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INITIAL ANALYSIS : ECONOMIC VIABILITY OF SHIPS FISHING AROUND FADs OFF THE SOUTH-WEST COAST OF EFATE

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ECONOMIC VIABILITY OF SHIPS FISHING AROUND FAD'S OFF THE SOUTH-WEST COAST OF EFATE

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SUMMARY

An assessment has been carried out on the profitability of fishing for pelagic species around the fish aggregating devices (F.A.D.) moored in Vanuatu, and more specifically on Efate. A balance of accounts covers the costs and income on a fishing trip basis. Ideally, an average of 100 trips per annum should be achieved to offset the investment. On Efate, fuel consumption costs during the fishing trip account for 56% of the overall costs of the trip. The fluctuation in income follows the fluctuating levels of production depending on the amount of time spent trolling around the rafts. The relation is expressed as $R = -432\ T^2 + 4{,}661.4\ T$ ($R^2 = 0.960$). On Efate, with a four hour return journey to the FAD, it takes 2.15 hours of trolling around the rafts to offset the costs and start making a profit, which will not exceed 1,000 vatu. This is not seen to be an encouraging figure. If the price of the FAD were to be included in costs, it would make the whole operation totally unviable. The extension of travel time causes a short-fall in expected income and a cut-back on trolling time, during which profits can be achieved.

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INTRODUCTION

If fish aggregating devices (F.A.D.'s) are to be any real help in fishing for pelagic species, the conditions of use are a major criteria. One factor is distance : travelling to the targeted area takes time during which the fuel cost cannot be offset against income generating catches (CILLAURREN, 1990). The life expectancy of F.A.D.'s is another. The present expenditure involved in an F.A.D. varies between US$ 3,300 and US$ 5,000, depending on the materials used and the set-up. Installing any F.A.D. therefore represents a considerable investment. The viability of such investment is conditional upon three aspects :

a) The F.A.D. must be well anchored - there is a high risk of losing it otherwise; therefore, careful thought should be given to the type of materials used and to the set-up (BOY & SMITH, 1984).

b) The F.A.D. must be suitably located to maximise the chances of attracting fish. It is therefore necessary to carry out a thorough survey of the proposed site (de SAN, 1982; PRESTON, 1982) and fishermen should be consulted in such matters.

c) Fishing around F.A.D.'s should enable the fishermen to earn more than they spend.

A financial statement provides an accurate picture of the viability of a fishing concern. It shows the balance of income and expenditure for the past financial year. The financial statements of vessels fishing around F.A.D.'s not being available to us, we based our analysis on an estimate of the balance sheets according to the scale of the trip. This was then compared with the curve of average yield which was drawn up on the basis of some fifty trips.

PRODUCTION COSTS

Operating costs are represented by the depreciation of the initial capital outlay, the operating costs and variable costs. Any new fisheries project requires some assistance, at least in the beginning (CROSSLAND, 1984a). Under this premise, we have assumed that FAD's are provided by overseas aid and their cost has not been included in the production costs at this particular stage.

Fixed Costs

In respect of one trip, fixed costs include all expenditure, the amount of which remains set regardless of the duration of the trip. Among these, we distinguish between the costs pertaining to the repayment of the investment incurred to set up the fishing operation and the actual operating costs.

Investment Amortization

Since the beginning of 1990, the new development objectives in fisheries aim to make the fisherman responsible for funding the investment. The initial capital required for the purchase of a vessel (Alia catamaran or Hartley monohull, 5 to 7 meters long) fitted out with 25 and 8 HP engines and reels amounts to US$ 5,760, i.e. VT.700,000. In addition to this, there is the cost of equipment replacement over a term of eight years, being US$ 4,360 (VT.530,000). Capital loans are granted over a period of eight years, at a 10% rate of interest. The yearly repayment of the credit is US$ 1,392, i.e. VT.169,215 (Table 1) (LINDLEY, 1990).

In respect of the trip, capital repayments depend on the number of trips throughout the year. Figure 1 shows the relation between the amount of investment reimbursement and the number of trips per year. This relation is a holomorphic function. The decrease in repayment, per trip, drops for a number of trips ranging between 80 and 120 per year. One hundred trips is an average figure. It corresponds to an optimum fishing operation for the best possible ratio of number of trips to amount of investment repayment.

Operating Costs

The operating costs include all fixed costs relating to trolling, i.e. maintenance costs of the vessel, purchase of fishing gear, which has to be replaced fairly frequently, insurance for the boat, transport costs of the fish from the point of offloading to the market and the cost of ice taken on board to keep the fish fresh.

The maintenance of the boat, replacement of fishing gear (lines, hooks, lures), boat insurance and transport of fish amount to US$ 1,544 per annum, i.e. VT. 187,711 (Table 1).

On each trip, 36 kg of ice @ VT.30/kg (US$ 0.25) are taken on board to keep the fish cold.

The total fixed costs per year are US$ 3,818, i.e. VT.464,326. At the rate of 100 trips per year, the fixed costs for each trip are VT.4,643 (approx. US$ 38).

Variable Costs

Variable costs include the fuel expenses incurred :

- for the return trip to the F.A.D.;
- whilst trolling around the raft.

Travel time and trolling time vary depending on the location of the F.A.D. and the fishermen's determination. In South-West Efate, the average travel time is four hours (two to get there and two for the return). The average trolling speed is seven knots. Fuel consumption is assumed to be constant during travelling and whilst trolling around the rafts; at 12.5 ltr per hour. A litre of fuel is sold for VT.32 duty-free and VT.72 all inclusive. Only those fishermen who are registered with the Fisheries Department and provide feed-back are entitled to tax exemptions on fuel. They account for about 40% of the actual numbers recorded (pers. comm., 1990). We have assumed VT.52 as an average price per litre reflecting the average fuel costs for all fishermen taken overall. For each trip, therefore, the variable costs can be expressed as follows :

$$VC = 12.5 \times 52 \times (T + R)$$

Where : T represents the trolling time around the FAD in hours
R represents the return journey in hours

In South-West Efate, where R = 4 hours, the variable costs are calculated as being :

$$VC = (650 \times T) + 2{,}600$$

INCOME GENERATED FROM FISHING

95% of the yield through trolling is actually caught around the FAD's. We have therefore assumed that the amount of fish picked up during the trip to and from the FAD's is insignificant. To assess the income generated from fishing we have taken into account only the fish caught around the FAD's.

All the catches from around the FAD's in South-West Efate are intended for the Port Vila fish market. The prices are not based on the free forces of supply and demand, but are fixed by the Government as owner of the fish market (CROSSLAND, 1984b).

Depending on their size and state of freshness on arrival, the fish are divided according to species into three price categories. Generally, the price offered to the fisherman is higher for mahi-mahi (*Coryphaena hippurus*) than for the yellow-fin tuna (*Thunnus albacares*) and the skipjack (*Katsuwonus pelamis*), whereby the latter is the lowest-priced. All price categories taken together, the average selling price for trolling species upon offloading amounted to VT.135 per kilo in 1989. The income from fishing, per trip, can be expressed as follows :

$$I = C \times 135$$

Where : I represents the income per trip, in vatu
C corresponds to the weight of catch per trip, in kilos.

There is a relation between the income generated by an trip and the fishing effort expended. Assuming the sale price of fish is constant, this relation can be associated with the relation between the quantity of fish caught and the fishing effort. It is shown in Figure 2 graphically as an average curve. The relation can be expressed through the equation :

$$C = 34{,}529\ T - 3{,}200\ T^2$$

Where $R^2 = 0.96$

Therefore $I = 135 \times (34{,}529\ T - 3{,}200\ T^2)$
and $I = -\ 432\ T^2 + 4661.4\ T$

FINANCIAL RESULTS OF A FISHING TRIP

For a fishing trip, the total amount of fixed costs is VT.4,643, of which VT.2,951 are operating expenses and VT.1,692 are repayment costs.

Adding up fixed costs and variable costs, the production costs F can be expressed as follows :

$$F = 4{,}643 + 650 \times (T + R)$$

R being 4 hours in South-West Efate,

$$F = 7{,}243 + (650 \times T)$$

When the receipts from fishing offset the costs (Fig. 2), the financial balance is nil and :

$$C \times 135 = 7{,}243 + (650 \times T)$$

Given travelling times of four hours, i.e. from Port Vila to the FAD's on South-West Efate, the balance of an trip will begin to show a profit where the trolling time around the raft is :

$$T = [(P \times 135) - 7{,}243] \div 650$$

The value of T has been recorded graphically in Fig. 1. It corresponds to two and a quarter hours approximately. The figure for the relevant yield is 64 kg.

If the cost of the FAD were included in the terms of repayment of the investment, the overall fixed costs would be VT.8,650 and T would equal :

$$T = [(P \times 135) - 11{,}250] \div 650$$

The cost curve is well above that of income, fishing is therefore no longer a viable activity.

In South-West Efate, the time required to go fishing round the FAD's represents an expenditure of VT.2,600 (US$ 21) per fishing operation. If this could be cut back, i.e 56% of fixed costs saved, it would result in a reduction of the trolling time required in order to balance income.

We have attempted to consider from an empirical angle, given an increasingly positive financial situation, the development of the fisheries activities around rafts in terms of travel time.

The balance is equal to the receipts from the trip, less costs and can be expressed as follows :

$$B = I - F$$

in which case $B = -432\ T^2 + 4{,}661.4\ T - 4{,}643 - 650\ T - 650\ R$
i.e. $B = -432\ T^2 + 4{,}011.4\ T - 650\ R - 4{,}643$

B and R being variable (by 1000 VT or one hour respectively), the solution of the equation provides the minimum and maximum amounts of time to be spent trolling in order to make a profit (Fig. 3).

Four and a half hours of trolling, regardless of actual profit, is the maximum travelling time acceptable to achieve these profits. If the time required to reach the raft increases, it will result in :

- extended trolling time around the FAD in order to offset costs;
- once costs are offset, proportionately longer trolling time to increase profits;
- a decrease in optimum profits to be expected;
- a reduction of the trolling time in which optimum profits can be made.

On Efate, most fishing vessels are home-based in Port Vila. However, the most favourable areas for dropping rafts are located at least 2 hours away (single journey), given a 25 HP engine craft. These zones are found 6 miles to the south of Devil's Point, near Ilot Chapeau (Hat Island), and in the Nguna area. Two options are available to cut down fuel costs due to the journey :

- either to set up FAD's closer to the coast, with no guarantee, however, as to productivity;

- or to get closer to the fishing zones by road and set up the fishermen on land for a few days, close to the FAD sites.

This economic assessment was established on the basis of the following assumptions :

- the cost estimates are in relation to the current market, but are likely to vary depending on said market;

- the relation between yield and fishing effort is, in our example, adapted to the formula $y = -ax^2 + bx - c$, but it can vary (SAMPLES & SPROUL, 1984).

The next stage would consist in setting up a model of all parameters so as to work out the fishing effort depending on which factor varies. The one major aspect of fluctuation in this study would appear to be fuel consumption.

CONCLUSION

Trolling as carried out in South-West Efate around the FAD's anchored some ten miles off the coast is not really a viable proposition. Maybe a profit of some 1000 vatu can be expected after 3 hours of trolling around the FAD. The profit represents approximately 10% of the total income from fishing, a much lower percentage than the 20% awarded by way of wage to the fishermen who take on a vessel from the Fisheries Department on a leasing basis (LINDLEY, 1990).

Profits could be increased, either by cutting down the fuel expenditure during the journey, or by improving the efficiency of the fishing effort. This aspect has not been examined in any detail as yet, but could be implemented either by diversifying fishing methods (in particular with drift fishing down to 50 m deep), or by improving the trolling fishing techniques.

Table 1 - Production costs of trolling around fish aggregating devices

FIXED COSTS

Fishing investments (over 8 years)

Boat: .....: 330,000 Vatus
Engine 25 HP.....: 140,000 Vatus
Engine 8 HP.....: 110,000 Vatus
Equipment .....: 19,713 Vatus
Safety gear.....: 70,000 Vatus
Replacement of equipment .....: 530,000 Vatus

TOTAL .....:1,230,000 Vatus

Annual rapayment (over 8 years) at 10% interest: 169,215 Vatus

Opérating expenses

Capital repayment.....: 169,215 Vatus
Boat maintenance and repair.....: 16,500 Vatus
Fishing equipment.....: 19,713 Vatus
Maintenance of the engines.....: 22,998 Vatus
Insurance.....: 24,500 Vatus
Fish conveyance.....: 104,000 Vatus
Ice, 3600 Kg, (30Vt/kg) .....: 108,000 Vatus
TOTAL .....: 464,926 Vatus

VARIABLE FISHING COSTS / Trip

Fuel, 12.5 L/hour,(average cost 52 Vt/l)....: 650 Vatus/hour

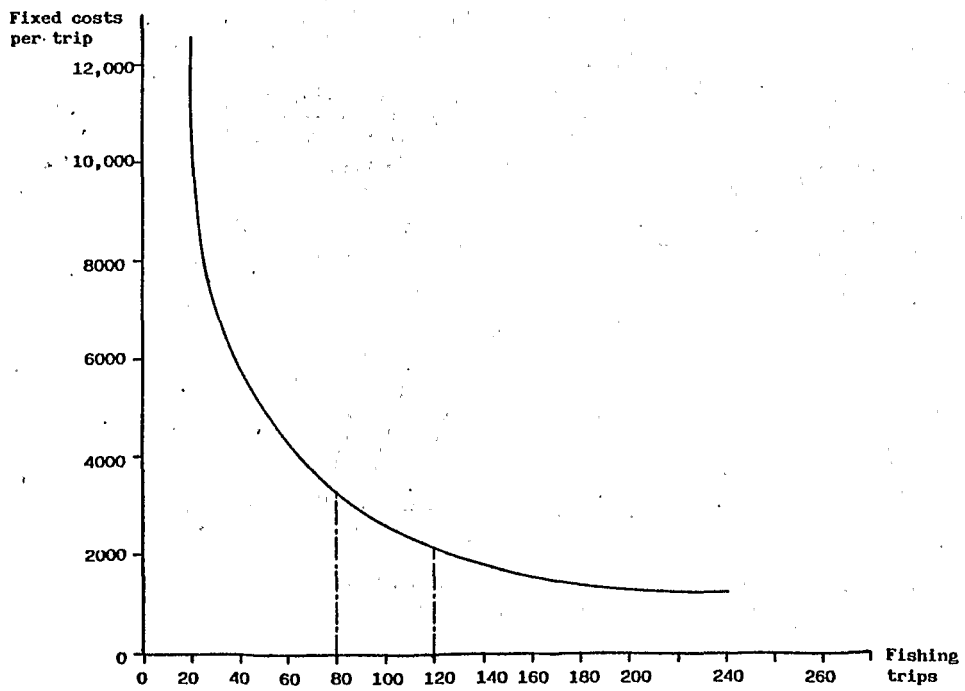

Figure 1 - Holographic relation between fixed costs per trip and number of fishing trips

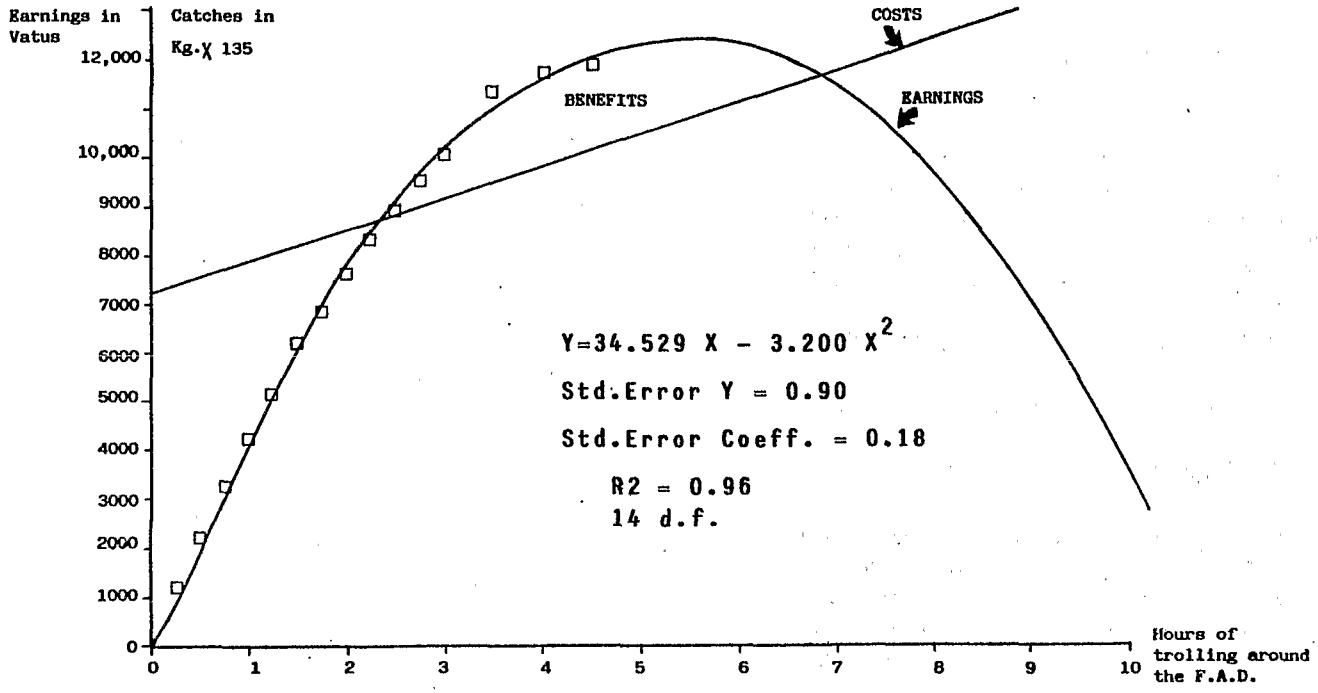

Figure 2 - Relation between costs and earnings for fishing trips around F.A.D.'s set up in Efate

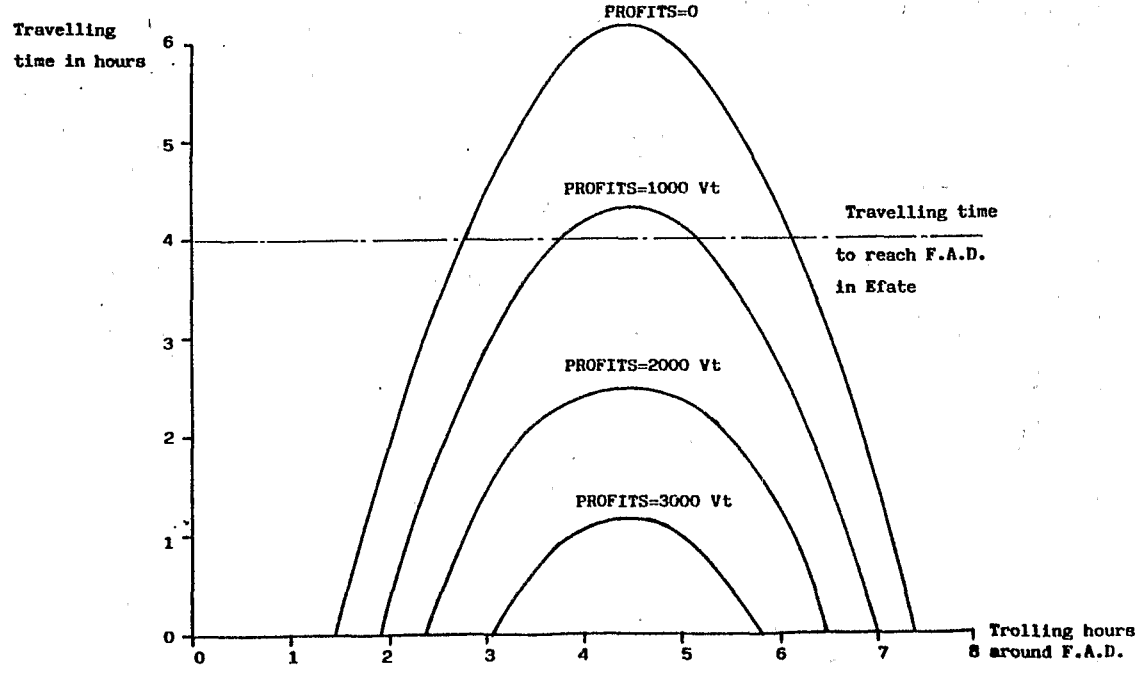

Figure 3 - Relation between travelling time and trolling time around F.A.D. in order to increase profits.

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