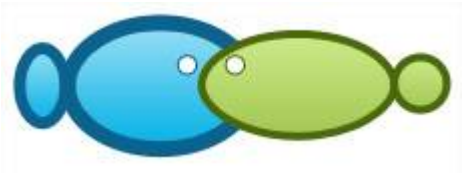

The effect of increasing fuel price on the sustainability of the fixed lift net operation in Banten Bay

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Abstract. The fixed lift net is a lift net that operates permanently in water with artificial lights to attract fish. The increase in fuel prices has affected fishermen. The fuel cost is the main cost of the lift net because it is used to turn on the generator all night. Fuel use is essential in fishing operations, affecting fishermen's businesses. The research objective is to determine the sustainability status of the fixed lift net in Banten Bay viewed from business feasibility. The study was conducted from March to August 2023 in Banten Bay. Data analysis includes net benefit, net B/C ratio, R/C ratio, and payback period (PP). The result showed that the fixed lift net is still profitable but experienced a decline in profits. The increase in fuel prices causes an increase in fixed lift net fuel costs in Banten Bay of up to 12.5%. The fixed lift net fishery business is still beneficial considering the R/C value of 1.79-3.28 and PP around 0.53-0.92 years. The increase in fuel prices impacted the majority of fishermen, who experienced a decrease in the net B/C value to below 1. If fishermen can access subsidized fuel, they can save up to 37.5% on fuel costs, which also means increasing benefits. The sustainability status of fixed lift net business in Banten Bay is still profitable and feasible, based on the R/C value > 1, and the PP is less than one year. The increase in fuel prices causes a decrease in the net B/C value. If fuel prices continue to rise, the sustainability of fixed lift net fisheries in Banten Bay could be threatened.
Key Words: feasibility, fixed lift net, fuel price increase, sustainability.

Introduction. The fixed lift net is a lift net that operates permanently in water with artificial lights to attract target species (He et al 2021). The fixed lift net in Banten Bay has experienced many developments in using lights as fishing lamps. Many fishermen have now switched to LED lamps from fluorescent lamps and CFL lamps (Susanto et al 2017). The fixed lift net utilizes lights as a fish aggregating device. It is operated at night using light to attract fish to harvest them (Irnawati et al 2018).

The increase in the lift net's number and size increases energy consumption. Currently, fixed lift net fishers in Banten Bay have switched to LED lights, but still with many lamps and power. This results in high fuel consumption, resulting in increased operational costs for fishing. Until now, fuel is still the most significant cost of the total expenses incurred for fishing operations (Guillen & Maynou 2016).

The Indonesian government has raised fuel prices since the end of 2022, and prices continue to fluctuate, especially for non-subsidized fuel. It is pretty burdensome for fishermen to do fishing activities, especially fixed-lift net fishers who do not use fuel subsidies. In addition, fishermen also buy fuel at agents or retailers, so the price is higher than at gas stations. Fuel use is essential in fishing operations, affecting fishermen's businesses. The costs incurred for fuel purchase are very high compared to the cost of other supplies. Fuel costs, along with labor costs, are the main costs that fishing fleets have to bear. The share of the fuel cost over the total costs reached 27-50% (Guillen & Maynou 2016).

The fuel price increases significantly in the fleet's operational costs, raising the share of the fuel costs in the total costs (Guillen & Maynou 2016). The fuel cost is the main cost that the lift net must bear because it is used to turn on the generator all night. Fuel is a strategic commodity whose price is controlled by the government and is occasionally adjusted according to international market prices. The increase in fuel prices causes an increase in operational costs and can potentially reduce business profits (Subhecanis et al 2016).

Research related to the feasibility of the fixed lift net business is significant to see the impact of fluctuating fuel prices and can be used to determine the sustainability of the fixed lift net fishing business. This study aims to analyze the feasibility of the fixed lift net in Banten Bay. The business feasibility study will provide direction on whether the investment in the business is feasible or not. It is hoped that the results of this study can provide information to fishery business actors regarding the sustainability of the floating net fishery business from an economic perspective so that better management can be formulated in the future.

Material and Method

Study area. This study was conducted from March to August 2023 at Banten Bay and Karangantu Fishing Port, Banten village, Kasemen District, Serang City, Banten, Indonesia. The fixed lift net fishing operation was carried out in the Banten Bay waters. The observation and interview with fixed lift net fishermen were conducted around Karangantu Fishing Port.

Data collection. The method used is a survey. Observation and interviews with fixed lift net fisheries actors were carried out data collection. The data taken included investment costs, fixed costs, variable costs, the number of fish caught, fishing season, location of fishing ground, and fish price. The fuel prices were calculated based on the minimum and maximum prices during the study.

Data analysis. The business feasibility analysis of fixed lift net fisheries was carried out with the criteria of benefit (business profit), revenue cost (R/C) ratio, net benefit cost (net B/C) ratio, and payback period (PP) (Kadariah et al 1999; Irnawati et al 2021).

Business profit (benefit). Business profit is the amount of revenue after deducting the costs incurred for the production process, calculated by the following formula:

$$\text{Profit } (\pi) = \text{Total Revenue (TR)} - \text{Total Cost (TC)}$$

Revenue cost (R/C) ratio. Revenue cost (R/C) ratio is an analysis of revenue and cost balance, calculated by the following formula:

$$R/C = TR/TC$$

R/C > 1 means the business makes a profit; R/C < 1 means the business gets a loss, and R/C = 1 means the business is breakeven.

Net benefit cost (net B/C) ratio. Net B/C is the ratio between the present value of the total net income to the present value of total production costs, calculated by the following formula:

$$\text{Net B/C} = \text{total net benefit / total production cost}$$

If Net B/C > 1, then the business is feasible; if Net B/C = 1, then the business breaks even, and if Net B/C < 1, then the business is unfit to continue.

Payback period (PP). The payback period (PP) is the time required to return an investment's capital. If the return capital is less than one year, then the investment is profitable or feasible, calculated by the following formula:

$$\text{Payback period (PP)} = (\text{investment / profit}) \times 1 \text{ year}$$

Results. The fixed lift net in Banten Bay ranges from 10 x 10 m to 11.5 x 11.15 m with a water depth of 7-9 meters. The lift net building material is bamboo, while the net uses polyethylene or waring, as presented in Figure 1. One fisherman operates fixed lift nets

in Banten Bay. Lift net fishermen usually go to sea in groups, about 4 to 10 people. One group member owns a boat, while the other fishermen join and pay for the boat or transport fee.

Figure 1. The fixed lift net in Banten Bay (original photo).

The feasibility of a fixed lift net in Banten Bay is calculated based on actual conditions, where costs and revenues are calculated based on the average value. The result of the feasibility of a fixed lift net in Banten Bay is presented in Table 1. The investment cost of a fixed lift net includes a vessel and fishing gear. As mentioned before, the fishers do not all have a boat, so in this study, the feasibility calculation was carried out on those who have a boat (fixed lift net 1 with the boat) and those without boats (fixed lift net 2 without boat), as presented in Table 1.

Table 1

The results of the feasibility of fixed lift net in Banten Bay

No.	*Components*	*Amount (IDR)*	
		Fixed lift net 1 (WB)	*Fixed lift net 2 (WOB)*
1.	Investment		
	a. Fishing boat	68,000,000	-
	b. Fishing unit	18,000,000	18,000,000
	Total investment cost	86,000,000	18,000,000
2.	Fixed cost	7,000,000	5,000,000
3.	Variable cost		
	a. Fuel	26,880,000	19,200,000
	b. Supplies	7,200,000	7,200,000
	c. Boat fee	-	11,532,000
	Total variable cost	34,080,000	37,932,000
4.	Revenue		
	a. Catch	76,880,000	76,880,000
	b. Boat fee	57,660,000	-
	Total revenue	134,540,000	76,880,000
5.	Net benefit	93,460,000	33,948,000
6.	Net B/C	2.28	0.79
7.	R/C	3.28	1.79
8.	PP	0.92 year (11 months 12 days)	0.53 year (6 months 11 days)

Note: WB = fixed lift net with boat; WOB = fixed lift net without boat.

In this calculation (Table 1), the fuel price at the retail level is IDR 16,000 per liter after the fuel price increases. The fishermen usually buy fuel at retailers, with a price difference of up to IDR 2,000 per liter from the official price for non-subsidized fuel set by the government. The subsidized fuel price is IDR 10,000/liter and non-subsidized IDR 14,000/liter. The fishermen can only buy non-subsidized fuel because subsidized fuel is only sold at gas stations. If fishermen can access fuel purchases at gas stations, the profits obtained can be higher, as presented in Table 2.

Table 2

The feasibility of fixed lift net on different fuel prizes (subsidized and non-subsidized fuel)

Components	*Amount (IDR)*	
	Fixed lift net 1 (WB)	*Fixed lift net 2 (WOB)*
Subsidized fuel		
Fuel cost	16,800,000	12,000,000
Net benefit	103,540,000	41,148,000
Net B/C	3.34	1.15
R/C	4.34	2.15
PP (year)	0.83	0.44
Non-subsidized fuel		
Fuel cost	23,520,000	16,800,000
Net benefit	96,820,000	36,348,000
Net B/C	2.57	0.90
R/C	3.57	1.90
PP (year)	0.89	0.50

Note: WB = fixed lift net with boat; WOB = fixed lift net without boat.

The feasibility analysis result shows that financially, the fixed lift net fisheries business in Banten Bay is still feasible to continue working on and profitable to invest in. All the fixed lift nets are still beneficial. The revenue and profit (net benefit) from all the fixed lift net fisheries business are still higher than the investment cost (Table 1). If fishermen can access subsidized fuel, their profits will be more significant because the operational costs will be reduced significantly, and the PP will be faster (Table 2).

Discussion. The fixed lift net fishery in Banten Bay is a small-scale capture fishery, usually operated by one fisher. Fishermen carry out fishing operations daily (one-day fishing), leaving in the afternoon and returning in the morning. The size of the fixed lift net in Banten Bay is almost the same as the fixed lift net operating in Pangandaran in terms of size and materials used (Krisnafi et al 2020). Lift net fishermen in Banten Bay usually go to sea in groups, about 4 to 10 people. As a member, the fisherman will pay the boat owner 10-20% of the total fish caught as a fee. When the fishermen catch a lot, the price is usually 20%, but when there are few fish, they can pay 10% or even free.

Individuals carry out the fixed lift net investment in Banten Bay. Based on Table 1, the most significant investment value is for a fishing boat. Around five people own boats, with prices ranging from IDR 68 million. The lowest price is IDR 50 million, and the highest is IDR 85 million. Making a fixed lift net is also carried out in cooperation so that the cost of IDR 18 million is the cost of all fixed lift net materials (bamboo, net, generator engine, and lamps). Prasetyo et al (2016) stated that investment capital is the foundation for building a business. The investment costs are adjusted to the catch target, location, and fishing gear.

The variable costs are almost the same. The fixed lift net operates daily with 5 to 7 L fuel requirements. Meanwhile, the supplies are usually the same size for cigarettes and food. The difference is the cost of transportation to the boat owner, which is an average of 15% of the total fish caught. However, if the catch is small, fishermen may not pay transport fees or boat owners may voluntarily not collect transportation fees. If the average boat owner has five members, the total income from the transport fee (boat fee) is IDR 57.66 million.

The fixed costs consist of repair costs for the engine and bamboo. Fishermen need to add or replace bamboo to support the lift net structure. It is usually carried out every season. The service cost for repairing the engine is generally one year or when the machine breaks down. The fixed price from the boat owner is higher because of ship maintenance.

The revenue from the fixed lift net is still higher than the investment cost (Table 1). The income obtained by fishermen is almost the same because the fishing gear size and fishing location are still in the same area. Likewise, the price of fish is still the same between fishermen. The main target of the fixed lift net is anchovy. In peak season, the average anchovy catch can reach up to 20 kg/trip, with a price of IDR 10,000/kg. Meanwhile, in the regular and lean seasons, the average can reach 10 kg/trip and 5 kg/trip respectively, with prices ranging from IDR10,000 to IDR15,000/kg. The bycatch of the lift net are sardines, squid, ponyfish, and other fish.

Fish prices differ in each season. During peak season, fish prices fall. Meanwhile, fish prices rise/high during regular and lean seasons because of their availability. Alam et al (2017) stated that the catch per day for the anchovies is relatively high during the peak season so that the anchovies can produce high production on each trip. However, the price of fish for each region can differ depending on the abundance of fish. If one type of fish is abundant, the price will usually fall and vice versa. According to Wasahua & Lukman (2016), seasons can influence the amount of fish caught, and the cost of fish can be the same or different each season. The revenue is affected by the number of catches and the fish price (Ningsih et al 2013). In addition to receiving payment from the selling catch, fishermen who own boats also receive income from transportation costs from fishermen who do not own boats.

The results of the business feasibility analysis show that the fixed lift net business in Banten Bay, whether owned by boat or not, is still feasible to continue to operate and is still profitable. The fixed lift net is still beneficial because the revenues exceed the costs incurred. The results of the R/C analysis show that fixed lift nets are still profitable because they are worth more than 1 (R/C > 1). If a company is feasible, it rarely fails in practice (Foeh & Tuera 2014).

The results of the net B/C from all fixed lift net fishermen who own boats is more than one. However, for fishermen who do not own a boat, the net B/C value is less than one at the price level for non-subsidized fuel (Table 2) and fuel price at retailers (Table 1). Net B/C > 1 means the business is profitable and can be continued, but if net B/C < 1, the company is unfit to continue (Kadariah et al 1999; Irnawati et al 2021). It shows that the increase in fuel prices is burdening fishermen. If fuel prices continue to rise, then business is unfit to continue. The cost of purchasing fuel is the most significant component of fishing operational costs (Luhur & Sari 2012). An increase in fuel consumption will change variable costs (Rahmawati et al 2017). The rise in fuel prices causes an increase in fixed lift net fuel costs in Banten Bay of up to 12.5%. If fishermen can access subsidized fuel, they can save up to 37.5% on fuel costs.

The increasing fuel price will decrease fishermen's incomes because of increasing operating costs (Lasut et al 2016; Choirunnisa & Atmanti 2021). Fuel costs represent a significant part of the operational costs, up to 50% of the total fishing costs. Fuel price changes have a relevant impact on the fleets' economic performance (Guillen & Maynou 2016). Fuel use is essential for the economy of the fisheries. Fuel-intensive fisheries can remain profitable due to fuel subsidies if the target species is highly valued (Bastardie et al 2022). The absence of fuel price support will negatively impact fishers' income (Parker & Tyedmers 2015) and threaten the sustainability business of fishermen in Banten Bay.

The fishing effort's feasibility requires considering the length of the return on investment from the net profit earned (PP). The PP for all fixed lift net is less than one year, which means the anchovy fishing business with a fixed lift net in Banten Bay is still profitable because the return on investment can be done faster. The PP can describe the time it takes and which is embedded in an asset to be fully recovered.

Conclusions. The sustainability status of fixed lift net business in Banten Bay is still profitable and feasible, based on the R/C value > 1, and the payback period is less than

one year. The increase in fuel prices causes a decrease in the net B/C value. If fuel prices continue to rise, the sustainability of fixed lift net fisheries in Banten Bay could be threatened.

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Conflict of interest. The authors declare that there is no conflict of interest.

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