Original Research Article

Feasibility Analysis of Seaweed Cultivation Gracilaria with Polyculture System (Study Case of Domas Village District Pontang Serang Banten)

ABSTRACT

This research aims to analyze business feasibility and factors that affect farmers' incomes in Domas Village, Pontang District, Serang Banten Regency. This research was conducted from April 2021 to June 2021 in Domas Village, Pontang Subdistrict, Serang Regency, Banten. This research was conducted by survey method . Determination of location is done by the census sampling method. Sampling was conducted by 35 seaweed farmers in Domas Village, Pontang Subdistrict, Serang Regency, Banten. The data analysis used is a business feasibility analysis that includes income analysis, R/C ratio, Payback period, Break event point, sensitivity analysis, and multiple linear regression analysis. The result of the business feasibility analysis obtained is the profit value of Gracilaria Sp. cultivation in Domas Village of Pontang District of Serang Banten Regency, which is 115,168,232 / year, R / C of 1.32% means that the business is worth running, the payback period value is 1.51 years since the company was established so that it is possible to develop BEP Value (kg) products in this research is 1,320 kg which means the break-even point will be achieved if cultivation produces Gracilaria sp. As for the sensitivity, the value increases acceptable operating costs by 5%. In addition, the calculation of sensitivity to the decline in selling value is known to be a very sensitive variable because if there is a decrease of only 3%, then the value of R / C will be smaller than 1. This indicates that variable selling prices are more sensitive to investment value than operating costs. Factors that affect the income of cultivators in Domas Village of Pontang Subdistrict are Modal (X_1), Total Production (X_2), gracilaria Sp. (X_5), and Bandeng Fish Seedlings (X_6) with a coefficient of determination of 91.8%.

Keywords: business feasibility, Gracilaria cultivation, polyculture system, Domas Village

1. INTRODUCTION

In Indonesia, seaweed production increased by 78.4%, from 5.2 million seaweed in 2011 to 9.2 million tons in 2013 (KKP 2014). In addition, in the marine and aquatic sector, seaweed is one of the leading comuditas with a selling point (Pratama, Nurhayati, Rizal, and Suryana 2021). Administratively, Serang Regency is located in Banten Province. Its location is in the district. Pontang, Kec. Tanara and Kec. Tirtayasa with superior commodities of bandeng and seaweed. This place is a minapolitan cultivation area. One economic utilization with superior entities in Serang Regency is Gracilaria seaweed. Gracilaria seaweed is one of the biological resources with great potential in Serang Regency.

Domas Village is located in Pontang Subdistrict, Serang Regency, Banten. Domas Village, located in Pontang Regency, is included in the northern coastal region of Banten Province. Domas Village, Pontang Regency is included in one of the areas that are still actively producing in fishery cultivation, one of which is the cultivation of Gracilaria sp seaweed. With the polyculture system. Efforts are being made to take advantage of the area through the polyculture system in the pond. In addition to optimizing land productivity, the polyculture system also prevents disease attacks in milkfish cultivation (Hendrajat and Ratnawati 2021).

Seaweed has a vital role in various products related to daily life. From an economic point of view, seaweed is a commodity that can be developed considering the nutritional value it contains. In addition, seaweed can be used as food ingredients such as gelatin, vegetables, cakes and produce algin, carrageenan, and various materials used in the pharmaceutical, cosmetic, and textile industries (Salim and Ernawati 2015). In addition, Gracilaria sp. can be used as animal feed (Qi et al., 2010; Johnson et al., 2014). Gracilaria seaweed can contribute more than 66% of total production orders globally (Pereira and Yarish, 2008). It is one of the commodities cultivated in the pond. However, Serang Regency, a producer of Gracilaria seaweed, is still not utilized in the area. For that, it is necessary to develop Gracilaria seaweed cultivation efforts to increase the production of Gracilaria cultivation in the future.

Polyculture is a cultivation activity that preserves more than one commodity (species). The role of bandeng in polyculture with seaweed includes cleaning seaweed that sticks by eating moss. In seaweed cultivation, bandeng fish and shrimp are usually polycultural stocked, intended to reduce moss in ponds because the presence of moss will reduce the quality of dried seaweed (Ratnawati and Mustafa 2003).

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Increased production of Gracilaria sp. It can be achieved through cultivation. Seaweed cultivation is one way that can meet industrial demand and also suppress excessive extraction in nature (Budiyani et al., 2012). To achieve maximum production, Gracilaria sp. It needs to be encouraged by providing nutrients expected to increase its growth. Coastal communities are the main actors in developing seaweed cultivation to produce seaweed as cultivators. Cultivation of Gracilaria in ponds absorbs 50 workers/year (KKP Serang 2018). Local traders, intercity traders, and exporters will emerge in the trade sector, which will also be a job opportunity. Downstream, the industrial sector absorbs quite a lot of labor. One industry can absorb 100-500 workers (DKP 2009).

METHODOLOGY

1.1 Time and Place

Research Analysis of Feasibility of Seaweed Cultivation With Polyculture System in Domas Village Pontang District Serang Banten is located on Jalan Raya Domas District Pontang Serang Banten Province. The research was conducted from May to June 2021.

1.2 Research Methods

This research uses data collection methods. Data collection techniques are primary and secondary data, both qualitative and quantitative. Primary data collection techniques were carried out, among others, by making direct observations in Domas Village, Pontang District, Serang Regency, Banten by taking a census sampling sample of 35 people, which chose a selection based on the number of population members to be used as a sample. Secondary data collection techniques include internet browsing and data observation through the Department of Fisheries and Marine Affairs, Serang Regency, Banten..

1.3 Data Analysis Methods

The tool used in this research is to use the IBM SPSS Statistics 25 program to calculate multiple linear regression analysis while to calculate business feasibility analysis using Microsoft Office Excel 2016 program to calculate revenue analysis, R/C (Return Cost Ratio), PP (Payback period), BEP (Break-Even Point) and sensitivity analysis.

1.4 Business Feasibility Analysis

According to Sobari (2006), business feasibility can be determined by analyzing investment criteria. This business feasibility analysis is used to determine whether the seaweed cultivation business in Domas Village of Pontang District of Serang Banten Regency is feasible or not to run sustainably. The analysis is done by calculating income analysis, R/C (Return Cost Ratio), Payback Period (PP), BEP (Break-Even Point), and sensitivity analysis . The analysis formula is as follows.

1.4.1 Profit Analysis

Profit analysis is the difference between total revenue and total cost (Suratiyah 2015). the purpose of income analysis is to determine the value of profits from the cultivation of Gracilaria sp. with a polyculture system. (Berlia et al. 2017) The income formula is as follows.

$$\Pi = TR - TC$$

Description :
Π = keuntungan
TR = total revenue
TC = total cost

1.4.2 *Return Cost Ratio* (R/C)

Return Cost Ratio is used to calculate the comparison between the ratio and cost in the feasibility analysis of seaweed cultivation with a polyculture system. The formula for the Return Cost Ratio is as follows.

$$a = (Py.Y) / (FC+VC)$$

ket
a = comparison of the ratio between recipients and costs
R = reception
C = cost
Py = Output Price
Y = Output
FC = Fixed cost

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According to Soekartawi (2003), the criteria for business feasibility are as follows.

1. Theoretically, with an R/C ratio = 1, it means that there is no profit and no loss; in this case fishers or producers can be stated in the break-even point (BEP).
2. R/C < 1, then the business is not feasible to carry out
3. R/C > 1, then the business is feasible to carry out

1.4.3 *Payback Period* (PP)

The payback period is the time it takes for a project's benefits to cover all previous project costs incurred, usually within an annual timeframe. The value of the money used is the actual value, i.e., in the prevailing price (not discounted), but it can also be in cash value (i.e., after discount) (Sucipto, 2011). The formula used in calculating PP is as follows:

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$$PP = n + \frac{a-b}{c-b} \times 1 \text{ year}$$

Description :

n = The last year where the amount of cash flow still cannot cover the original investment
a = amount of original investment
b = cumulative amount of cash flow in year n
c = cumulative amount of cash flow in year n + 1

1.4.4 *Break Event Point (*BEP)

Break Event Point is used to determine a point in both units and rupiah that shows costs equal to revenue. If this point can be known, then there is no profit or, in other words, no profit and no loss (Garrison dkk 2013 : 224).The following is the formula for calculating BEP.

1. BEP Production = $\frac{Total\ Production\ Cost}{Selling\ Price}$
2. BEP Price = $\frac{Total\ Production\ Cost}{Total\ Production}$

1.5 Analysis of Factors Affecting the income of Gracilaria sp cultivators.

Multiple Linear Regression is used to determine the factors that affect the income of seaweed farmers in Domas Village, Pontang District, Serang Banten Regency. Then, multiple linear regression models can be obtained by estimating their parameters using specific methods. The multiple linear regression formula with the free variable p is as in the following equation.

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + b_9X_9 + b_{10}X_{10} + e$$

Dengan :

Y = Cultivator's Income
a = Constant
X_1 = Capital (Rp)
X_2 = Total Production of gracilaria sp. (tons)
X_3 = Total Production of milkfish (tons)
X_4 = Land (Ha)
X_5 = Seedling gracilaria.sp (kg)
X_6 = milkfish seeds (kg)
X_7 = Drying area (m^2)
X_8 = Medium size basket (unit)
X_9 = Price of seaweed gracilaria sp. (Rp)
X_{10} = Price of milkfish (Rp)
E = *Error*

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Before testing multiple linear regression analysis, do a classic assumption test first. The classical assumption test consists of the normality, multicollinearity, and heteroscedasticity tests (Ghozali 2016). Then proceed with making a regression model with statistical tests consisting of the R-Square Test and ANOVA (F Test and T-Test).

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3. RESULTS AND DISCUSSION

3.1 General Conditions of Domas Village, Pontang District, Serang Regency, Banten

This research was conducted in Pontang District, Domas Village. Domas Village is located in the northern region of Java Island, Pontang Subdistrict, Serang Regency, West Java Province. The distance traveled from Pontang District is about 5 km. The distance from the district government center is 38 km. It takes about 2 hours. There are two villages in Domas Village, namely Domas Village and Cerocoh Village.

There are 4 RW and 12 RT. In Pontang District, its potential is a micropolitan area. Superior products produced from Domas Village, Pontang District, Serang Banten Regency are bandeng and seaweed Gracilaria sp.

Pontang District, located in Serang Regency of Banten Province, has administrative area boundaries, namely: The north borders the Java Sea, Ciruas District borders the South, Kasemen District borders the Westside, and on the East borders the Tirtayasa Subdistrict. All villages in Pontang District have less than 500 m above sea level with a land slope of fewer than 15 degrees (tilted). The area of Pontang Regency is 58.09 km2 or 3.96% of the area of the district of 1,467.35 km2 and is part of 29 sub-districts in Serang Regency.

3.2 Characteristics Of Respondents

In this research, we used 35 respondents who were seaweed farmers gracilaria sp. in Domas Village Pontang District Serang Regency, Banten. The question in this research questionnaire contained 40 questions related to the variables studied.

Capital has a vital role in business because the amount of capital determines the size of the business. The greater the capital the business owns, the more significant the opportunity to grow the business, and vice versa. Based on the interviews with cultivators in Domas village, the highest percentage value in issuing seaweed farming business capital with a polyculture system is Rp1,200,000.00-Rp1,400,00.00 with a percentage of 37%. In comparison, the lowest percentage of capital is 3%, amounting to Rp800,000,00-Rp1,000,000.00 with the amount of 1 cultivator.

Amount of seaweed production gracilaria sp. Very influential on the income of cultivators in Domas Village. More and more production of gracilaria sp. Then the income of the cultivator will be higher. Based on the results of interviews with cultivators in Domas Village, overall, the cultivators with the highest amount of gracilaria sp production are 16 cultivators with a total production of 1 ton - 2 tons and a percentage of 46%, while there are two cultivators with the highest amount of production of 5 tons - 6 tons in the space of 3 months with a percentage value of 6%.

The amount of milkfish production in polyculture gracilaria sp. In Domas Village, Pontang District, Serang Regency, Banten, it affects the income of cultivators. Based on interviews with cultivators, the number of cultivators with the highest production of bandeng fish is 40%, while the lowest is 26%.

The land is an essential means of cultivating polyculture ponds seaweed gracilaria sp. with bandeng in Domas Village Pontang Kabupaten Serang Banten District. Based on the results of interviews with cultivators obtained the highest number of cultivators based on the land used, which is 74%, with land area ranging from 1-1.5 ha. while the lowest number of cultivators based on land is 9%, with land area ranging from 2 - 2.5 ha.

Seedlings gracilaria sp. It influences the seaweed production and income of cultivators in Domas Village, Pontang Subdistrict, Serang Banten Regency. Based on the results of interviews with cultivators in Domas Village, 31 cultivators plant gracilaria seeds weighing 1 ton - 1.5 tons with a percentage of 89%. In addition, two cultivators plant gracilaria sp seeds: as much as 1.5 tons - 3 tons with a percentage of 12%.

Based on the interviews of cultivators in Domas Village, the highest number of cultivators who spread the seeds of bandeng fish found in category 0 - 0.5 tons, which is as many as 24 respondents with a percentage of 69%. At the same time, the smallest amount is in the category of 1 ton - 1.5 tons, which is as much as one cultivator who sows the seeds of bandeng fish with a percentage of 3%.

At the drying stage, the length of the drying ground is effective in drying seaweed gracilaria sp. Based on interview results, there is 28 land with a length of drying land of 500-1000 meters with a percentage of 80%, while there are seven lands with a size of drying land along 1000-2000 meters with a rate of 20%.

Baskets are a tool for harvesting fish and seaweed. The more baskets, the more effective they will be in harvesting. Based on the interviews of cultivators in Domas Village, Pontang District, Serang Regency, Banten, 21 pond lands use baskets with the number of 1 basket unit each with a percentage of 60%. In addition, there is 14 pond land that uses baskets with the amount of each pond land two units with a percentage of 40%.

The price of gracilaria sp. influences the income of the cultivator. The price is determined based on the price in the market . Based on the results of interviews with cultivators in Domas Village, 21 cultivators sell seaweed gracilaria sp. with a price of Rp4500.00 with a percentage of 60%, in addition, 12 cultivators sell seaweed gracilaria sp. with a price of Rp4000.00 with a percentage amount of 34%, and two cultivators sell seaweed at a price of Rp5000.00 with a percentage of 6%.

The price of fish affects the income of farmers. Prices are determined based on market prices. Based on interviews with cultivators in Domas Village, cultivators issued two price categories, namely Rp.

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20,000.00 and Rp. 25,000.00. Eighteen farmers sell milkfish for Rp. 25,000.00 with a percentage of 51%, and 17 farmers sell milkfish production for Rp. 20,000.00 with a percentage of 49%.

3.3 Feasibility Analysis of Seaweed Cultivation gracilaria sp. With a Polyculture System in Domas Village, Pontang District, Serang Regency, Banten

Feasibility analysis of seaweed cultivation gracilaria sp. with the polyculture system in Domas Village, Pontang District, Serang Banten Regency is done to determine whether or not a business is worth in the village. Business feasibility analysis is conducted using investment criteria consisting of income analysis, R/C (Return Cost Ratio), Payback Period (PP), and Break-Even Point (BEP). The business feasibility analysis assumes that the analysis is conducted on polyculture ponds with an average area per hectare. In calculating the feasibility analysis of seaweed cultivation, Gracilaria sp. The polyculture system in Domas Village of Pontang District of Serang Banten Regency requires an estimated cost consisting of investment, operational, and production costs whose own sources come from their business capital.

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Based on the estimated cost results, the investment remains in the cultivation of Gracilaria sp. with a polyculture system in Domas Village, Pontang District, Serang Regency, Banten requires a fixed investment of Rp. 112.170.000 and working Rp. 29,666,917, so the estimated total funding requirement for this pond business is Rp. 141,836,917.

The polyculture system in Domas Village, Pontang Subdistrict, Serang Regency, Banten . The cost of investing in this cultivation business consists of materials and equipment. The investment cost of this pond cultivation business is used to purchase Gracilaria sp cultivation support equipment. This investment is carried out gradually according to the technological age of each piece of equipment needed. Geacilaria sp. with the polyculture system, the initial expenditure is Rp. 112,170,000. At the end of the fourth year, Higher cost to replace equipment whose technology has been exhausted, namely Rp. 113,764,881 considering inflation of 4.5% per year, and the determination of this technological era refers to the Regulation of the Minister of Finance Number 96 / PMK.03 / 2009. The operational costs incurred for ponds with operational time per year are divided into two parts, namely direct costs, and indirect costs.

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Fixed costs consist of the purchase of products and the cost of human resources. The cost of purchasing products is incurred to obtain bandeng seed products, seaweed, urea fertilizer, SP-36, NPK, Organic, Medicines, and vitamins. The product's price is assumed to increase each year by 4.5%. In the first year, the number of product purchases amounted to Rp 60,403,000, with a projected harvest of 8 tons of fish ponds and 60 tons of seaweed. Meanwhile, the cost of human resources included salary fees for cultivators, where salaries were adjusted to ensure that agriculture had been maintained. As for the amount of compensation every month from cultivators, that is, the number of human resource costs in the first year amounted to Rp 286,000,300, the cost is assumed to rise 4.5% per year.

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Maintenance costs incurred to pay for pond maintenance in running a pond business. Variable costs consist of site maintenance costs and depreciation costs. From these considerations, the determination of the budget for the maintenance of the pond budgeted at Rp. 70,000,000.00 assuming an increase of 4.5% per year. While the depreciation cost is calculated based on the economic life of each tool so that the amount of depreciation in the first four years is the same because the economic life of the tool remains standardized for four years. However, in the 5th year, the amount of depreciation increased to Rp. 33,441,203.00 due to inflation of 4.5% and the end of the economic life of the fixed assets set.

From the results of the calculation of the income analysis obtained from the current value of money from revenues minus the current value of money from the cost of the current investment period of 5 years, the profit is Rp. Rp 115,168,233 shows that this pond is feasible to run in terms of investment. R/C is one of the essential factors determining the feasibility of a project or business. The R/C level achieved for the 5-year investment period in aquaculture is 1.32%. The R/C level shows that this project/business is feasible because R/C > 1. This means that in 1 rupiah issued, and it can generate revenue of 1.32 rupiah.

PP analysis is used to determine the time required for a return on capital or initial investment. Using the estimated cash flow, PP has been obtained for 1.51 years since the business started. In that period, the cumulative value of cash has shown positive results so that it can be said that the payback period is below the investment age specified at the beginning, namely for 5 years, which means that the return on invested capital in the pond business can be obtained for 1 year 5 months and this shows a positive thing considering the remaining investment life, which is for 3 years and 5 months, is the profit from the investment made.

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Break Event Point is used to determine a point in both units and rupiah that shows costs equal to revenue. If this point can be known, then there is no profit or, in other words, no profit and no loss. BEP calculation is presented in weight (kg) and price (Rp).

The results of BEP (price) calculation on the cultivation of seaweed Gracilaria sp. with a polyculture system obtained a value of 1,320 Kg, which means that the break-even point will be achieved when cultivation produces seaweed Gracilaria sp. as much as 1,320 Kg. Meanwhile, the price BEP (Rp)

for seaweed Gracilaria sp., namely Rp2.291,00. This means that the break-even point will be achieved at the selling price of seaweed of Rp2.291,00/Kg.

Sensitivity analysis is used to anticipate unexpected conditions with the aquaculture business, so a sensitivity analysis is carried out on the estimates that have been made previously. Sensitivity analysis is used to see and anticipate the effects of changes related to the factors involved in investment financing. This research has determined to calculate the sensitivity of changes in the increase in operational costs and decrease in selling prices.

Changes that occur after calculating the sensitivity of the increase in operating costs. When operational costs increase by 5%, the value of this investment is still feasible because the R/C value is still more than 1. which can be accepted as 5%.

The sensitivity calculation to a decrease in selling value is a very sensitive variable because when there is a decrease of only 3%, the R/C value becomes smaller than 1. This shows that the selling price variable is more sensitive to the investment value than operating costs.

3.3 Multiple Linear Regression Analysis

Multiple linear regression calculation is used to analyze the factors that influence farmers' income in Domas Village, Pontang District, Serang Regency, Banten. Based on the calculation results, there are 10 variables analyzed. These variables include X_1 (capital)/Rp, X_2 (amount of seaweed production)/ton, X_3 (amount of milkfish production)/ton, X_4 (land), X_5 (Gracilaria sp.)/kg, X_6 (milkfish seeds).)/kg, X_7 (length of drying area)/m, X_8 (basket)/unit, X_9 (price of seaweed)/kg, X_{10} (price of milkfish)/kg.

Prior to forming the regression model, the classical assumptions were tested first so that the model formed gave a BLUE estimate (Best, Linear, Unbiased, Estimator). This assumption test consists of three tests, namely normality test, heteroscedasticity test, and mutikolinierity test.

Based on the SPSS output (fig. 1), the Sig value is obtained. normality test using the Kolmogorov-Smirnovs method is 0.2. Because the p-value is more significant than alpha (0.2 > 0.05), it can be concluded that the residual data is usually distributed

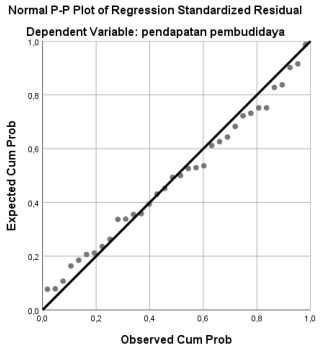

Fig 1. Normality Test

The heteroscedasticity test aims to test whether there is an inequality of variance in the regression model from the residuals of one observation to another observation. A good regression model is one with homoscedasticity or no heteroscedasticity. One of the methods used to detect the presence or absence of heteroscedasticity is to look at the graph plot between the predicted values of the dependent (dependent) variable, namely ZPRED, with the residual SRESID.

Based on the heteroscedasticity test image (figure 2), it can be seen that the points spread randomly, not forming a pattern, as well as the points spread both above and below zero on the Y-axis. It can be concluded that there is no heteroscedasticity in the regression model, so the regression model is feasible to use for subsequent analysis.

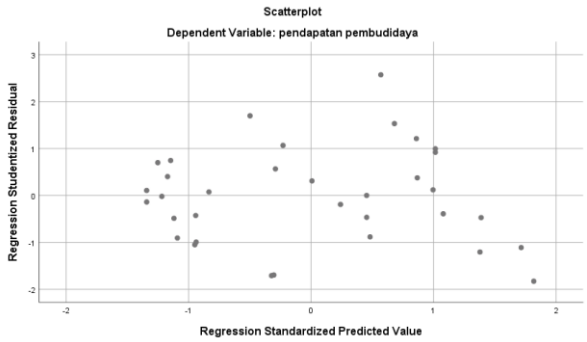

Fig 2. Heteroscedasticity

The multicollinearity test aims to test whether there is a correlation between the free variables in the model. A good model doesn't have to be correlated with free variables. Based on the results of multicollinearity test data, the VIF values of all free variables are below 10. Based on these results, it can be concluded that there is no multicollinearity between free variables in the model.

In this research, multiple linear regression analysis is intended to determine the effect of the independent variable on the dependent variable. The goal is to predict or estimate the value of the dependent variable in a causal relationship to the value of other variables.

Based on the output above, the constant values and regression coefficients can be obtained so that multiple linear regression equations can be formed as follows: $\mathbf{Y = -500400{,}995 + 0{,}743X_1 + 138617{,}939X_2 - 162625{,}719\ X_3 - 113538{,}576\ X_4 - 152357{,}146X_5 - 318060{,}350X_6 - 35{,}439X_7 + 58480{,}579X_8 + 174{,}124X_9 + 7{,}821X_{10}} + e$

Pearson Product Moment correlation analysis is an analysis that is used to find a relationship and prove the hypothesis of a relationship between two or more variables if the variable data is in the form of an interval or ratio and the data sources of each variable are the same. Based on the interpretation table of the correlation coefficient presented above, the correlation coefficient of 0.958 indicates a solid relationship between the independent variables and the dependent variable.

Based on the results of the calculation of the coefficient of determination, the value of the coefficient of determination is 91.8% which indicates that the effect of X_1 (Capital), X_2 (amount of seaweed production)/ton, X_3 (amount of milkfish production)/ton, X_4 (Land)/Ha, X_5 (Gracilaria Seeds)/ton, X_6 (Milkfish Seeds)/ton, X_7 (length of drying area)/m, X_8 (baskets)(Unit), X_9 (seaweed price)/kg, and X_{10} (milkfish price)/kg is 91.8% of Y (Cultivator's income) Rp/month. At the same time, the remaining 8.2% is influenced by other factors not observed in this research.

Tabel 1. R Square Test Result

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,958[a]	,918	,882	155741,63857

Simultaneous hypothesis testing is a hypothesis testing that aims to determine whether simultaneously or simultaneously the independent variables (independent) have a significant or no significant effect on the dependent variable (dependent).

Based on the results of the test F obtained a significance value of 0.000, because p-value (sig) > 0.05 (alpha 5%) or 0.00 < 0.05 then H0 is rejected, meaning that free variables simultaneously affect bound variables. The value F calculates based on table 6 of 25,756, and the value of F table by 2.24. This can be interpreted as F count > F table, then H0 is rejected, and H1 is accepted, meaning there is a significant influence between independent bounds on the model that has been created.

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Partial hypothesis testing aims to determine whether or not there is a partial or self-exerted influence of the dependent variable (X) on the independent variable (Y). Based on the analysis results obtained from the p-value for the variable X1 (Capital) of 0.002. Due to the p-value (sig) < 0.05 (alpha 5%) or 0.02 < 0.05 then H0 is rejected, meaning that X1 (Capital) has a significant effect on Y (Cultivator's Income) Rp/month. This shows that the high capital spent on the cultivation of seaweed Gracilaria sp., the higher the income earned by farmers. Based on field facts, it is shown that cultivators in Domas Village,

Pontang District, Serang Regency, Banten still use internal capital or their capital, so that cultivators still find it challenging to save the results of the income they get. The income they earn can only be used for their daily needs.

Based on multiple linear regression analysis, the variable value of X2 (amount of seaweed production)/tonne is 0.012. Due to the p-value (sig) < 0.05 (alpha 5%) or 0.012 < 0.05 then H0 is rejected, meaning that X2 (amount of seaweed production)/ton has a significant effect on Y (Cultivator's Income) Rp/month. It can be said that the variable amount of seaweed production Gracilaria sp. positive impact on farmers' income. If the total production of Gracilaria sp. increases, farmers' income also increases. Based on the research site's facts, the minimum production of seaweed Gracilaria sp. of 1000 kg, and a maximum of 6000 kg. This indicates the production of seaweed Gracilaria sp. in the village of high Domas.

Based on the results of multiple linear regression analysis, it is obtained that the variable value X3 with a p-value (sig) < 0.05 (alpha 5%) or 0.061 > 0.05 then H0 is accepted, meaning that X3 (amount of milkfish production)/ton has no effect. Significant to Y (Cultivator's Income) Rp/month. It can be said that the amount of milkfish production harms farmers' income. If the amount of milkfish production increases, farmers' income will decrease. This is caused by several factors, including the pond area, which is divided into six parts of a total area of 35 hectares, meaning that the pond land has a different area. If the pond land is getting wet, the opportunities to increase the productivity of milkfish production will increase. In addition, other factors that affect the amount of milkfish production are water quality and aspects of soil fertility in the pond.

Based on the multiple linear regression analysis results above, the p-value for X4 (Land)/Ha is 0.262. Due to the p-value (sig) > 0.05 (alpha 5%) or 0.262 < 0.05 then H0 is accepted, meaning that X4 (Land)/Ha does not have a significant effect on Y (Cultivator's Income) Rp/month. it means that if the area of land planted with seaweed increases, the income of farmers will decrease or even stay.

Based on the multiple linear regression analysis results for Variable X5 (Seeds Gracilaria)/ton of 0.044. Due to the p-value (sig) < 0.05 (alpha 5%) or 0.044 < 0.05, H0 is rejected, meaning that X5 (Gracilaria Seeds)/ton has a significant effect on Y (Cultivator's Income) Rp/month . it means that the more seeds of Gracilaria sp. to be planted, the higher the income of cultivators.

Based on the multiple linear regression analysis results, the p-value for the variable X6 (Milkfish Seed)/ton is 0.015. Due to the p-value (sig) < 0.05 (alpha 5%) or 0.015 < 0.05 then H0 is rejected, meaning that X6 (Milkfish Seed)/ton has a significant effect on Y (Cultivator's Income) Rp/month. It can be interpreted that the more milkfish seeds are planted in the pond, the higher the income of farmers in Domas Village.

Based on the multiple linear regression analysis results, the p-value for the variable X7 (drying area length)/m is 0.639. Due to the p-value (sig) > 0.05 (alpha 5%) or 0.639 > 0.05 then H0 is accepted, meaning that X8 (drying area length)/m does not have a significant effect on Y (Cultivator's income) Rp/month. It can be interpreted that the longer the drying area, the farmer's income decreases.

Based on the multiple linear regression analysis results, the p-value for X8 (basket) (Unit) is 0.364. Due to the p-value (sig) > 0.05 (alpha 5%) or 0.089 > 0.05 then H0 is accepted, meaning that X8 (basket) (Unit) has no significant effect on Y (Cultivator's Income) Rp/month. It means that more baskets are used to harvest seaweed Gracilaria sp. and milkfish, then farmers' income will decrease or remain .

Based on the regression analysis results, the p-value for the variable X9 (seaweed price)/kg was 0.106. Due to the p-value (sig) > 0.05 (alpha 5%) or 0.106 > 0.05 then H0 is accepted, meaning that X14 (seaweed price)/kg has no significant effect on Y (Cultivator's Income) Rp/month. It means that the higher the price of seaweed Gracilaria sp., then the income of farmers will decrease or remain.

Based on the multiple linear regression analysis results, the p-value for the variable X10 (milkfish price)/kg is 0.566. Due to the p-value (sig) > 0.05 (alpha 5%) or 0.566 > 0.05 then H0 is accepted, meaning that X15 (milkfish price)/kg has no significant effect on Y (Cultivator's Income) Rp/month. it can be interpreted that the higher the price of milkfish, farmers' income will decrease or remain.

4. CONCLUSION

Based on the results of the research that has been done, it can be concluded as follows:

1. Results of Feasibility Analysis of Gracilaria sp. with a polyculture system in Domas Village, Pontang District, Serang Regency, Banten, ~~the~~ profit is Rp. IDR 115,168,233 shows that this pool is feasible to run from an investment perspective. The R/C value achieved for the 5-year investment period in the cultivation sector is 1.32%. The R/C level indicates that the project/business is feasible because R/C > 1, the Payback Period (PP) value obtained is 1.51 years since the business started. In addition, for the Break-Even Point (BEP) value, a value of 1,320 Kg is obtained, which means that the break-even point will be reached if the cultivation produces Gracilaria sp. as much as 1,320 Kg. While the results of the calculation of the BEP price (Rp) for Gracilaria sp. seaweed, which is Rp. 2,291.00. While for the sensitivity value, it is known that the acceptable increase in operational costs is 5%. In addition, the calculation of sensitivity to a decrease in selling value is known to be a very sensitive variable because if there

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is a decrease of only 3%, the R/C value will be smaller than 1, indicating that the selling price variable is more sensitive to the investment value than operating costs.

2. Factors that affect the income of cultivators in Domas Village, Pontang District, Serang Regency, Banten, namely Capital, Total Seaweed Production, Total Milkfish Production, Gracilaria Sp. Seeds, and Milkfish Seeds. Based on these variables, the most influential factor on the income of cultivators is the capital, with a significance value of 0.002. In addition, the coefficient of determination was obtained at 91.8%. It shows that the dependent variable influences the independent variable by 91.8%, while the remaining 8.2% is influenced by other factors not observed in this research.

5. REFERENCES

1. Berlia, M., I. Gumilar, L. Yuliadi, and A. Nurhayati. 2017. Business Analysis and Value Added Crackers from Fish and Shrimp. Journal of Fisheries and Maritime Affairs. Vol. VIII No.2 (118-125). Padjadjaran University.
2. Budiyani, F.B., K. Suwartimah and Sunaryo. 2012. Effect of Nitrogen Addition with Different Concentrations on Growth Rate of Seaweed Caulerpa racemosa var. Urivera. Journal of Marine Research. 1 (1) :10 - 18.
3. Department of Fisheries and Marine Affairs [DKP]. 2009. Fisheries and Marine Affairs in Figures 2009: Fisheries and Marine Service of Banten Province.
4. Garrison, Noreen & Brewer. 2013. Managerial Accounting. Book 2. Issue 14. Jakarta: Salemba Empat.
5. Ghozali, Imam. 2016. Application of Multivariete Analysis With IBM SPSS 23 Program (8th Edition). VIII Printing. Semarang : Diponegoro University Publishing Agency.
6. Isnaini and M. Prihatna Sobari. 2009. Technical and Financial Analysis of the Muroami Capture Unit in the Thousand Islands Waters. Journal of Capture Fisheries, 18(2): 1 - 10.
7. KKP. (2019). Seaweed Business And Investment Opportunities. Ministry of Maritime Affairs and Fisheries.
8. M. F. A. Pratama, A. N. (2021). Strategy for the Development of Seaweed Cultivation in Karawang Regency, West Java. *Asian Journal of Fisheries and Aquatic Research*.
9. Ratnawati, A. M. (2005). Management Factors Affecting the Production of Seaweed (Gracilaria Verrucosa) in Acid Sulfate Soil Ponds (Case Study In Luwu Regency, South Sulawesi Province). Indonesian Journal of Fisheries Research, 67-69.
10. Ratnawati, E. A. (2021). Polyculture seaweed Gracilaria sp. and milkfish in the pond. Scholarly Journal, 1.
11. Salim, Z., And Ernawati. 2015. Seaweed Commodity Info. Trade Policy Research and Development Agency. Ministry of Trade of the Republic of Indonesia. Jakarta. Case. 3.
12. Soekartawi. 2003. Economic Theory of Production with Cobb-Douglas Analytical Subject matter. Jakarta : PT RajaGrafindo Persada. 250 things.
13. Sucipto, A. 2011. Business Studies.Malang: UIN-Maliki Press.
14. Qi Z., Liu H., Li B., Mao Y., Jiang Z., Zhang J., and Fang J., 2010, Suitability of two seaweeds, Gracilaria lemaneiformis and Sargassum pallidum, as feed for the abalone Haliotis discus Hannai Ino, Aquaculture, 300(1): 189-193 https://doi.org/10.1016/j.aquaculture.2010.01.019
15. Pereira R., and Yarish C., 2008, Mass production of marine macroalgae, Encyclopedia of Ecology, Ecological Engineering, Elsevier, 3: 2236-2247

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General Comments:

1. Please present your observations/data in past tense throughout the manuscript.

2. Please arrange references in ascending alphabetical order.

3. Please compare your observations with published information of others throughout the results presented in the manuscript (for example: *"Based on the estimated cost results, the investment remains in the cultivation of Gracilaria sp. with a polyculture system in Domas Village, Pontang District, Serang Regency, Banten requires a fixed investment of Rp. 112.170.000 and working Rp. 29,666,917, so the estimated total funding requirement for this pond business is Rp. 141,836,917"* this statement is to compared with the values/observations of other researchers of the similar fields).

4. Authors may consult and cite following references to enrich the quality of the manuscript:

1. Rimmer, M.A.; Larson, S.; Lapong, I.; Purnomo, A.H.; Pong-Masak, P.R.; Swanepoel, L.; Paul, N.A. Seaweed Aquaculture in Indonesia Contributes to Social and Economic Aspects of Livelihoods and CommunityWellbeing. Sustainability **2021**, 13, 10946. https://doi.org/10.3390/su131910946

2. Santelices B., Doty, M.S. 1989. A review of *Gracilaria* farming. Aquaculture 78:95–133.

3. Adhawati, S.S.; Fudjaja, L. Analysis productivity of seaweed cultivation (Glacilaria. sp) in Takalar Regency, South Sulawesi. IOP Conf. Ser. Earth Environ. Sci. **2020**, 492, 012121.

4. Laapo, A.; Howara, D. Coastal community welfare improvement through optimization of integrated pond farming management in Indonesia. Int. J. Agric. Syst. **2016**, 4, 73–84.

5. Zamroni, A.; Laoubi, K.; Yamao, M. The development of seaweed farming as a sustainable coastal management method in Indonesia: An opportunities and constraints assessment. WIT Trans. Ecol. Environ. **2011**, 150, 505–516.