

Economics of Operation of 18 m Fuel Efficient Steel Trawlers of CIFT Design

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The economic performance of 18 m steel trawler of CIFT design, under commercial operations during 2001-03, is presented. The operation has been profitable even in times of lowering catch and increasing operational expenditure. The operational profit was 47.58 % of the operating costs and the net profit was 7.06% of the total costs indicating the economic viability of the operation. The fuel consumption rate was observed to be 13-14 litres per hour, which establishes the fuel efficiency of the vessel.

Key words: Stern trawler, fishing operation, economics of operation parameters, fuel efficiency, vessel profit

The marine fishing sector in India underwent a great revolution with the mechanisation of fishing in the late sixties. The Central Institute of Fisheries Technology (CIFT), taking a leading role in the design and development of fishing vessels, introduced designs of small mechanised boats basically stern trawlers, in 1965. The innovative technology spread very fast among fishermen community and the design and its modifications were soon adopted along the west coast. The unchecked growth in the number of mechanised crafts, however, exerted great pressure on the resources resulting in dwindling catches per unit effort. As the profit margins declined, the fishing activity became less economical. Diversification of target species from prawns to cephalopods with the aid of larger vessels with better sea endurance having multi day fishing capability, was the emerging trend. Construction of vessels upto 60' LOA, with the basic design remaining the same, became popular. The operational costs increased with the increase in fuel consumption of the larger trawlers and the periodic increase in

the unit price of fuel. Cost reducing technologies, especially those targeting at fuel efficiency was the need of the hour.

The Central Institute of Fisheries Technology designed and constructed a new generation fuel efficient fishing vessel (stern trawler) '*Sagar Kripa*' (15.5 m) with the financial support of the Department of Agriculture, Govt. of India, in the year 1998. The hull and propeller were designed to give substantial saving in fuel. The vessel after construction was handed over to the mechanised boat owners association in Munambam at Cochin for actual commercial operation. The design proved very successful and gave about 15 to 17% fuel saving compared to conventional trawlers of the same size (Anon., 2000).

Consequent to the success of the 15.5 m vessel new designs of 18 m steel stern trawlers were developed and lines plan was supplied in 2001 to the Department of Animal Husbandry and Dairying, Ministry of Agriculture on a consultancy basis.

Subsequently a private entrepreneur, who came forward to try the newly designed hull forms for commercial operation, was provided one of the above structural designs (details given elsewhere) and its construction was supervised by the Institute.

The entrepreneur has expressed full satisfaction in the design, stability, rate of fuel consumption etc. The technical aspects of the vessel were also evaluated by a high power committee deputed by the Ministry of Agriculture under the chairmanship of the Director General, Fishery Survey of India. The CIFT has been continuously monitoring the technical and economic performance of the vessel with a view to incorporate possible modifications for future research in the area.

This paper is an attempt to study the economics of operation of the vessel in detail. Similar studies earlier have examined the economics of operation of various classes and types of vessels (Torbjorn, D., 1978; Unnithan *et al.*, 1985; Panikkar *et al.*, 1990 and FAO, 2001). However, this is the first time that an evaluation of this class of new generation, fuel efficient fishing vessel is being taken up.

Material and methods

The 18 m vessel was made of 25 tons of ship building steel and was fitted with a 126 hp ALM engine to attain a trawling speed of 4 knots and free running speed of 8.2 knots. Onboard facilities were limited to bare necessities to effect maximum economy in construction without compromising on endurance and stability of the vessel. The fishing vessel was constructed at Cochin and area of operation extended from Mangalore to Kanyakumari on the west coast of India.

The economic evaluation was based on a total 76 fishing trips made during 2001-02 and 2002-03. Data on capital investment, which includes the cost of hull, engine, gears and accessories and fixed costs including depreciation of craft and gear, interest on borrowed capital and insurance were recorded. On the variable cost side, the quantity and cost of fuel including lubricants, ration to the crew, bata, toll, cost of ice, water, gas, auction charges, crew share, helper charges, repair and maintenance and miscellaneous expenses were taken into consideration. Details of the catch and sale proceeds, net revenue, apart from details of fishing time, area and depth of operation, duration of fishing etc. were also collected. The crew members were personally interviewed based on a structured proforma. Relevant data were collected from the well maintained records of the owner to ensure the authenticity of the information.

The approach for estimation of various economic parameters for this evaluation is described below.

Depreciation, a major component of the fixed cost, has been arrived at by the straight line method using the formula:

$$D = [(F-S)/n].$$

where,

F= cost of the vessel in rupees

S = salvage value in rupees

n = life of the vessel

D= Annual depreciation change in rupees

As per expert opinion sought by the authors, life of the craft was taken as 20 years and the salvage value was estimated at Rs. 5.00 lakh. Life of the gear has been taken as

3 years and the depreciation per year of gear was worked out as one-third of its investment. The boat was observed to use 20 nets of different nature for varying operations. The borrowed capital was 12 lakhs, which was to be repaid in 72 monthly instalments, as per the owner's agreement with the bank. The annual interest was worked out on diminishing capital. The insurance payable was 3% of the capital investment.

On the operational cost side, the crew bata was calculated @ Rs. 50.00 per day per crew member, the crew size being 8 on an average. On an average 75 blocks of ice is being used per trip, the cost of one block being Rs. 35.00. Auction charge was worked out @ 2% of the total revenue.

The share of the crew and owner was worked out as follows:

Crew share = 35% of (Total revenue – Total Operational costs)

Owner's share or Gross Cash Flow = 65% of (Total revenue – Total operational costs)

Bonus = 1% of Owner's share or Gross cash flow

The total variable cost includes the total operational cost, crew share and bonus.

Results & discussion

The general particulars of the 18 m steel trawler and its operational aspects are presented in Tables 1 and 2. The vessel was constructed with ship building steel at the cost Rs. 24.00 lakhs in 2001. It made 42 trips in the first year and 34 in the subsequent year. The average number of fishing days per trip was 6.53 against the trip cycle of 8 to 9 days. This is a clear indication that the vessel was functioning efficiently during the

Table 1. General particulars regarding 18 m steel trawler and its operation

1	Year of construction	2001
2	Place of construction	Cochin
3	LOA	18 m
4	Breadth	5.20 m
5	Cost of construction of trawler	Rs. 24.00 lakhs
6	Cost of gear	Rs. 1.00 lakh
7	Make of hull	Ship building steel
8	Material of deck and wheel house	<i>Aini</i> wood
9	Depth of operation	50-200 m
10	Area of operation	Mangalore to Kanyakumari
11	Engine	ALM 412, 126 hp
12	Free running speed	8.2 knots
13	Average fuel consumption/hr	13.7 lts/hour
14	Fish hold capacity	45 m ³
15	Fuel capacity	6000 lts
16	Fresh water capacity	3000 lts
17	Duration/trip	5-10 days
18	Electronic equipment	GPS, Fish finder, VHF, mobile phone
19	Crew size	8
20	Trip cycle, days	8 – 9

two years of operation under study and there was no major repair work undertaken. The vessel consumed an average 13 - 14 litres of fuel per h based on an average 15 h of fishing per day, when compared to an average of 16 – 17 litres per h as observed in other larger vessels of similar class (Anon., 2001). This proves the fuel efficiency of the vessel.

The costs and returns of the 18 m fishing vessel for the years 2001-02 and 2002-03 is presented in Table 3.

The capital investment consists of the cost of construction of steel hull, cost of

Table 2. General operational details of the 18 m trawler, 2001-02 & 2002-03

S.No	Item	2001-02	2002-03	2001-03
1	Total number of trips	42	34	76
2	Total number of days of operation	274	222	496
3	Average no of days/trip	6.52	6.53	6.53
4	Total fuel consumption (lts)	55416	46684	102101
5	Average fuel/trip (lts)	1319	1373	1343
6	Average fuel consumption/day (lts)	202.30	210.26	205.67

engine, gear etc. which was Rs. 25.00 lakhs. Depreciation was worked out on the assumption that the vessel will be operational for 20 years. Average annual depreciation of the hull, which is a major component in the fixed costs, has been arrived at Rs. 0.95 lakhs. Depreciation of the gear was worked out to be Rs. 0.33 lakhs. Insurance has been worked out to be Rs. 67500 and Rs. 60750 in 2001-02 and 2002-03 respectively. Thus the total fixed cost was Rs. 293100 and Rs. 286350 for the two years.

Of the total operational costs, the cost of fuel was the largest component contributing to 76.76%. The expenditure on fuel was 55.69% of the total costs. Considering the fact this is a fuel efficient fishing vessel, the contribution of fuel to the operational costs of other vessels will be even higher and for the same reason is crucial to the economic viability of mechanised fishing.

Operational costs per trip were Rs. 34173 and Rs. 39418 for the two years studied. The increase in operational costs during the second year may be attributed to increase in the unit price of fuel.

The gross revenue per trip has been observed to be Rs. 52906 and the operational

profit was 47.58% of the operating costs. It was observed that the variation in total revenue between trips was high ranging from Rs. 7000 to Rs. 1.85 lakhs. Of the total number of trips 72% were profit making whereas the rest 28% ended in loss.

Table 4 gives the overall economic and financial performance of the vessel. The operating profit is worked out as the revenue minus the total operating costs and was an

Table 3. Revenue, operational costs, variable costs and fixed costs of 18 m trawler

	Year		
	2001-02	2002-03	2001-03
Total Revenue	2222068	1873813	4095881
Variable costs			
<i>Operating costs</i>			
Fuel consumption cost	1083106	1047199	2130305
Crew bata	109600	88800	198400
Cost of ice	135410	118030	253440
Toll	2485	2000	4485
Miscellaneous	9810	5890	15700
Repair of nets (@ Rs. 1200/ trip)	50400	40800	91200
Auction charges	44441	37476	81918
Total operating costs	1435252	1340195	2775448
<i>Other variable costs</i>			
Crew share	275385	186766	462152
Bonus	5114	3469	8583
Total variable costs	1715752	1530430	3246182
Gross cash flow	506316	343383	849699
<i>Fixed costs</i>			
Depreciation	95000	95000	190000
Depreciation (gear & accessories)	33000	33000	66000
Interest	97600	97600	195200
Insurance	67500	60750	128250
Total fixed costs	293100	286350	579450
Total costs	2008852	1816780	3825632
Net profit (Total revenue-Total costs)	213216	57033	270249

Table 4. Economic and financial performance of the 18 m trawler

	Year		
	2001-02	2002-03	2001-03
Operating profit (Rs.) (Total revenue- Total operating costs)	786816	533618	1320433
Gross cash flow (Rs.)	506316	343383	849699
Net profit (Rs.)	213216	57033	270249
Net profit/Total costs %	10.61	3.14	7.06
Return on investment [Net profit/capital investment] %	8.53	2.28	5.40
Capital recovery factor [Gross cash flow/capital investment] %	20.25	13.74	16.99
Ratio of total cost to gross revenue	1.11	1.03	1.07
Ratio of operating costs to operating profit	0.55	0.40	0.48
Ratio of operating profit to gross revenue	2.82	3.51	3.10
Ratio of gross cash flow or owner's share to gross revenue	4.39	5.46	4.82

average Rs. 17374 per trip. The net profit was the total revenue minus the total costs and was an average Rs. 3556 per trip. The gross cash flow or owner's share was Rs. 506316 and Rs. 343383 during the two years under study.

The net profit as a percentage of total costs was 10.61% in the first year and fell drastically to 3.14% in the second year as a result of fall in fish catch and reduction in the number of trips. The net profit was 7.06% of the total costs for the two years taken together.

The ratio of operating costs to operating profit indicates that the operating profit was as high as 47.58% of the operating costs. The operating profit percentage over capital

investment was 26.41 and net profit percentage over it was 5.40. The comparison of the fuel cost with the revenue indicates that every rupee spent on fuel yields revenue of 1.92.

The return on investment (net profit/capital investment) was 5.4% and capital recovery factor (annual cash flow/capital investment) was 16.99%. This implies that the capital can be recovered in six years time, all other factors remaining constant.

The results of the study indicate that the operation of this new generation vessel was profitable even in the face of diminishing catch. Profits, in general, can be enhanced by reducing the expenditure on fuel by introducing more fuel efficient fishing vessels leading to an economically viable fishing industry. Suitable policy initiatives like optimisation of the fishing fleet and subsidising fuel used by fishing vessels, as is already being practised in some states, are to be implemented. Decrease in the bank interest rates to encourage investments also deserves consideration.

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