JURNAL IPTEK
MEDIA KOMUNIKASI TEKNOLOGI
homepage URL : ejurnal.itats.ac.id/index.php/iptek

Economical Analysis of 3GT Traditional Fishing Vessels in The Waters of Bengkalis Island

Jamal[1], Budhi Santoso[2]

[1,2]Marine Engineering, Politeknik Negeri Bengkalis, Indonesia

ARTICLE INFORMATION

Jurnal IPTEK – Volume 25
No. 2, December 2021

Page:
77 – 86
Published Date:
31 December 2021

DOI:
10.31284/j.iptek.2021.v25i2.257

ABSTRACT

Bengkalis Island is the island of the capital city of Bengkalis regency, Riau province. Bengkalis Island is surrounded by the ocean so that the people who are on the edge of the coast mostly work as fishermen. Fishing boats in Bengkalis Island reach more than 2000 units. The limitations of fishing make it fishermen more difficult to get more income. There are a lot of efforts made by fishermen to improve these results including increasing engine power/speed of the ship and also changing fishing gear. To change this means increasing the operational costs of ships. For this reason, economic analysis needs to be calculated. In this study fishing boats are divided into 6 models, 3 models are distinguished based on the driving machine, namely 12 PK, 16 PK, and 24 PK while the other 3 models are distinguished based on the fishing gear, namely tansi net, kurau net, and longline. Analysis using the Net Present Value (NPV) method is knowing the model of the ship that returns the fastest capital and has the biggest advantage. The largest Net Present Value (NPV) is in Model 3 or 4 with NPV of Rp 307,091,520 and Internal Rate of Return (IRR) of 608.4%, namely yapal vessels that have 24 PK engine power and use tansi fishing gear

Keywords: *Bengkalis Island; Economic analysis; Fisherman Ship; Net Present Value.*

EMAIL

jamal@polbeng.ac.id
budhisantoso@polbeng.ac.id

PUBLISHER

LPPM- Institut Teknologi Adhi Tama Surabaya
Address:
Arief Rachman Hakim Street No.100, Surabaya 60117,
Phone: 031-5997244

ABSTRAK

Pulau Bengkalis adalah sebuah pulau yang merupakan ibu kota Kabupaten Bengkalis, Provinsi Riau. Pulau Bengkalis dikelilingi oleh lautan sehingga sebagian besar masyarakat yang tinggal di pesisir pantai adalah nelayan. Ada lebih dari 2000 perahu nelayan di Pulau Bengkalis. Keterbatasan penangkapan ikan membuat nelayan semakin sulit untuk mendapatkan lebih banyak. Banyak upaya yang telah dilakukan oleh nelayan untuk meningkatkan hasil tersebut, antara lain meningkatkan daya/kecepatan mesin perahu dan juga mengganti alat tangkap. Untuk mengubah ini berarti meningkatkan biaya operasi kapal. Untuk itu, analisis ekonomi perlu diperhatikan. Pada penelitian ini kapal penangkap ikan dibagi menjadi 6 model, 3 model dibedakan berdasarkan mesin penggeraknya yaitu 12 PK, 16 PK, dan 24 PK, sedangkan 3 model lainnya dibedakan berdasarkan alat tangkap yaitu jaring tansi, jaring kurau, dan antrean panjang. Analisis menggunakan metode Net Present Value (NPV) adalah untuk mengetahui model kapal mana yang mengembalikan modal tercepat dan memiliki keuntungan terbesar. Net Present Value (NPV) terbesar terdapat pada Model 3 atau 4 dengan NPV sebesar IDR 307.091.520 dan Internal Rate of Return (IRR) sebesar 608,4% yaitu kapal yapal yang memiliki tenaga mesin 24 HP dan menggunakan alat tangkap tansi.

Kata kunci: Pulau Bengkalis; Analisis Ekonomi; Kapal Nelayan; *Net Present Value.*

INTRODUCTION

Bengkalis is a part of Riau province with an area of 7,773.93 km2 whose territory is at a position of 2°30' North Latitude - 0°17'N and 100°52'E - 102°10'E. Bengkalis Regency is also in the position of Indonesia's growth triangle, namely: Malaysia, Indonesia, Singapore and Indonesia,

Malaysia, Thailand which are separated by the Malacca Strait and are directly opposite the State of Malaysia. Bengkalis Island can be seen on the map of Riau province in Figure 1.1

Bengkalis Island is an archipelagic area so it requires inter-island transportation means, the means of transportation used in general are traditional fishing boats. The need for fishing vessels every year has increased and has a very large demand. In accordance with data from the Bengkalis Regency Fisheries Service, in 2004 alone, the need for Pompong fishing vessels reached 2,284 specifically in Bengkalis Regency [1] while in 2014 it reached 1119 specifically in Bengkalis Island waters [2].

Figure 1. Map of Riau Province [4]

. By taking Bengkalis Island as the object of research, because Bengkalis Island is one of the islands that are rich in fisheries resources and there are still many traditional boats used by fishermen to go to sea, where almost all traditional boat fleets use diesel engine propulsion. The limitations of catching fishery resources make it increasingly difficult for Bengkalis fishermen to get their catch, this condition is addressed by increasing the speed of ships to hunt fish by increasing power. catches have decreased due to limited capital to be able to go to sea longer. The economic analysis in this study aims to make the fishermen get optimal income, can be used as a reference for the economic side of the shipowner in operating the fleet, so the following problem formulations are taken [6]:

1. How to determine the economic feasibility of a ship with optimal cost planning?
2. How long will it take to reach BEP?

LITERATURE REVIEW

A fishing/fishing vessel is a vessel that is built to carry out fishing business work with the size, design of the deck shape, loading capacity, accommodation, engines, and various equipment which are entirely adapted to the functions in the operating plan [7]. The shipowner must take into account the costs that must be incurred during the operation of the ship. By knowing what costs are incurred and the amount, the shipowner can calculate the profit earned, and for the shipowner to find out in how many years or how many times the ship has operated, it can be used for a return on investment for an investment.

To analyze the feasibility of vessel investment can be calculated using the Net Present Value (NPV) and Cost-Benefit Analysis methods, namely:

Break Event Points (BEP)

BEP is the point at which total revenue is equal to total cost [3]

Net Present Value (NPV)

NPV is a method that basically aims to find the difference between current receipts and spending money. All receipts and expenditures that occurred in the past are brought to the present condition

then the difference is sought and if the difference is positive, it means that the income that has occurred is greater than the expenditure that has occurred [3].

NPV = PV of income – PV of output

= average profit per year (P/a,i,5) + ship depreciation price (P/F,i,5) (1)

Internal Rate of Return (IRR)

IRR is an indicator value that is identical to how much interest the investment can provide compared to the generally accepted bank interest rate (market interest rate or Minimum Attractive Rate of Return/MARR). At the IRR interest rate, NPV = 0, in other words, that the IRR implies the interest rate that can be given an investment, which will give NPV = 0. The eligibility condition is if IRR > MARR interest rate. According to Gray, IRR is the discount rate that makes NPV equal to zero but has nothing to do with the discount rate 41 which is calculated based on data outside the project as a social opportunity cost of capital (SOCC)

Generally applicable in the community (deposit interest). To calculate the previous IRR, you must find the discount rate that produces a positive NPV, then look for the discount rate that produces a negative NPV. The next step is to interpolate with the following formula:

$$i_1 + \frac{NPV_1}{(NPV_1 - NPV_2)}(i_2 - i_1) \quad (2)$$

description:

IRR = *Internal Rate of Return*
i_1 = Discount Rate resulting in NPV+
i_2 = Discount Rate resulting in NPV-
NPV1 = Net Present Value is positive
NPV2 = Net Present Value is negative

According to Yacob Ibrahim, the Internal Rate of Return or IRR is a discount rate that produces an NPV equal to 0. IRR has three values, each of which has meaning on the investment criteria, namely [3]:

1. IRR < SOCC, this means that the business or project is not financially viable.
2. IRR = SOCC, this also means that the business or project is in a state of the break-even point.
3. IRR > SOCC, this means that the business or project is financially viable

METHOD

The economic analysis in this study aims to select and determine the most profitable traditional fishing boat model in Bengkalis waters. The amount of profit and return on investment is calculated annually. The analysis is carried out in two ways, namely:

1. Economic analysis based on the comparison of engine power used
2. Economic analysis based on the type of fishing gear used.

Based on the two economic analyzes, an analysis of several ship models that can represent the fishing boats on the island of Bengkalis is carried out. Some of these models can be seen in the diagram below. It is a Decision Tree for ship selection methodology to determine the most economical/profitable vessel to be used as a fishing vessel in the waters of Bengkalis Island. The selection of engine power is based on the majority of the use of engine power for 3GT fishing boats in the waters of the Bengkalis island. In general, 3GT fishing boats in the waters of Bengkalis Island use the main propulsion engine with the general power being: 12 PK, 16 PK, and 24 PK. Likewise, the fishing gear used varies, and in general are tansi nets, kurau nets, and long lines.

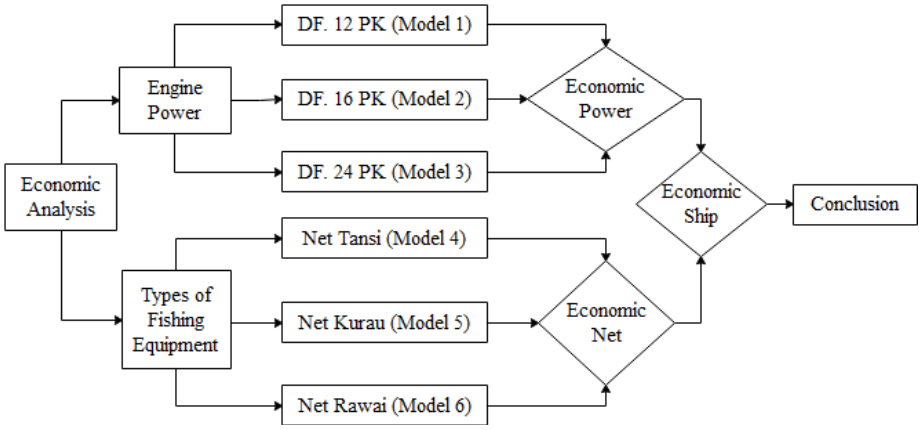

Figure 2. Decision tree of the most economical fishing boat selection methodology.

To determine the most economical ship, an analysis is carried out using the Net Present Value (NPV) method, which is to find out which ship model has the fastest return on capital and has the greatest profit.

RESULTS AND DISCUSSION

In determining the economic analysis, the size of power and types of fishing gear are used as several models, namely:

1. Model 1: Engine power 12 PK, fishing net tansi
2. Model 2: Engine power 16 PK, fishing net tansi
3. Model 3: Engine power 24 PK, fishing net tansi
4. Model 4: Using tanance net fishing gear, engine power 24 PK
5. Model 5: Using kurau net fishing gear, engine power 24 PK
6. Model 6: Using longline fishing gear, engine power 12 PK.

In this study, the steps for calculating the economic analysis were carried out in several stages. The steps are described as follows:

Ship Investment Calculation

The investment cost of fishing boats is the total cost that must be incurred by the shipowner to build or buy a ship and fishing boat fishing equipment.

(Rp) (Rp) (Rp) (Rp)

Table 1. Vessel investment costs

Ship Model	Boat Price (Rp)	Fishing Equipment Cost (Rp)	Net Reel Price (Rp)	Total Vessel Investment Cost (Rp)
Model 1	15.000.000	42.000.000	-	57.000.000
Model 2	20.000.000	42.000.000	3.000.000	65.000.000
Model 3	22.000.000	42.000.000	3.000.000	67.000.000
Model 4	22.000.000	42.000.000	3.000.000	67.000.000
Model 5	23.000.000	63.000.000	3.000.000	89.000.000
Model 6	15.000.000	5.000.000	-	20.000.000

From table 1 above, the largest investment costs incurred were by ship model 5 with an investment of Rp. 89,000,000.00, while the smallest investment was in model 6 with an investment of Rp. 20,000,000.00.

Investment Multiplier Analysis

Investment multiplier cost analysis and calculation of investment components are shown in table 5.2. Investment multiplier consists of loan, loan period, grace period, bank interest, loan interest, final investment value, and economic life. The economic age of 10 years is taken based on the productive age of the fishing boat [5].

Table 2. Assumption of investment multiplier

Loan	75%	Capital
Loan Period	5	years
Grace Period	0	years
Bank Interest	12%	/ years
Loan Interest	12%	/ years
Final Value of Investment	5%	
Economic Life	10	years

Vessel Operating Cost

Included in the operational costs in this study are: shipping costs, crew salaries, and maintenance costs

Shipping Fee

Shipping costs include fuel costs, crew costs, lubricating oil costs, and bait costs (especially for longline fishing gear). for more details can be seen in table 3.

Table 3. Fuel costs

Ship Model	BBM/year (Rp)	Lubricant per year (Rp)	Consumption per year (Rp)
Model 1	5.940.000	500.000	19.800.000
Model 2	8.316.000	500.000	19.800.000
Model 3	11.880.000	500.000	19.800.000
Model 4	11.880.000	500.000	19.800.000
Model 5	11.880.000	500.000	33.000.000
Model 6	17.820.000	500.000	31.860.000

The calculation of the cost of fuel (diesel) per year for all models is calculated based on the fuel used per trip multiplied by the market price of diesel, which is Rp. 6000 / liter. From the survey data that has been carried out, it is found that model 6 has the most expensive fuel cost, which is Rp. 17,820,000 / year, this is because it has the longest cruising distance even though this ship has the smallest engine. The smallest fuel cost is owned by model 1 at a cost of Rp. 5,940,000 / year.

The calculation of the cost of lubricants for all models is the same, which costs Rp. 500,000 / year with the need for lubricants of 20 liters per year. To get the cost of the annual need for lubricants, the need for lubricants per year is multiplied by the market price of lubricant, which is Rp. 25,000 / liter.

The cost of crew needs is the cost of crew consumption, cigarettes, and other needs while onboard. The cost of the largest crew requirement is Rp. 33,000,000 per year, which is model 5. Model 5 has the largest cost because in fishing activities, not only during the day but must stay for 7 days at sea. In contrast to models 1, 2, 3, or 4, has the smallest consumption because fishing per trip is only done for 1 day without staying at sea.

Salary of Ship's crew (ABK)/Crew

The salaries of 2 crew members include: Salaries of the captain and crew, the details of the funds can be seen in Table 4 below. Crew salary costs for models 1, 2, 3, 4, and 6 are the same,

namely Rp. 49,000,000/year. In contrast to the cost of crew salaries, model 5 has a cheaper crew salary of Rp. 46,970,000 / year because it has fewer working hours. Model 5 has the biggest cost because in fishing activities it is not only during the day but has to stay for 7 days at sea.

Table 4. ABK/crew salary costs

Model Ship	Salary Crew	Annual Wage (Rp)
Model 1, 2, 3, 4 & 6	Captain	29.700.000,00
	crew	19.800.000,00
	Total	49.500.000,00
Model 5	Captain	26.950.000,00
	crew	20.020.000,00
	Total	46.970.000,00

Maintenance costs

The total maintenance costs based on the survey results that have been carried out are generally the same, namely IDR 4,000,000 / year for maintenance and repair of the hull. However, model 5 has the largest maintenance cost, which is Rp. 16,600,000 / year because model 5 has a more expensive net price.

Table 5. Vessel Maintenance Costs

Type of Maintenance and Maintenance	Annual Maintenance Fee (Rp)		
	Model 1, 2, 3 & 4	Model 5	Model 6
Hull Care and Maintenance	4.000.000	4.000.000	4.000.000
Net Maintenance and Replacement	8.400.000	12.600.000	5.000.000
Total Treatment Cost	12.400.000	16.600.000	9.000.000

Gross Income

Get the cost of maintenance and replacement of nets by dividing the price of the net into 5 years (the age of the net). To see more clearly the maintenance costs of each model of a fishing boat on the island of Bengkalis can be seen in table 5.7. Gross income is the amount of income earned by the owner of the ship in accordance with the sales of fish caught during 1 year. Table 5.11 explains that the largest gross income is model 5, which is Rp. 149,100,000/year. While the smallest gross income in model 1 is Rp 126,900,000/year.

Table 6. Gross income

Ship Model	Revenue per trip (Rp/trip)	Number of trips per year	Gross Income per year (Rp)
Model 1	705.000	180	126.900.000
Model 2	1.020.000	180	183.600.000
Model 3	1.071.000	180	192.780.000
Model 4	1.071.000	180	192.780.000
Model 5	7.455.000	20	149.100.000
Model 6	915.000	180	164.700.000

Administration Fee and Tax

Ship tax costs are costs incurred by shipowners to the government, in accordance with the rules if a shipping company (domestic company) provides shipping services such as transporting people and/or goods, the shipping company must pay PPh article 15 at a rate of 1.2%, so it's the income tax. = 1.2% x Revenue.

Table 7. Administration fees and taxes

Ship Model	Gross Revenue (Rp)	Cost of PPH (Rp)
Model 1	126.900.000	1,522,800
Model 2	183.600.000	2.203.200
Model 3	192.780.000	2.313.360
Model 4	192.780.000	2.313.360
Model 5	149.100.000	1.789.200
Model 6	164.700.000	1.976.400

Ship Insurance

Ship insurance is a party that guarantees damage or loss to ships due to perils of the seas such as bad weather, collision, aground, stranded, sinking, collision, fire, explosion, piracy, dumping of goods into the sea (jettison), collision, negligence of the captain/crew, etc., legal liability to third parties due to ship collision (collision liability), general average loss contribution. According to PT. Sinar Mas conditions for ships that can be insured are as follows:

- Iron Ship Maximum Age 25 years Minimum 100 GRT
- Barge & Tug Boat Maximum Age 15 years Minimum 100 GRT
- LCT Maximum Age 15 years Minimum 100 GRT
- Wooden Ship Maximum 10 years Minimum 100 GRT so boats smaller than 100 GT cannot be insured

Based on the terms of the insurance, the 3GT fishing boat does not have insurance or the insurance is equal to zero.

Return on Capital or Break Event Point (BEP), Net Present Value (NPV), and Internal Rate of Return (IRR)

Calculation of the BEP payback table for more details can be seen in the appendix. However, in Tables 8 to 12, it is clearly shown that the Break Event Point (BEP), Net Present Value (NPV), and Internal Rate of Return (IRR) are clearly shown.

Table 8. Table of NPV, BEP, and IRR of Model 1 vessels

Investment Criteria	Unit	Value	Criteria	Min	Remarks
Present Worth (PW or NPV) at 5th year	Rp	86.699.540	Ok	0	Positive Incr. Wealth
Present Worth Index (NPVI)	time	1,52	Ok	0	Null
IRR	%	184,2%	Ok	8,0%	MARR
IRR Index (IRRI = IRR / MARR)	time	23,02	Ok	0	Null
BEP from a year -		1	Ok	1	Construction Period
Accum Cash on BEP	Rp	10.745.134	Ok	0	Positive Accum Cash

Table 9. Table of NPV, BEP, and IRR of Model 2 vessels

Investment Criteria	Unit	Value	Criteria	Min	Remarks
Present Worth (PW or NPV) at 5th year	Rp	218.570.905	Ok	0	Positive Incr. Wealth
Present Worth Index (NPVI)	time	3,83	Ok	0	Null
IRR	%	437,2%	Ok	8,0%	MARR
IRR Index (IRRI = IRR / MARR)	time	54,66	Ok	0	Null
BEP from a year -		1	Ok	1	Construction Period
Accum Cash on BEP	Rp	47.327.534	Ok	0	Positive Accum Cash

Table 10. Table of NPV, BEP, and IRR of Model 3 & 4 vessels

Investment Criteria	Unit	Value	Criteria	Min	Remarks
Present Worth (PW or NPV) at 5th year	Rp	307.091.520	Ok	0	Positive Incr. Wealth
Present Worth Index (NPVI)	time	5,39	Ok	0	Null
IRR	%	608,4%	Ok	8,0%	MARR
IRR Index (IRRI = IRR / MARR)	time	76,05	Ok	0	Null
BEP from a year -		1	Ok	1	Construction Period
Accum Cash on BEP	Rp	71.884.014	Ok	0	Positive Accum Cash

Table 11. Table of NPV, BEP, and IRR of Model 5 vessels

Investment Criteria	Unit	Value	Criteria	Min	Remarks
Present Worth (PW or NPV) at 5th year	Rp	60.305.088	Ok	0	Positive Incr. Wealth
Present Worth Index (NPVI)	time	1,06	Ok	0	Null
IRR	%	94,8%	Ok	8,0%	MARR
IRR Index (IRRI = IRR / MARR)	time	11,85	Ok	0	Null
BEP from a year -		2	Ok	1	Construction Period
Accum Cash on BEP	Rp	21.534.668	Ok	0	Positive Accum Cash

Table 12. Table of NPV, BEP, and IRR of Model 6 vessels

Investment Criteria	Unit	Value	Criteria	Min	Remarks
Present Worth (PW or NPV) at 5th year	Rp	179.508.253	Ok	0	Positive Incr. Wealth
Present Worth Index (NPVI)	time	3,15	Ok	0	Null
IRR	%	971,0%	Ok	8,0%	MARR
IRR Index (IRRI = IRR / MARR)	time	121,37	Ok	0	Null
BEP from a year -		1	Ok	1	Construction Period
Accum Cash on BEP	Rp	43.175.134	Ok	0	Positive Accum Cash

It can be seen in tables 8 to 12 that they have the same Break Event Point (BEP), which is 1 year after running. However, the largest Net Present Value (NPV) is in Model 3 or 4 with an NPV of IDR 307,091,520 and an Internal Rate of Return (IRR) of 608.4%. while the one with the longest Break Event Point (BEP) is model 5 with a duration of 2 years after running.

Based on these calculations, it is clear that model 3 or model 4 is the most economical or the most profitable with a net profit after tax of Rp. 86,134,014/year and is followed by model 2, model 6 and with the smallest economic model, model 5.

CONCLUSION

In the calculation of 3 GT fishing vessels in the waters of Bengkalis Island using 6 models, 3 models are distinguished by differences in ship engine power, namely 12, 16, and 24 PK, while the other 3 models are distinguished based on their fishing gear, namely tansi nets, kurau nets, and long lines. The most economical ship is model 3 or model 4, namely a 3 GT fishing boat with an engine power of 24 GT using a tansi net fishing gear with a value with a Break Event Point (BEP) of 1 year, an NPV of IDR 307,091,520 and an Internal Rate of Return (IRR) of 608.4%.

ACKNOWLEDGEMENTS

Thank you to the Bengkalis State Polytechnic Research and Community Service Center (P3M) which has funded this research in the 2017 Polbeng PNBP Lecturer Research program and we also thank you for the cooperation of Bengkalis ship owners/fishers.

REFRENCES

[1] Zarkasyi, I. "Pengaruh Keberadaan Tangkahan Terhadap Pengoprasian Pangkalan Pendaratan Ikan Bengkalis" Fakultas Perikanan dan Ilmu Kelautan. Institut Pertanian Bogor. 2006
[2] M. Nasoha, "Data Prasarana Penangkapan Ikan Kabupaten Bengkalis Tahun 2014". Dinas Kelautan dan Perikanan: Pemerintah Kabupaten Bengkalis. 2014
[3] Suliyanto."Teknik Proyeksi Bisnis". Yogyakarta : ANDI. 2008
[4] Petatematikindo, " Peta Administrasi," 13 March 2013. [Online]. Available: https://petatematikindo.wordpress.com/2013/03/13/.
[5] Samuel, Jowis Novi B.K. "Analisa Ekonomis Pembangunan Kapal Ikan Fiberglass Katamaran Untuk Nelayan Di Perairan Pantai Teluk Penyu Kabupaten Cilacap" Teknik Perkapalan Faktultas Teknik Universitas Diponegoro
[6] De Garmo, E.P. 1999. "Ekonomi Teknik". Jilid 1. Jakarta, Indonesia : PT Prehallido.
[7] Fyson, J. 1985. "Design Of Small Fishing Vessels". England: Fishing News Book.

This Page Intentionally Left Blank