertain whether an aquaculture investment project is feasible or not, a co - operative evaluation should first be conducted by both the biologist and the 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. Many considerations affecting the feasibility of aquaculture investment are discussed in this chapter and the previous one. They are briefly summarized below.

1. The first requirement for any aquaculture investment project in both the public and private sectors is the availability of suitable land and water resources.

2. 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.

3. There should be no legal constraints on development (this is particularly important for private investors).

4. The products of the investment project should have a high market demand with a reasonable price.

5. 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 project in aquaculture, one must consider six criteria :

- Resource availability,
- Environmental suitability,
- Biological feasibility,
- Market potential,
- Economic feasibility, and
- Institutional feasibility,

6. It is also important to realise that many variables ought to be considered for each criteria. 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.

7. Summary sheet for feasibility evaluation is given below :

SUMMARY SHEET FOR FEASIBILITY EVALUATION

Criteria	Variables	Rank of Suitability	Score or Code
Resources	Suitable land area	a. Available for expansion limited for expansion b. Not available for expansion Sub-score or code	---
	Value of suitable land	a. Low b. Average c. High Sub-score or code	---
	Water supply of suitable quality	a. Adequate year round b. Seasonal shortage c. Not available Sub-score or code	---
General score or code for resource availability			---
Environ-mental suitability	Water temperature	a. Well suited b. Suited after temperature is manipulated during certain periods of the year c. Not suited Sub-score or code	---
	Salinity	a. Well suited b. Suited after salinity manipulation c. Not suited Sub-score or code	---
	pH value	a. Well suited b. Suited after pH value is manipulated c. Not suited Sub-score or code	---
	Tidal flushing	a. Well suited b. Suited after tidal manipulation c. Not suited Sub-score or code	---
General score or code for resource availability			---

Biological factors	Breeding	a. No breeding problem, spawning in captivity, fry available from hatchery. b. Supply of fry relies on captured wild gravid females, or on the catch from native waters, but availability of fry is not limited at present. c. Availability of fry from natural waters is unlimited but the breeding problem is expected to be solved in the near future. d. Availability of fry from natural waters is limited and the breeding problem is not expected to be solved in the near future Sub-score or code	---
	Feeding	a. Nutritional requirements of different age stages are known and appropriate feeds (artificial or natural) are available at reasonable cost. b. Nutritional requirements are partially known. c. Nutritional requirements are not known Sub-score or code	---
	Crowding	a. Adapted to crowding conditions with no major problems in diseases and parasites, and/or with wide range of oxygen tolerance. b. Some problems with disease and parasites under crowded conditions, or with narrow range of oxygen tolerance. c. Not suited for crowding conditions Sub-score or code	---
	Growing period	a. Less than one year b. One to two years c. More than two years Sub-score or code	---
General score or code for resource availability			---

Market potential	Price elasticity	a. Elastic demand with ready market b. Inelastic demand but elasticity can be improved by market promotion and product development c. Inelastic demand with limited market Sub-score or code	---------
	Income elasticity	a. Elastic demand b. Unitary elasticity c. Inelastic demand Sub-score or code	---------
	Competition	a. No competition b. Competes favourably in price with close substitutes c. Competes unfavourably with close substitutes at the present but favourably in the future d. Cannot compete with close substitutes Sub-score or code	---------
	Culture, religion and tradition	a. Species is currently cultured and preferred by majority of population without socio-cultural limitation b. Species is accepted by a part of the population due to socio-cultural limitations. c. Species is not accepted due to religion or tradition Sub-score or code	---------
	General score or code for resource availability		---------

Economic feasibility	Profitability	a. High rate of return compared with alternatives. b. Average rate of return compared with alternatives. d. Low rate of return compared with alternatives. Sub-score or code	---------
	Socio-economic feasibility	a. Average cost per unit of protein, or protein yield per unit of land is favorable compared with alternatives if the national policy concerns animal protein deficiency. Foreign exchange earnings per unit of land or other scarce resources are favourable compared with other alternatives if national policy concerns foreign exchange earnings. Employment per unit of land is favourable compared with agriculture activities if national policy concerns employment in rural areas. Combination of all the above mentioned conditions or any two of them is favourable compared with alternatives. b. Partially favourable compared with alternatives. c. Unfavourable compared with alternatives. Sub-score or code	----------
	General score or code for institutional criteria		----------
Institu-tional feasibility	Permit	a. Easy to get permit. b. Difficult to get permit.	
	Conflicts in use	a. No conflict b. Some conflict Strong conflict	

Exercise 18	PROJECT INVENTORY MANAGEMENT AND CONTROL

Basic concepts :

Inventory : It includes tools, standard supply items, raw materials, goods in process and finished goods having economic value.

Inventory Management : The balancing of a set of costs that increases with larger inventory holdings with a set of costs that decreases with larger order size. In other words, it is the procedure and the body of knowledge, which can help us in planning to maintain an optimum level of the idle resource.

Inventory Control : Inventory planning is generally based on the information concerning the part usage and also on factors that are likely to crop up in the future, then only the control process starts. Thus, inventory control and planning goes together.

Methods :

1. Economic Order Quantity (EOQ)
2. Cost Comparison Approach

EOQ method is mostly practiced for the determination of optimum ordering quantity.

Economic Order Quantity (EOQ) : It is the optimum (Least Count) quantity of inventory that should be ordered.

Inventory of any item consist of :

(a) Working stock - which depends on pattern of inflow and outflow.

(b) Safety stock - is designed to guard against unexpectedly high demand, delays in receiving shipment or both.

Different costs :

(A) Ordering Cost : It is the cost incurred to get the materials into the inventory of an organisation.

E.g. Advertisement, salaries, etc.

(B) Carrying Cost : Costs incurred for maintaining for given level of inventory are called carrying costs.

E.g. Capital investment cost, storage cost, etc.

Ordering Cost	Carrying Cost
Requisitioning	Warehousing
Order placing	Handling
Transportation	Insurance
Receiving, inspecting and storing	Depreciation
Clerical and staff	Obsolescence

Objective of determining the EOQ is to minimize the sum of Ordering Cost and Carrying Cost.

Determination of the Optimal Order Quantity :

To avoid problems that may arise from carrying too much or too little inventory, a business must determine the optimal quantity of a product to purchase each time an order is placed.

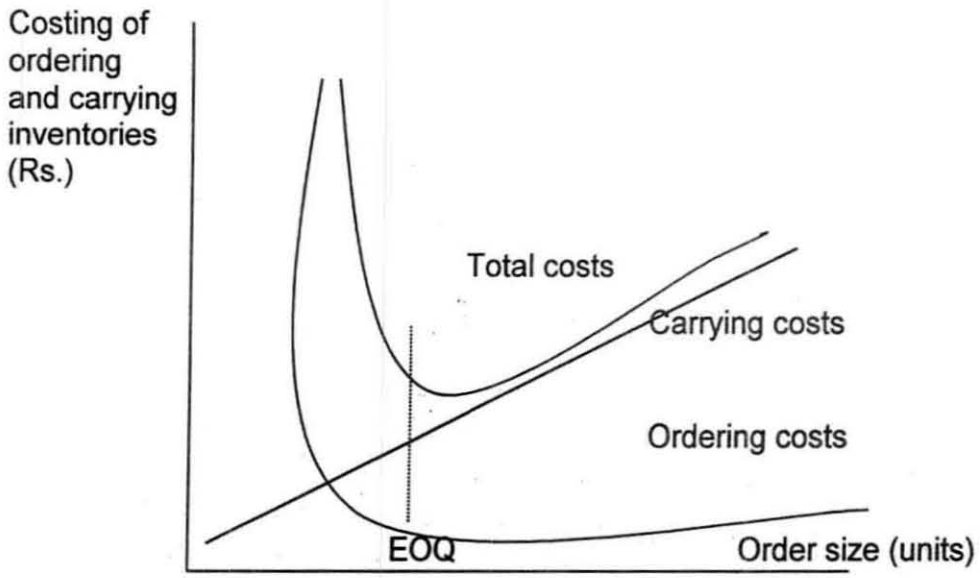


Fig.18 : *Carrying costs increases steadily as order size increases; ordering costs on the other hand decline with larger order sizes. The sum of these two curves, and the lowest point on that curve is the optimal order size, or EOQ.*

Ordering cost decreases the no. of orders per year are decreased. On the other hand decreasing the no. of orders per year increases the inventory involved and therefore annual carrying cost.

For determining the EOQ there are two approaches.

1. Trial and Error approach - by the help of table.
2. Order formula approach - by the help of formula

(1) Trial and Error approach :

The following table gives :

No. of orders/yr.	Order size (Rs.)	Average inventory	Annual carrying cost	Annual ordering cost @ Rs.25/ order	Total cost
1	30,000	15,000	3,000	25	3,025
3	10,000	5,000	1,000	75	1,075
5	6,000	3,000	600	125	725
10	3,000	1,500	300	250	(Minimum) 550
15	2,000	1,000	200	375	575
20	1,500	750	150	500	650
25	1,200	600	120	625	745
30	1,000	500	100	750	850

Note : Average inventory value - is equal to half of the maximum inventory (order size).

Annual carrying cost - 20% of the average inventory value.

Total cost = Annual carrying cost + Ordering cost

Economic order quantity or EOQ is that quantity where the total cost is minimum.

By observing the above table it is clear that the total cost 550 is minimum value. Therefore, it is clear that the order should be in 10 lots and the EOQ will be 3,000, i.e., for this economic order size the investment on the inventories will be minimum.

(2) Formula approach :

$$EOQ = \sqrt{\frac{2.4 \times 0}{C}}$$

Here,

EOQ = Economic ordering quantity or the optimal quantity to be ordered each time an order is placed.

A = Order size

O = Ordering cost per order

C = Carrying cost expressed as percentage of inventory value.

By using this formula :

$$EOQ = \sqrt{\frac{2 \times 30{,}000 \times 25}{0.2}}$$

$$= 2738$$

$$\simeq 3{,}000$$

Therefore, EOQ will be 3,000 to keep the inventories at the lowest.

Assumptions of EOQ model :

1. Sales can be forecasted perfectly.
2. Sales are evenly distributed throughout the year.
3. Orders are received with no delays whatever.

Example :

Following information is given by a fish processing company about the number of orders and order size. Find out the Economic Order Quantity. Represent it graphically.

Given Carrying Cost is 10 per cent of any inventory value. Order Cost is Rs. 50/order.

No. of orders/ Year	1	3	4	5	8	10	20	25
Order size	49,000	30,000	15,000	10,000	6,000	4,000	2,000	1,000

Make a table and also find out the total cost.

Solution :

No. of orders/yr.	Order size (A)	Avg. inventory	Annual (C) carrying cost	Annual (O) ordering cost @ Rs.25/order	Total cost (O+C)
1	40,000	20,000	2,000	50	2,050
3	30,000	15,000	1,500	150	1,650
4	15,000	7,500	750	200	950
5	10,000	5,000	500	250	750
8	6,000	3,000	300	400	(Minimum) 700
12	4,000	2,000	200	600	800
20	2,000	1,000	100	1,000	1,100
25	1,000	500	50	1,250	1,300

EOQ will be 6,000.

i.e., order size of 6,000 in 8 lot will be EOQ.

By formula :

$$EOQ = \frac{2 \times A \times 0}{C}$$

$$= \frac{2 \times 40{,}000 \times 50}{0.1}$$

$$= 6{,}324$$

$$= 6{,}000$$

Conclusion :

An inventory management system should include an area approach before a micro approach involving units to be effective.

By the application of inventory management, a firm can maintain a smooth, continuous supply of product throughout the year as per worked demand. By using models like EOQ, optimum order quantity can be found and to avoid the profile loss due to large investment on inventories and storage and cost of production interruption caused by inadequate inventories.

A system must be designed to fit the present situation and capabilities must be enhanced to incorporate system improvement.