



Business Model

Integrated Fish Farming

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CONTENTS

1. Background	1
2. Constraints in Fish Farming	1
3. Project Idea	3
4. Integrated Fish Farming (IFF) - The Model	3
5. Scope of Credit Financing and Subsidy	5
6. Expected Impacts (Social, Economic, Environmental)	5
7. Mainstreaming the Model - Options	6
Annexures	7
Model 1: Fish Farming with Vegetable cultivation	9
Model 2: Fish Farming with Poultry	10
Model 3: Fish Farming with small scale duck farming	11
Model 4: Fish Farming with Dairy	12

Integrated Fish Farming

1. Background

The fishery in India is a very important economic activity and a flourishing sector with varied resources and potentials. The country ranks second in the world in terms of total fish production. Annually, the country produces about 9.06 million metric tonnes of fish. Aquaculture in India has evolved as a viable commercial farming practice from the level of traditionally backyard activity. Over the last three decades, there has been considerable diversification in aquaculture in terms of species and systems and it shows an impressive annual growth rate of (6-7)%. Freshwater aquaculture contributes to over 95% of the total aquaculture production and contributes to around 60% of the total fish production¹. Importance of aquaculture is further emphasised by the fact that fish is a major source of livelihood and provides nutritional security for the rural poor.

Aquaculture resources in India include 2.36 million hectares of ponds and tanks. Whereas, in addition to 0.12 million kilometres of canals; 3.15 million hectares of reservoirs and 0.72 million hectares of upland lakes could be utilised for aquaculture purposes. Ponds and tanks are the prime resources for freshwater aquaculture in India. However, less than 10% of India's natural potential is been utilised for aquaculture currently.

Freshwater aquaculture activity is prominent in the eastern part of the country, particularly in the states of West Bengal, Odisha and Andhra Pradesh, new areas are also coming under it in the states of Punjab, Haryana, Assam and Tripura.

2. Constraints in Fish Farming

Aquaculture or fish farming is however vulnerable because of the following reasons:

1. Climate change impacts such as water availability, weather patterns like extreme rain and exacerbates eutrophication and stratification in static waters has led to crop failures. This is more relevant in the context of coastal areas where aquaculture and fish farming forms a major source of livelihood.
2. Floods and cyclones, especially in the eastern coast have become more frequent in recent years and had severe impacts on the aquaculture scenario. Fish farmers are therefore, forced to abandon their ponds due to siltation and water salinity.
3. Constraints in availing credit from formal sources for fish farming are forcing farmers to take loans from informal sources like money lenders at a very high rate of interest.
4. Lack of technical know-how to improve productivity, further dissuades farmers to take up fish-farming as a viable livelihood option.

1 Handbook of Fisheries and Aquaculture, 2013, ICAR publication, India



3. Project Idea

The project idea is based on the concept of IFF wherein 'there is no waste', and waste is only a misplaced resource which can become a valuable material for another product².

In India, in the coastal and fishing belt, several ponds are available which are unused, unproductive and underproductive. These ponds can be easily revived with minimal resources which can lead to significant income enhancement for the fish farmers.

At present, the farmers involved in fish farming have an annual productivity ranging from 500 to 600 kgs per acre. This can be significantly increased through IFF to around 1900 kgs per acre per annum. The low productivity is attributed to lack of capital, technology, extension, marketing facility, poor socio-economic condition and frequent natural disasters etc. In addition to fish farming, the integrated system would have duckery, dairy and vegetable cultivation in and around the pond unit. The graphical representation of the model is provided in Figure 1, below.

IFF can thus serve as a model of sustainable food production by following principles, such as:

- Waste products of one biological system serve as nutrients for a second biological system.
- The integration of fish and plants results in a polyculture that increases diversity and yields of multiple products.
- Water is reused through biological filtration and recirculation.
- Local food production provides access to healthy foods and enhances the local economy.

Integration of agricultural and animal husbandry activity for optimal utilisation of resources in a sustainable manner is the central theme on which the interventions are based. IFF model has shown potential for enhancing aquaculture productivity through the enrichment of the heterotrophic or detritus food chain. The model has the potential for replication in other parts of the country especially in coastal areas.

4. Integrated Fish Farming (IFF) - The Model

Fish farming with the integration of one or more activities amongst duck rearing, poultry, dairy and horticulture is taken up under IFF model. All these activities and fishery are complementary to each other.

For example, the cow dung is used as manure to create plankton (natural fish feed) in the pond. Besides, dairy is a regular source of income to the farmers.

Duck droppings are good organic fertilisers for fish farming. Approximately, 40-50 kgs of this organic manure can produce 1 kg of fish flesh. Moreover, when ducks flap their wings while swimming in the pond, oxygen is being made available to fish.

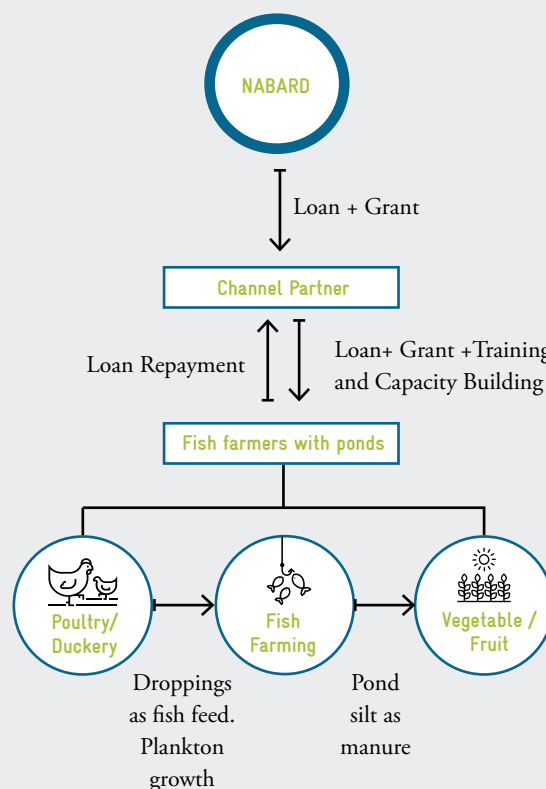
Pond silt can be used as fertiliser for land crops, which in turn can be used by livestock, poultry or as fish feed, thus, a recycling ecosystem is achieved. The dikes of ponds can also be used for cultivating fruit bearing trees like banana, papaya, drumstick and other horticultural production. The interventions of the project are as under:

- Undertaking scientific fish farming through renovation of ponds
- Duck rearing/backyard poultry/dairy development
- Horticulture/vegetable cultivation

² FAO, 1977

- Training & capacity building
- Formation of co-operatives/ federation
- Establishment of knowledge centres for farmers
- Establishment of local fish nursery

Fig 1: UPNRM Operational Model- IFF



Case Study of Gram Utthan Project, Odisha

Gram-Utthan (GU), an NGO based at Rajkanika block, Kendrapara district in Odisha piloted the IFF model under the UPNRM programme. The need for an IFF project arose from the fact that a large number of ponds in this coastal block/area remained unutilised and fish productivity from ponds was too less, prompting the farmers to switch to other livelihood activities. The water table in some areas has reduced over a period of time due to pond degeneration in the area.

Gram-Utthan availed a loan from NABARD and on-lent to 432 farmers for fishery integrated with dairy/duckery/poultry/vegetable cultivation activity. The farmers used the loan for repairing the ponds, procure fish fingerlings and inputs along with purchase of dairy animal, poultry, ducks or investment in vegetable cultivation. Gram-Utthan assisted the farmers in sourcing the above and provided technical assistance for the same.

The project has been able to bring back farmers into fish farming through renovating ponds resulting in increased water table and restricting salinity in the coastal areas. It has also helped to improve the productivity of fish and doubling farmer's income over a period of time. There was 100% repayment of loans from farmers to Gram Utthan and back to NABARD.

Considering the success of the project, commercial banks and other financial institutions have also shown interest to take up the project for funding.

5. Scope of Credit Financing and Subsidy

The scope for lending is huge in this sector with almost 7% annual rise in production every year. The outlay for the fishery sector in India during the current plan is more than Rs.4,00,000 crore. Centrally Sponsored Scheme (CSS) on Development of Inland Fisheries and Aquaculture under the Ministry of Agriculture & Farmers' Welfare has also designed a number of subsidy schemes which can be linked to commercial loans from banks. The risk of Non Performing Asset (NPA) in this sector is extremely low compared to other Priority Sector Lending (PSL) schemes. This becomes even lower when combined with the other subsidy schemes. Some of the schemes have been outlined below:

Loan on Construction of New Ponds: Loan upto Rs 2.00 lakh/ha in the plain areas. Subsidy @ 20% with a ceiling of Rs. 40,000/ha for all farmers except Scheduled Castes's (SC's)/Scheduled Tribe's (ST's) for whom it will be Rs 50, 000/ha (25%). Loan upto Rs 3 lakh/ha in the hill States/Districts and the North-Eastern (NE) region. Subsidy @ 20% with a ceiling of Rs 60,000/ha for all farmers except SC's/ST's for whom it will be Rs 75, 000/ha (25%).

Loan for Integrated Fish Farming: Rs 80,000/ha. Subsidy @ 20% with a ceiling of Rs 16,000/ha for all farmers except SCs/STs for whom it will be Rs 20,000/ha (25%).

Loan for Reclamation/Renovation of Ponds/Tanks: Rs 60,000/ha. Subsidy @ 20% with a ceiling of Rs 12, 000/ha for all farmers except SCs/STs for whom it will be Rs 15,000/ha (25%)

Loan for Freshwater Fish Seed Hatchery: Rs 8 lakh for a fish seed hatchery with 10 million (fry) capacity for the plain areas and Rs 12 lakh for same capacity in the hill States/Districts and the NE region. Subsidy @ 10% with a ceiling of Rs 80,000/- and Rs 1.20 lakh in the plain and hilly areas respectively to entrepreneurs only.

6. Impacts

1. Social

- Women members of households were earlier less involved in backyard aquaculture even though it often occurred within the homestead. By the provision of training, women now participate in the pond, feed and medicine management which enhanced their social standing and decision making in the household.
- Self Help Group (SHG) programs have empowered women to contribute financially to such livelihood activities thereby elevating their social status as entrepreneurs.
- Research studies have shown that the main source of protein for households with aquaculture is fish which is more than the combination of all meat (poultry and mutton) products. Fish contributes more than 80% of the total protein.

2. Economic

- IFF with better management practices led to a significant rise in fish production and productivity per acre. This was supplemented by enhanced income from dairy/ poultry/duckery/vegetable production. As calculated, the net income from this integrated model can be close to Rs.2,00,000 annually per acre which is substantially higher as compared to traditional farming methods.
- IFF led to diversification of livelihood, thus, reducing the risk for poor farmers by integrating it with dairy, fishery, vegetable cultivation and meat production.
- The prohibitive cost of pelleted feeds was a problem in aquaculture which required a cheap substitute. The integrated fish farm produced feeds and fertilisers for itself, thereby, contributed in saving energy and reducing expenditures.

3. Environmental (water recharge, soil quality, soil organic matter, salinity control, green cover and health effects)

- Unused ponds in villages are generally used to dispose trash of and debris from household and are a source of mosquitoes, bugs and other insects. Renovation of ponds not only reduced such risks but also has proven economically advantageous.
- Groundwater recharge through ponds; a very imminent outcome of the activity helped in enhancing the productivity of crops grown in the vicinity.
- Aquaculture can provide large amounts of silt and fertile water for agriculture. Land on fish farms has much agricultural potential. It can be directly used as base manure for fodder crops. In the summer, silt is applied to the fields with water. This method is beneficial to release and diffuse the nutritional elements. It also improves the dissolved oxygen content of the bottom layer of water.
- Water salinity level in the coastal regions tends to rise because of frequent floods and cyclones. Freshwater ponds and rivers reduce the salinity levels of the aquifers.

7. Mainstreaming the Model - Options

- The model has been showcased at both state and national level events organised under UPNRM and other NABARD events. Exposure visits to the project sites have also been regularly organised for a diverse range of stakeholders such as government officials, bankers, donors etc. Information leaflets, video documentary and other knowledge materials have been developed under UPNRM, to popularise and mainstream the model.
- Gram-Utthan has also made constant efforts at district and state level for replication and upscaling of the model. The model has received awards and accolades at various forums.

Potential Institutional means of Finance

- ✓ Producer Organisation Development Fund (PODF), NABARD Financial Services Limited (NABFINS), NABKISAN.
- ✓ District Co-operative Central Bank (DCCB)/Regional Rural Bank (RRB), Micro Finance Institutions (MFIs), Commercial banks
- ✓ Grants - Corporate Social Responsibility (CSR), State Government

Scope for upscaling

- ✓ Geographical - Within Odisha and other states like Bihar, Assam and Tripura
- ✓ Institutional - Schemes and policies of state government, financial products by financial institutions
- ✓ Convergence – Programmes and projects by government and private agencies

ANNEXURE

THE 1 ACRE IFF MODEL

The loans support to the beneficiaries under the IFF model is extended by combining fisheries with any one of the activities i.e poultry, vegetable cultivation, duckery or dairy farming. The analysis is based on a loan amount of Rs.1,00,000 to Rs. 1,20,000 for a period of 3 years @ 12% per annum. The detailed financial modelling for these four loan models under IFF is presented below.

IFF Model Cost Analysis

1. A CAPITAL COST		Amount in Rs
Sl No	Name of component	Amt (Rs)
1	Clearing and repairing of dyke	2000
2	Desilting and renovation	120000
3	Farm equipment	2500
Sub Total		124500

1. B RECURRING COST				Amount in Rs	
Sl No	Name of component	Quantity	Unit	Rate	Amt (Rs)
1	Lime	500	Kg	12	6000
2	Cow dung	2000	Kg	1	2000
3	Single super phosphate	100	Kg	22	2200
4	Urea	100	Kg	15	1500
5	Kerosene	15	liters	40	600
6	Medicine and Feed supplement	5	liters	900	4500
7	Fish seed (Yearlings)	2500	Nos	14	35000
8	Feed	2500	kg	30	75000
Sub Total					126800
9	Add Minor Repairs to pond				5000
10	Netting cost	6	No. s	500	3000
Recurring Cost from Year II onwards					134800

1. C PRODUCTION AND INCOME				
			Year 1	Year 2
i	Stocking density (@2500 seeds)	2500	2500	2500
ii	Survival rate (90 %)			
iv	Year wise total production (KG)	1350	1620	1944
v	Average price/KG	130	140	150
Total Income		175500	226800	291600

Cost analysis: Integrated Fish Farming

	Year 1	Year 2	Year 3
Fishery 1 acres as calculated above	124500	Included in maintenance Cost	
Duckery (Duck house)	13000	Included in maintenance Cost	
Poultry (Poultry house)	13500	Included in maintenance Cost	
Dairy (cow shed)	80000	Included in maintenance Cost	
Vegetable growing	0		
Subtotal	231000	0	0
Recurring Costs			
Fishery 1 acre	126800	134800	134800
Duckery	7500	7500	7500
Poultry	9000	9000	9000
Dairy	40000	40000	40000
Vegetable growing	11000	11000	11000
Recurring cost total	194300	202300	202300
Capital+ Recurring	425300	202300	202300

Income Stream: Fish Farming with Duckery, Poultry, Dairy and Vegetable

Items / Years	Year 1	Year 2	Year 3
Fishery 1 acres	175500	226800	291600
Duckery	38000	42000	42000
Poultry	34560	43200	43200
Dairy	60000	67380	67380
Vegetable growing	25000	27500	30250
Total Income	333060	406880	474430
Net Income (Total Income-Total Cost)	-92240	204580	272130

Model 1: Fish Farming with Vegetable cultivation

A		Capital Cost	Year 1	Year 2	Year 3
1	Capital Cost of fish cultivation		124,500		
2	Capital cost of vegetable cultivation		-		
	Total Capital Cost		124,500	-	-
B		Recurring Cost	Year 1	Year 2	Year 3
1	Fisheries cultivation in 1 acre		126,800	134,800	134,800
2	Vegetable cultivation in 1 acre pond bund		11,000	11,000	11,000
	Total recurring costs		137,800	145,800	145,800
	Total Cost		262,300	145,800	145,800
C		Income	Year 1	Year 2	Year 3
1	Income from Sale of Fisheries		175,500	226,800	291,600
2	Income from sale of vegetables		25,000	27,500	30,250
	Total income		200,500	254,300	321,850
	Net Income		-61,800	108,500	176,050
D Financial analysis (NPV, IRR, BCR, NPW)					
	DF @15%				
	NPV of Costs			434,199	
	NPV at Income			578,257	
	NPW			144,058	
	BCR			1.33	
	IRR			178%	
E Total financial outlay					
	Loan			100,000	
	Repayment Period (in years)			3	
	No. of installments (half yearly)			6	
F		Repayment Schedule	Year 1	Year 2	Year 3
	Total loan o/s		100,000	66,667	33,333
	Interest repayment (@ 12%)		12,000	8,000	4,000
	Principal repayment		33,333	33,333	33,333
	Income		200,500	254,300	321,850
	Capital+ recurring		268,300	145,800	145,800
	Net surplus		-67,800	108,500	176,050
	Total repayment		45,333	41,333	37,333
	Net profit		-113,133	67,167	138,717
	DSCR		-1.2	2.8	4.8
	Avg. DSCR		2.1		

Model 2: Fish Farming with Poultry

A		Capital Cost	Year 1	Year 2	Year 3
1	Capital Cost of fish cultivation		124,500		
2	Capital cost of Poultry		13,500		
	Total Capital Cost		138,000		-
B		Recurring Cost	Year 1	Year 2	Year 3
1	Fisheries cultivation in 1 acre		126,800	134,800	134,800
2	Poultry		9,000	9,000	9,000
	Total recurring costs		135,800	143,800	143,800
	Total Cost		273,800	143,800	143,800
C		Income	Year 1	Year 2	Year 3
1	Income from Sale of Fisheries		175,500	226,800	291,600
2	Income from Poultry		34,560	43,200	43,200
	Total income		210,060	270,000	334,800
	Net income		-63,740	126,200	191,000
D		Financial analysis			
	DF @15%				
	NPV of Costs			441,371	
	NPV at Income			606,956	
	NPW			165,585	
	BCR			1.38	
	IRR			198%	
E		Total financial outlay			
	Loan			100,000	
	Repayment Period (in years)			3	
	No. of installments (half yearly)			6	
F		Repayment Schedule	Year 1	Year 2	Year 3
	Total loan o/s		100,000	66,667	33,333
	Interest repayment (@ 12%)		12,000	8,000	4,000
	Principal repayment		33,333	33,333	33,333
	Income		210,060	270,000	334,800
	Capital+ recurring		279,800	143,800	143,800
	Net surplus		-69,740	126,200	191,000
	Total repayment		45,333	41,333	37,333
	Net profit		-115,073	84,867	153,667
	DSCR		-1.3	3.2	5.2
	Avg. DSCR		2.4		

Model 3: Fish Farming with small scale duck farming

A		Capital Cost	Year 1	Year 2	Year 3
1	Capital Cost of fish cultivation		124,500		
2	Capital cost of Duck farming		13,000		
	Total Capital Cost		137,500	-	-
B		Recurring Cost	Year 1	Year 2	Year 3
1	Fisheries cultivation in 1 acre		126,800	134,800	134,800
2	Duck farming		7,500	7,500	7,500
	Total recurring costs		134,300	142,300	142,300
	Total Cost		271,800	142,300	142,300
C		Income	Year 1	Year 2	Year 3
1	Income from Sale of Fisheries		175,500	226,800	291,600
2	Income from Duck farming		38,000	42,000	42,000
	Total income		213,500	268,800	333,600
	Net income		-58,300	126,500	191,300
D		Financial analysis			
	DF @15%				
	NPV of Costs			437,512	
	NPV at Income			608,251	
	NPW			170,739	
	BCR			1.39	
	IRR			220 %	
E		Total financial outlay			
	Loan			100,000	
	Repayment Period (in years)			3	
	No. of installments (half yearly)			6	
F		Repayment Schedule	Year 1	Year 2	Year 3
	Total loan o/s		100,000	66,667	33,333
	Interest repayment (@ 12%)		12,000	8,000	4,000
	Principal repayment		33,333	33,333	33,333
	Income		213,500	268,800	333,600
	Capital+ recurring		277,800	142,300	142,300
	Net surplus		-64,300	126,500	191,300
	Total repayment		45,333	41,333	37,333
	Net profit		-109,633	85,167	153,967
	DSCR		-1.2	3.3	5.2
	Avg. DSCR		2.4		

Model 4: Fish Farming with Dairy

A		Capital Cost	Year 1	Year 2	Year 3
1	Capital Cost of fish cultivation		124,500		
2	Capital cost of Dairy		80,000		
	Total Capital Cost		204,500		-
B		Recurring Cost	Year 1	Year 2	Year 3
1	Fisheries cultivation in 1 acre		126,800	134,800	134,800
2	Dairy		40,000	40,000	40,000
	Total recurring costs		166,800	174,800	174,800
	Total Cost		371,300	174,800	174,800
C		Income	Year 1	Year 2	Year 3
1	Income from Sale of Fisheries		175,500	226,800	291,600
2	Income from Dairy		60,000	67,380	67,380
	Total income		235,500	294,180	358,980
	Net income		-135,800	119,380	184,180
D		Financial analysis			
	DF @15%				
	NPV of Costs			569,977	
	NPV at Income			663,260	
	NPW			93,283	
	BCR			1.16	
	IRR			68%	
E		Total financial outlay			
	Loan			120,000	
	Repayment Period (in years)			3	
	No. of installments (half yearly)			6	
F		Repayment Schedule	Year 1	Year 2	Year 3
	Total loan o/s		120,000	80,000	40,000
	Interest repayment (@ 12%)		14,400	9,600	4,800
	Principal repayment		40,000	40,000	40,000
	Income		235,500	294,180	358,980
	Capital+ recurring		377,300	174,800	174,800
	Net surplus		-141,800	119,380	184,180
	Total repayment		54,400	49,600	44,800
	Net profit		-196,200	69,780	139,380
	DSCR		-2.3	2.6	4.2
	Avg. DSCR		1.5		







