

Financial and Business Sensitivity Analysis of Soft-Shell Crab Cultivation in Tarakan, North Kalimantan

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This study aimed to conduct a financial feasibility analysis of the soft-shell crab cultivation business using both discounted and non-discounted investment criteria, assess its sensitivity to changes, and provide an overview of the practical challenges faced by soft-shell crab cultivators. The study was carried out from September 2021 to April 2022 in Tarakan, North Kalimantan. The total number of eligible population members, consisting of three soft-shell crab farmers, were chosen as respondents or samples using the census method. The research results reveal the following financial feasibility indicators for soft-shell crab cultivation: Net Present Value (NPV) = 4,234,818,810 IDR, Internal Rate of Return (IRR) = 46%, Net Benefit Cost Ratio (Net B/C Ratio) = 3.61, and Payback Period (PbP) = 2.77 years (equivalent to 33.27 months). These findings collectively indicate that soft-shell crab cultivation is financially viable and profitable. Furthermore, the sensitivity analysis demonstrates that the soft-shell crab cultivation business is highly responsive to changes in economic conditions. To maintain profitability, it is crucial to ensure that production and revenue declines remain below the minimum threshold, while cost increases stay within the maximum threshold. The challenges encountered by soft-shell crab cultivators in Tarakan include reduced crab catches, low-quality mangrove crab seedlings, weather-related factors, and issues related to feeding.

Keywords: *Financial Analysis, Sensitivity Analysis, Soft-Shell Crab Cultivation.*

INTRODUCTION

Mangrove forests serve two primary functions: ecological and economic. Ecologically, they function as spawning grounds, feeding areas, nursery grounds for marine life, and a buffer zone against coastal erosion (Gunarto, 2004; Heriyanto & Subiandono, 2012; Setiawan, 2013; retrieved from <https://www.google.com/search?q=fungsi+hutan+mangrove/>, accessed on Thursday, August 10, 2023, at 14:19 Central Indonesian Time). Economically, they provide livelihoods for coastal communities, including the harvesting of mangrove wood for sale and the capture of various creatures living around mangrove trees, including birds, mangrove cats, monkeys, clams, shrimp, fish, and crabs, as well as mangrove clearing for shrimp pond conversion (retrieved from [https://www.brilio.net/hewan yang tinggal di hutan mangrove/](https://www.brilio.net/hewan-yang-tinggal-di-hutan-mangrove/), accessed on Thursday, August 10, 2023, at 14:50 Central Indonesian Time).

The economically valuable species frequently captured by communities in mangrove areas are clams, fish, shrimp, and crab, especially the mud crab (*Scylla serrata*), also known as the soldier crab due to its shell color resembling a soldier's uniform (see Figure 1). North Kalimantan is one of the Indonesian provinces with approximately 21 hectares of mangrove forest in its capital city, Tarakan (retrieved from <https://www.nativeindonesia.com/hutan-mangrove-tarakan/>, accessed on August 10, 2023, at 14:01 Central Indonesian Time). The economic potential of mud crabs in Tarakan is highly promising, as evidenced by the designation of the mud crab as an iconic species in the city. Mud crabs from Tarakan are well-known not only in various cities within Indonesia but also internationally, particularly in neighboring countries like Malaysia (retrieved from <https://kaltara.prokal.co/read/news/34584-ekspor-kepiting-kaltara-ke-malaysia/>, accessed on Friday, August 11, 2023, at 15:02 Central Indonesian Time). Consequently, the demand and price of mud crabs from Tarakan have increased significantly. These conditions have led to an increase in mud crab hunting in Tarakan, further exacerbated by the government's decision, namely the Minister of Marine Affairs and Fisheries Regulation No. 12 of 2020, allowing the export of mud crabs (M. Roy Pahlevi, 2020, Head of Supervision, Control, and Information at the Fish Quarantine and Quality Control Agency of Tarakan). Tarakan's mud crabs are not only exported to Malaysia but also to the United States, Europe, Australia, Japan, South Korea, and Hong Kong (Directorate General of Fisheries, 2000). The extensive harvesting of mud crabs in the wild has become one of the reasons for the declining availability of mud crabs in their natural habitat, and it is known that their potential is rapidly decreasing. This situation necessitates a shift towards cultivation methods (Wiranto, 2019; Mubarak, 2022; retrieved from <https://www.mongabay.co.id/2022/07/30/budidaya-kepiting-bakau-dalam-upaya-mengurangi-penangkapan-di-alam/>, accessed on August 6, 2023, at 16:47 Central Indonesian Time).

Lately, there has been a growing demand for mud crab products in Tarakan, both from domestic and international customers. What they are looking for is the soft-shell crab, which commands a significantly higher price than regular mud crabs. The soft-shell crab, also known as the soft-shelled crab, is a type of mud crab that is currently undergoing a molting process. Crabs in the molting phase have a soft-shell texture (see Figure 2). The transition of a mud crab into a soft-shell crab is marked by the softness of its shell and an increase in both weight and size (Wiranto, 2019). Soft-

shell crabs are favored not only for their soft shells but also for their delicious taste and ease of consumption compared to regular crabs with hard shells. Soft-shell crabs are rich in health benefits, as the crab meat is low in saturated fat, high in protein, and packed with minerals and vitamins. They also contain selenium, which plays a role in preventing cancer and boosting immunity against viral and bacterial infections (Asikin, 2022; retrieved from <https://www.jawapos.com/ekonomi/01425534/ramai-peminat-usaha-budidaya-kepiting-soka-layak-ditekuni>, accessed on Sunday, August 13, 2023, at 10:46 Central Indonesian Time). Similarly, soft-shell crab cultivators in Tarakan have been meeting the high demand for these crabs. They produce an impressive quantity of soft-shell crabs, with each cultivator yielding between 15-30 kg or even more per day (Lisman Duhali, 2020, a fisheries extension officer in Tarakan). The soft-shell crabs from Tarakan, which are highly favored by consumers, typically weigh between 80-150 grams per crab and are sold for 120,000 IDR per kilogram. As a result, each cultivator earns daily revenue ranging from 1,800,000 to 3,600,000 IDR.

One of the significant challenges faced by soft-shell crab cultivators in Tarakan is the unpredictable weather factor, such as sudden rainfall, which leads to an influx of freshwater into the ponds, causing molting to slow down. To address this issue, cultivators must invest in specialized cultivation facilities, including “crab boxes” (see Figure 3), incurring additional costs. In any business, including fisheries-related ventures, both the upstream (initial) and downstream (final) activities are inseparable from the costs incurred and the revenue generated. Ultimately, this determines whether the business is profitable (viable) or not. If it proves to be profitable, it becomes essential to assess the magnitude of revenue in comparison to the expenses incurred and the timeframe required to recover those costs. Moreover, it is crucial to determine the minimum tolerance level for production decline, selling price, revenue, and the maximum tolerance for cost increases to ensure the business’s ongoing viability.

To comprehensively understand these phenomena from a scientific perspective, a study titled “Financial and Business Sensitivity Analyses of Soft-Shell Crab Cultivation in Tarakan, North Kalimantan” was conducted. The primary objectives of this research were to perform a financial analysis of the feasibility of soft-shell crab cultivation in Tarakan, employing discounted investment criteria (i.e., NPV, IRR, and Net B/C Ratio) and non-discounted criteria (i.e., PbP). Additionally, it sought to assess the sensitivity of the business to determine the tolerance level for declining benefits and rising costs. Furthermore, the research aimed to identify the challenges encountered by soft-shell crab cultivators in Tarakan.

METHODS

Time and Location

The field research data collection took place in January 2022 in East Tarakan District, Tarakan, North Kalimantan.

Types of Data and Data Collection Methods

Primary data in this study were obtained directly from the research area through observations and interviews with respondents using a questionnaire prepared to align with the research objectives. Secondary data (supporting data) were collected through a literature review of reports or documents from the Central Bureau of Statistics (Indonesian: *Badan Pusat Statistik* [BPS]) of North Kalimantan, Central Bureau of Statistics of Tarakan, the Fisheries Office (Indonesian: *Dinas Perikanan*) of Tarakan, and the Tourism Office (Indonesian: *Dinas Pariwisata*) of North Kalimantan. The researchers also collected secondary data by analyzing related textbooks, theses, and research journals.

Sampling

The respondents in this study comprised all soft-shell crab cultivators in East Tarakan District, totaling dozens of individuals. However, only three entrepreneurs who met the criteria and were willing to participate in the study were selected as respondents. The selection was made because other potential respondents had relatively new businesses and lacked business records. Therefore, only these three soft shell-crab cultivators were included in the study (census method). Sugiyono (2013) defines a census as a sampling technique in which the entire population is used as a sample.

Data Analysis Methods

Descriptive Analysis

Descriptive analysis was employed to portray the factual conditions of soft-shell crab cultivators concerning the challenges they encounter while operating their soft-shell crab cultivation businesses in Tarakan, as well as the anticipated solutions.

Analysis of Revenue and Profit

The calculation of revenue (Soekartawi, 2003) can be carried out using the following formula.

$$TR = P_Q \times Q$$

Where:

TR = Total Revenue (in IDR/year)

P = Price (in IDR/kg)

Q = Quantity Produced (in kg)

Furthermore, profit can be determined using the following formula.

$$\pi = TR - TC$$

Where:

π = Profit (in IDR/year)

TR = Total Revenue (in IDR/year)

TC = Total Cost (in IDR/year)

Financial Analysis

Net Present Value (NPV)

As stated by Kasmir and Jakfar (2010) and Helminuddin *et al.* (2020), Net Present Value (NPV) is obtained by comparing the Present Value (PV) of net benefits with the Present Value (PV) of costs.

$$NPV = \sum_{t=1}^n \frac{Bt - Ct}{(1+i)^t}$$

Where:

Bt = Gross benefit in year t (in IDR)

Ct = Gross cost in year t (in IDR)

n = Economic lifespan of the soft-shell crab cultivation business (in years)

i = Applicable interest rate (%)

t = Year

Internal Rate of Return (IRR)

The IRR value indicates the ability of a project to generate a return on capital or the level of profitability achieved in the project being undertaken. IRR is calculated using the following formula (Kadariah, 2001; Helminuddin *et al.*, 2020).

$$IRR = i_1 + \frac{NPV_1}{NPV_1 - NPV_2} (i_2 - i_1)$$

Where:

NPV' = Positive Net Present Value (in IDR)

NPV'' = Negative Net Present Value (in IDR)

i' = Discount Rate that yields a positive NPV (%)

i'' = Discount Rate that yields a negative NPV (%)

Net Benefit Cost Ratio (Net B/C Ratio)

The Net B/C Ratio is the comparison between net benefits and net costs that have been discounted to present value, where the numerator is positive, and the denominator is negative (Kadariah *et al.*, 1999; Helminuddin *et al.*, 2020).

$$Net\ B/C = \frac{\sum_{t=1}^n \frac{Bt}{(1+i)^t}}{\sum_{t=1}^n \frac{Ct}{(1+i)^t}}$$

$$\frac{[Bt - Ct > 0]}{[Bt - Ct < 0]} = \frac{\sum PV \text{ Net Benefit (+)}}{\sum PV \text{ Net Benefit (-)}}$$

Where:

Bt = Gross benefit in year t (in IDR)

Ct = Gross cost in year t (in IDR)

n = Economic lifespan of the soft-shell crab cultivation business (in years)

i = Applicable interest rate (%)

t = Year

Payback Period (PbP)

The Payback Period (PbP) analysis aims to determine the time it takes to recover the investment made in a particular type of business. The formula used to calculate the Payback Period (PbP) according to Pudjosumarto (1998) is as follows.

$$PbP = \frac{I}{A_b}$$

Where:

PbP = Payback Period

I = Investment Cost

A_b = Net Profit (in IDR/year)

The criteria for PbP are as follows:

- A payback period of less than 3 years is categorized as a quick return.
- A payback period between 3 - 5 years is categorized as a moderate return.

Sensitivity Analysis

Sensitivity analysis, as defined by Khotimah *et al.* (2002), is a measure that indicates how much a project variable must change to render the project no longer feasible.

$$\text{Switching Value} = n_1 + (n_2 + n_1) - \frac{NPV_1}{NPV_1 - NPV_2}$$

Where:

n_1 = The value estimated to result in $NPV \leq 0$

n_2 = The value estimated to result in $NPV \geq 0$

NPV_1 = Positive Present Value of n_1

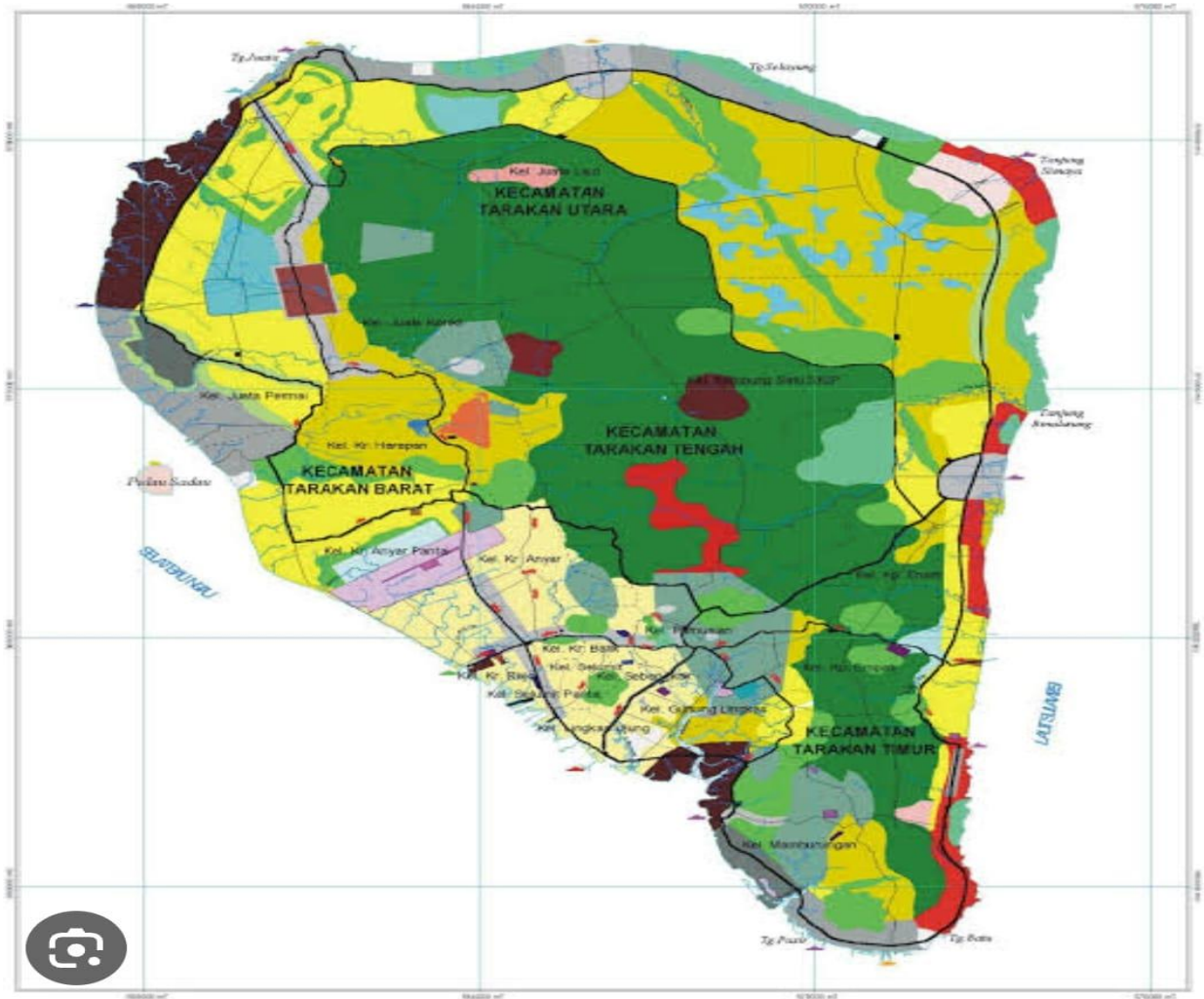
NPV_2 = Negative Present Value of n_2

RESULTS AND DISCUSSION

Tarakan is situated between 3°14'30" – 3°26'37" N and 117°30'50" – 117°40'12" E. Geographically, Tarakan shares boundaries with the following regions:

- North : Bulungan Regency and Tana Tidung Regency
- East : Sulawesi Sea
- South : Bulungan Regency
- West : Bulungan Regency (Central Bureau of Statistics of Tarakan, 2022)

Tarakan is divided into four districts, namely North Tarakan with an area of 109.36 km², East Tarakan covering an area of 58.01 km², Central Tarakan spanning 55.54 km², and West Tarakan with an area of 27.89 km² (Central Bureau of Statistics of Tarakan, 2022), as depicted in the astronomical map of Tarakan below.



Source:
downloaded on Saturday, September 2, 2023.

<https://peta-hd.com/peta-kota-tarakan/>,

Cultivation activities commence with the sorting of mangrove crab seedlings, the trimming of walking and swimming legs, seedling stocking, maintenance and feeding, and control procedures, culminating in the harvesting process. Research findings indicate that the soft-shell crab production cycle occurs once a month, resulting in twelve soft-shell crab production cycles per year. The products of soft-shell crab cultivation are illustrated in the following images.



Figure 1. Mangrove Crab
(*Scylla serrata*)



Figure 2. Soft-Shell Crab



Figure 3. Crab Boxes

Note: Figures 1, 2, and 3 are personal documentation (2022).

The economic performance of soft-shell crab cultivation activities necessitates expenditures, encompassing both investment costs and operational and maintenance costs. These are detailed as follows.

Investment Costs

Investment costs represent expenses incurred at the outset (before the operational activities of soft-shell crab cultivation commence). The investment capital utilized is derived from personal funds. Investment equipment employed for soft-shell crab cultivation comprises ponds, bridges, harvest houses, guard huts on rafts, crab boxes, baskets, and other investment equipment with lifespans ranging from 1 to 10 years. The total investment capital allocated to cars and speedboats is adjusted by the proportion of usage or the estimated quantity of these investment items utilized in soft shell-crab cultivation. For each respondent, car usage is estimated at 20-30% of the purchase price, while speedboat usage amounts to 20% of the purchase price. The overall investment costs incurred by respondents range from 703,565,000 IDR to 2,859,901,000 IDR, with an average expenditure of 1,624,808,667 IDR per respondent, as outlined in Table 1.



Table 1. Recapitulation of Average Investment Costs for Respondents

No.	Investment Items	Unit	Cost (IDR)
1	Crab Pond	unit	1,166,666,667
2	Bridge to Crab Pond	unit	13,333,333
3	Harvest House	unit	2,666,667
4	Guard House	unit	5,000,000
5	Electric Installation for Lighting	unit	1,500,000
6	Crab box with the size of $26 \times 19 \times 16$ cm	unit	272,000,000
7	Raft	unit	59,666,667
8	Scissors	unit	45,000
9	Freezer Box	unit	36,666,667
10	Production Shelf Refrigerator	unit	6,666,667
11	Plastic Bucket	unit	116,667
12	Seedling Baskets	unit	800,000
13	Harvest Baskets	unit	1,100,000
14	20 kg Styrofoam Box	unit	146,667
15	30 kg Styrofoam Box	unit	55,000
16	Small Plastic Chairs	unit	110,000
17	Digital Bench Scale	unit	2,666,667
18	Fabric Gloves	dozen	66,667
19	Water Pump Machine	unit	1,000,000
20	12 Inch Hose	m	52,000
21	Headlamp	unit	750,000
22	Towel	unit	133,333
23	Mobile Phone	unit	2,166,667
24	Cooking Equipment	package	66,667
25	Dining and Drinking Equipment	package	66,667
26	Motorcycle	unit	33,333,333
27	Car	unit	13,333,333
28	Speedboat	unit	3,000,000



29	Guard House Construction Fee	package	1.333.333
30	Harvest House Construction Fee	package	300,000
Total			1,624,808,667

Source: Primary Data, 2022

Operational and Maintenance Costs

Operational costs represent expenses incurred during the soft-shell crab cultivation process. The operational costs borne by the respondents are sourced from their respective capital. Operational costs are divided into two categories:

1. Fixed Costs: These are expenses whose amounts remain constant, even when the quantity of desired products changes. The soft-shell crab cultivation conducted by the respondents incurs fixed costs, including labor wages, electricity, phone credit, fuel, and equipment replacement costs with lifespans of 1-10 years. The fixed costs to be borne by the respondents from year 1 to year 10 amount to 75,600,000 IDR to 91,200,000 IDR per year.
2. Variable Costs: These are expenses whose amounts are not fixed and can change based on the quantity of soft-shell crabs produced. These include mangrove crab seedlings, seedling feed, and labor costs. The variable costs incurred by the respondents range from 391,800,000 IDR to 957,450,000 IDR.

The average monthly operational and maintenance costs incurred by the respondents amount to 66,531,083 IDR, with an average annual cost of 796,625,000 IDR. This can be seen in Table 2 below.



Table 2. Recapitulation of Average Operational Costs for Respondents

No.	Operational Items	Unit	Quantity	Price (IDR)	Total Cost (IDR/month)	Total Cost (IDR/year)
A	Variable Costs					
1	Mangrove Crab Seedlings	kg	1,467	37,000	54,279,000	649,600,000
2	Bycatch-Based Feed	kg	87.5	2,500	218,750	2,625,000
3	Shrimp-Based Feed	kg	75	20,000	1,500,000	18,000,000
4	Chinese Herring-Based Feed	kg	120	10,000	1,200,000	14,400,000
5	Labor Consumption	month	1	2,050,000	2,050,000	24,600,000
Subtotal A					59,247,750	709,225,000
B	Fixed Costs					
6	Labor Wages	person	2	2,500,000	5,666,667	68,000,000
7	Electricity	month	1	143,333	143,333	1,720,000
8	Phone Credit	month	1	100,000	100,000	1,200,000
9	Car Fuel	liter	50	12,000	600,000	7,200,000
10	Motorcycle Fuel	liter	40	10,000	533,333	6,400,000
11	Speedboat Fuel	unit	20	12,000	240,000	2,880,000
12	Equipment Peplacement	unit	-	-	-	-
Subtotal B					7,283,333	87,400,000
Total A and B					66,531,083	796,625,000

Source: Primary Data, 2022

Revenue and Profit

Revenue is obtained from the sales of soft-shell crab products, multiplied by their selling price. The average annual revenue obtained per respondent is 1,355,200,000 IDR. Profit is the difference between the total revenue (TR) and the total cost (TC) of the soft-shell crab cultivation business. The profit earned by the respondents is 558,575,000 IDR per year on average, as shown in Table 3 below.

Table 3. Average Revenue and Profit for Respondents Per Year

Soft-Shell Crabs	Revenue (IDR/year)	Total Cost (IDR)		Total Cost (IDR)	Profit (IDR)
		Variable Cost	Fixed Cost		
	1,355,200,000	709,225,000	87,400,000	796,625,000	558,575,000

Source: Primary Data, 2022

Financial Analysis

Financial analysis is used to determine the cash flow of the soft-shell crab cultivation business to analyze whether the business implementation can provide optimal profits to the cultivators. The financial analysis used includes discounted investment criteria (i.e., NPV, IRR, and Net B/C Ratio) and non-discounted investment criteria (i.e., PbP). The results of the financial analysis of the actual conditions of the soft-shell crab cultivation business in Tarakan show that the business is profitable and therefore worthy of continuation (see Table 4).

Table 4. Financial Analysis of Actual Conditions of the Respondents' Business

NPV (IDR)	IRR (%)	N B/C R	PbP (Year)	Remark
4,234,818,810	46	3.61	2.77	Feasible

Source: Primary Data, 2022

Net Present Value (NPV)

NPV represents the difference between benefits and costs that have been discounted to their present value. The NPV for soft-shell crab cultivation in Tarakan is 4,234,818,810 IDR (> 0). According to NPV criteria, if the NPV value is greater than 0, the business is considered profitable and feasible. An NPV of 4,234,818,810 IDR signifies that the soft-shell crab cultivation businesses run by the respondents are worth continuing because they can generate a net benefit equal to the NPV value over 10 years. This research outcome aligns with other studies conducted by Pratama *et al.* (2012), Khotimah and Sutiono (2014), and Suryanto and Sumartono (2016), confirming that an NPV greater than 0 implies a profitable and viable business (a “go project”).

Internal Rate of Return (IRR)

IRR represents the rate of return on invested capital used to operate a business. It is considered feasible if the IRR exceeds the opportunity cost of capital (OCC), or the prevailing bank interest rate. The analysis of soft-shell crab cultivation in Tarakan yielded an IRR of 46% ($> 5.5\%$), which is higher than the OCC (5.5%). Consequently, soft-shell crab cultivation in Tarakan is considered profitable and feasible. These research findings are consistent with previous studies conducted by



Pratama *et al.* (2012), Murwanto (2015), Sharon *et al.* (2016), Khotimah *et al.* (2018), and Iromo (2019), all of which assert that an IRR exceeding OCC signifies a profitable and viable business (a “go project”).

Net Benefit Cost Ratio (Net B/C Ratio)

The Net B/C Ratio is the ratio between benefits, which have been discounted to their present value (a positive value), and net costs, which have also been discounted to their present value (a negative value). The Net B/C Ratio obtained from the analysis is 3.61 (> 1). This value indicates that soft-shell crab cultivation is a profitable and viable business. Another interpretation of the Net B/C Ratio value of 3.61 is that for every 1 IDR spent, the business generates a benefit of 3.61 IDR. These research results are consistent with studies conducted by Astanu *et al.* (2013), Suryanto and Sumartono (2016), and Wiranto (2019), all of which argue that a Net B/C Ratio greater than 1 indicates a profitable and viable business worth pursuing.

Payback Period (PbP)

The Payback Period is a value that indicates the time required to recover the entire capital investment cost incurred in the soft-shell crab cultivation business in Tarakan. The analysis of the Payback Period resulted in a value of 2.77 years, meaning that the investment costs incurred will be recouped within a period of 2.77 years or 33.27 months (less than half of the project’s lifespan). These results indicate that soft-shell crab cultivation is profitable and feasible. This finding aligns with previous research conducted by Khotimah *et al.* (2018) and Kuswardani *et al.* (2020), both of which state that if the PbP value is less than the project’s lifespan, the business is worth continuing (a “go project”).

Sensitivity Analysis

Sensitivity analysis is used to determine how tolerant the soft-shell crab cultivation business in Tarakan is to changes in production, selling price, and income (benefits) in response to changes in production components that result in increased capital costs. The scenario used to conduct sensitivity analysis involves variations in production quantity, income, prices, and costs. The results of the sensitivity analysis for soft-shell crab cultivation in Tarakan can be found in Table 5.

Table 5. Assumed Scenario in Sensitivity Analysis of Soft-Shell Crab Cultivation Business

No.	Scenario	NPV (IDR)	IRR (%)	NB/CR	PbP (Year)	Remark
1	Actual*	4,234,818,810	46	3.61	2.77	Feasible
2	Production Decrease by 42%	-55,477,210	5	0.97	10.35	Not Feasible
3	Price Decrease by 81,000 IDR	-70,070,053	5	0.96	10.45	Not Feasible
4	Seedling Price Increase by 69,000 IDR	-26,773,900	5	0.98	10.17	Not Feasible
5	Operational and Management Costs Increase by 71%	-28,490,625	5	0.98	10.18	Not Feasible
6	Production Decrease by 20% and Price Decrease by 102,000 IDR	-26,291,522	5	0.98	10.16	Not Feasible
7	Production Decrease by 30% and Price Decrease by 117,000 IDR	-4,402,257	5	1.00	10.03	Not Feasible
8	Production Decrease by 20% and Total Cost Increase by 18%	-7,203,333	5	1.00	10.04	Not Feasible
9	Production Decrease by 10%, Price Decrease by 120,000 IDR, and Total Cost Increase by 14%	-20,969,181	5	0.99	10.13	Not Feasible

Source: Primary Data, 2022

*Note:

- Production Yield = 9,680 kg/year
- Selling Price = 140,000 IDR/kg
- Operational Cost = 2,284,890,000 IDR/year



1. Production Decrease

Production can withstand a reduction of up to lower than 42%. If production decreases by 42%, the endeavor of cultivating soft-shell crabs becomes unviable. The detailed information can be seen in Table 5 (no. 2).

2. Selling Price Decrease

The maximum acceptable decrease in selling price is lower than 81,000 IDR. If the selling price falls by 81,000 IDR, the soft-shell crab cultivation effort is no longer sustainable. The detailed information can be seen in Table 5 (no. 3).

3. Seedling Price Increase

Mangrove crab seedlings are one of the most critical operational components. The maximum allowable increase in mangrove crab seedling prices is lower than 69,000 IDR/kg. If the price of mangrove crab seeds increases by 69,000 IDR, the soft-shell crab cultivation effort is no longer feasible. The detailed information can be seen in Table 5 (no. 4).

4. Operational and Maintenance Cost Increase

The maximum acceptable increase in operational and maintenance costs is lower than 71%. If the increase reaches 71%, the soft-shell crab cultivation effort is no longer sustainable. The detailed information can be seen in Table 5 (no. 5).

5. Production Decrease and Selling Price Decrease

Scenarios involving production decrease by 20% and selling price decrease by 102,000 IDR render the endeavor unviable. Similarly, scenarios with production decrease by 30% and selling price decrease by 117,000 IDR make soft-shell crab cultivation unfeasible. The detailed information can be seen in Table 5 (no. 6 and 7).

6. Production Decrease and Total Cost Increase

Production decrease by 20% and total cost increase by 18% may make soft-shell crab cultivation unviable. The detailed information can be seen in Table 5 (no. 8).

7. Production Decrease, Selling Price Decrease, and Total Cost Increase

Production decrease by 10%, selling price decrease by 120,000 IDR, and total cost increase by 14% are intolerable conditions, rendering soft-shell crab cultivation unfeasible. The detailed information can be seen in Table 4 (no. 9).

Challenges in Soft-Shell Crab Cultivation

Information on the challenges in soft-shell crab farming was obtained through interviews with respondents, as follows.

1. Decreased Crab Catch

The availability of mangrove crabs in the wild is diminishing due to continuous and uncontrolled harvesting, which is not offset by conservation efforts. Consequently, the selling price of mangrove crab seeds is increasing, leading to higher expenses.

2. Low Quality of Captured Mangrove Crab Seedlings

Limited knowledge among fishermen during capture and post-capture activities can result in poor-quality mangrove crab seedlings. For instance, inadequate handling often leads to stress and even death among mangrove crabs. High-quality mangrove crab seedlings are essential for



successful cultivation.

3. Weather-Related Factors

Fluctuating weather conditions pose challenges for the acclimatization of released mangrove crabs to pond water pH, particularly during the rainy season. This can result in stress among mangrove crab seedlings, hindering the molting process and potentially leading to mortality.

4. Feeding Challenges

Farmers encounter difficulties in sourcing appropriate feed for soft-shell crab farming. Proper feeding practices expedite the molting process of mangrove crabs and contribute to increased soft-shell crab size.

CONCLUSION

This study concerning soft-shell crab cultivation in Tarakan yields the following conclusions:

1. Financial analysis, both with discounted and undiscounted investment criteria, yields positive results: NPV of 4,234,818,810 IDR (> 0), IRR of 46% ($> 5.5\%$), Net B/C Ratio of 3.61 (> 1), and a Payback Period of 2.77 years ($< \frac{1}{2}$ project lifespan). These values collectively indicate the profitability and feasibility of soft-shell crab cultivation in Tarakan.
2. Sensitivity analysis for soft-shell crab cultivation in Tarakan reveals that the business is sensitive to changes in economic conditions, such as production declines, fluctuations in selling prices, variations in revenue, and cost increases.
3. Challenges faced by soft-shell crab farmers encompass decreased crab catch in the wild, low quality of captured mangrove crab seedlings, weather-related factors, and feeding issues.

Acknowledgments

We would like to express our gratitude to the Rector of Mulawarman University and the Dean of the Faculty of Fisheries and Marine Sciences, as well as the reviewers, for their invaluable assistance in the completion of this journal article.



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